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THE CROMWELL QUARTZ REEF AREA 1865-85: A GEOGRAPHICAL ANALYSIS OF RISE AND DECLINE

Thesis presented for the Degree of Master of Arts in Geography

by

Gary O. Crombie
University of Otago
1974
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## ABBREVIATIONS

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<td>A.J.H.R.</td>
<td>Appendices to the Journals of the House of Representatives</td>
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<td>B.H.</td>
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<td>O.D.T.</td>
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Chapter 1

INTRODUCTION

The mind of the past is like a prism of which we see only the refracted light...

Hugh Trevor-Roper, 1958. (1)

Historical geography in New Zealand has been characterised by a preoccupation with the local and regional synthesis. Such a proliferation of historical geographical study is widely recognised as incorporating varying emphases and modes of theoretical application.

Although many such studies have illustrated a willingness to confine themselves to an intensiveness of pure research, (2) there is an accelerating trend towards the incorporation of historical, social science, quantitative and indeed, personal theory into the idiom of historical geography. This study, in following the latter trend, aims to lend weight to the current encouragement of the use of explanatory model-method in approaching spatial and temporal form in historical geography. (3)

The subject matter of this thesis concerns the historical development of the Cromwell quartz reef area during the period 1865-85. Although supplementing the proliferation of small scale historical geographies, it must be considered that the continued appraisal of the primary unit area by the historical geographer, is


(2) Several historical geographical theses of the pre 1960's era were of this mode.

necessary to provide a 'resource pool' of geographically processed primary material, for use in larger scale research.

In its broadest terms, the essay attempts to determine:

a. the causes of the rise and subsequent decline in prosperity of the Cromwell reefs quartz mining industry;

b. the differing social attitudes to the development of a quartz mining industry, and associated society, in the Cromwell quartz reefs area during the two decades after 1865, and

c. the extent to which this ideal was frustrated in materialising due to retarding environmental influence, a conflict between contemporary percepts and reality, or more realistically, a combination of these factors.

In preceding discussion on the subject matter itself, a reflection upon the methods of approach to, and formulation of the text of the above, is of importance. In consequence, the following current thought is considered as relevant.

Prince has pointed out that the amassing of facts has inevitably led to an impasse in historical geography, (4) as the more precisely the facts are known,

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the more certain is the idea that no idea will exactly fit them. Although historical geographers have conceded that such empiricism is inherently basic to their study, they have, as Baker suggests, jointly emphasized an application of techniques of analysis to historical problems, in turn creating a scaling down of the concern with narrative history.

In the current study, it was apparent early in the research process, that in examining the failure of longevity of the quartz mining industry, expectations as to the environmental determinant factors fell short of the total explanation. It became obvious that contemporary attitude to the past milieu warranted greater research emphasis.

Hence, the problems to be recognised in evaluating such phenomena, are man's percepts and responses. Furthermore, such problems are significantly complicated:

The problem with studying mankind, to paraphrase Alexander Pope, is man ... Given the historian's aim to understand man's behavior in past time, the very complicated problem of studying man is made even more difficult.

(5) Harvey, D.W. Supplementary Note to Locational Change in the Kentish Hop Industry and The Analysis of Land Use Patterns in A.R.H. Baker et.al. (eds), Geographic Interpretations of Historical Sources, 1970, p.265.


The current emphasis on the use of considering the viewpoint of the past is seen to stem partly from a dissatisfaction with the preoccupation with spatial patterns in geographical theory, and a consequent neglect of small-scale operating processes, and partly from recognition by the historical geographer, that his (the observer's) viewpoint of the process of historical change through time and space has hitherto rarely considered the contemporary motives, intentions, ideals and subsequent responses to the past environment.

In effect, the perceptual consideration, exhaustively outlined by Johnston (8) is currently seen not only as a positive method of clarifying the reasons behind the geographical change process, but also as a means of lessening the accusation that geographers "... by the very nature of their individual perspectives, warp the real world in their own particular way." (9) The focus in approach emphasis as being essentially a perception-decision relationship, is concisely suggested by Curry, when he remarks that:

... people in their adaptation to environment, act in accordance with their beliefs about the world rather than an objectively described world. They amend their beliefs with experience, as a learning process ...

(10)

(8) Johnston, J.A. The Use of Perception in Historical Geography, 1972.


This is perhaps the geographical application of Boulding's observation that illusion does not long delude people - '... we see the world the way we see it because it pays us and has paid us to see it that way ...' (11)

Thus, the perceptions of the environment are responses to past perceptions, in effect tempered by experience. If, as Boulding suggests, this process is continuous, then we must consider that our concern is with a dynamic set of responses. This, then, forms the first observation of the perceptual nature of this paper.

If we accept the notion that parts of any cultural landscape are the result of human actions, and that behind these actions lie ideas about the contemporary images of reality, (12) then two queries arise; which images should be selected, and what selection criteria should be employed? Even beyond the consideration of the characteristics of past behaviour, '... we are still a long way from encompassing the enormous variety of human actions and responses to environments.' (13) It is inevitable that conflicting environmental attitudes and inconsistent behaviour will occur in any study of human influence upon the geographic pattern. (14) Lowenthal has also

asserted the problem of individuality in reiterating that separate personal worlds of experience, learning and imagination underlie any group attitude. (15) In consequence, the second consideration holds that a group, class or common interest perception, by necessity, approximates the consensus of perception.

The final observation declares that the use of (as opposed to the acknowledgement of) a perceptual/behavioural approach in historical geography, is recent in origin, and as such, does not claim conclusiveness in explanation.

The varied attempts by geographers to fit perception into a geographical framework .... lead one to the conclusion that there is no accepted theoretical base to perceptual studies in geography. These studies are still of an exploratory nature. (16)

Consequently, the formulation of any general principles for the scientific treatment of the perceptual approach in historical geography seems as distant and elusive as the very nature of a past geography.

Geographers are continually cautioned regarding limitations in perceptual approaches, for example, in emphasising variables that might have been irrelevant to any contemporary situation, attributing motives that did not exist and ignoring the multitude of equally probable events co-existing in any situation. (17)

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As a result, this paper refrains from purporting to offer an exercise in perceptual study - rather, the subject is treated as merely a means in aiding the explanation of an end, that end being the geographical evaluation of change in a man-land relationship through time. No claim to conclusiveness is raised, yet, even when the most rigorous quantitative techniques are applied to the field of historical geography, such claim would be at best, warily made. There will always remain an elusive disparity between the observer's construct of reality and the actor's conception of reality (18) - a qualification which even the most critical twentieth century observer must recognise.

With the perceptual considerations of the subject enquiry clarified, and certain associated constraints isolated, subject matter itself may be discussed, in the light of the foregoing.

The vast majority of accounts of the development of the Otago province in some way acknowledge the inextricable significance of the gold deposits and associated early exploitation in the interior.

In any account of the history of the Province of Otago, this golden decade 1861-1871 assumes an importance that

can scarcely be over-emphasised. No matter what aspect of provincial life is studied, the influence of gold is all-pervading. \(19\)

Rife though the numerous gold mining annals of Otago may be with accounts of the golden years and their contribution to provincial prosperity, few such studies attempt to probe beyond the fact that gold production subsequently declined during the 1870s, and commonly ignore the reasons for such decline.

In accordance with the perceptual leanings of this work it is perhaps not imprudent to suggest that our contemporary perception of Central Otago local history would tend to place emphasis on the detail of the rush periods of gold discoveries, the 'boom years' and life at its most prosperous. Nonetheless, there is ample justification in this view, as economic progress of any area generally accompanies prosperity of endeavour and purpose; indeed, in evaluating a changing man-land relationship, recession conditions and subsequent decline are considerations of equal importance. Furthermore, since the historical geographer purports to evaluate a dynamic process over time and space, principal motivating agents must be acknowledged and their relative importance established.

One aspect in the colourful vista of Otago gold-mining, hitherto mentioned only in passing or relegated to an odd chapter in a local history, is the

industry of quartz reefing. (20) Largely developing during the early 1870s following the decline in alluvial mining output, the industry was heralded at the time as being a force of some magnitude in the future prosperity of the province.

Quartz veins are being discovered in all Otago auriferous areas; as this class of mining involves the labour of years to work out a reef when once the auriferous character of the stone is established, it is calculated to give employment to a large population. (21)

Sanguine hopes, frequently entertained to the point of apparent foolhardiness, together with the unique requirements of the industry in a physically and socially raw climate, justify special consideration to the place of this industry within the historical geography of Otago.

Both a long-latent interest in the particular quartz mining area of Cromwell and strong affinities to the maxim that a special emphasis upon the development and morphology of a local quartz reef area would perhaps gain greater insight into some of the perceptual attitudes to quartz mining, have tended to disfavour the production of an historical geography of Otago quartz

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(20) The industry of crushing quartz rock in order to extract the gold content was generally referred to in Otago as 'quartz reefing', 'quartz mining' or simply 'reefing'. This terminology originated on the Victorian diggings, in contrast to the Californian nomenclature such as 'lode mining' and 'quartz vein mining'. The latter terms were used rarely in Otago, but even their infrequent usage serves to illustrate the admixture of labour origins of the industry in New Zealand.

(21) Otago Witness, May 1, 1866, p.2.
mining.

The study is exploratory in two senses. Firstly, there exists no completed research analysis of the reasons for the decline in the quartz mining component of Otago gold production. A local area of reef communities may or may not serve to highlight reasons which are not evident in a large-scale study of quartz mining. Secondly, as already discussed, contemporary attitudes are recognised as contributing factors, affecting the fortune of the industry. A restricted population of perspectives will tend to afford greater control over consensus of attitude. However, this is not to say that other contemporary attitude is ignored. On the contrary, such attitude serves to contrast with percepts of the contemporary on the one hand and the observer on the other and in so doing, facilitates understanding of the case attitude. Thus, the restriction to a primary unit area morphology is simply a means of attaining control and coherence of analysis.

The Use of an Explanatory Model

It has been established that the study intends to make particular use of the contemporary Cromwell reefs area population attitude (attitude to both the quartz reef environment and attitude to the perceived responses to actions within that environment), as a means in endeavouring to analyse some of the underlying causes of the decline in prosperity, of the Cromwell quartz reef

(22) Refer pp.4-5.
Fig. 1

EXPLANATORY MODEL: EFFECT FLOW OF CONTEMPORARY ATTITUDE AND ENVIRONMENT

- The quartz reef prospector
- The working quartz miner
- The capitalist/shareholder
- The quartz miner/shareholder
- The quartz settlement businessman
- The quartz settlement resident
- Central Government
- Provincial Government

PRODUCTIVITY OF REEF

PHYSICAL ENVIRONMENT

TECHNICAL ENVIRONMENT

SOCIAL ENVIRONMENT

POLITICAL ENVIRONMENT

QUARTZ MINING INDUSTRY

QUARTZ MINING SETTLEMENT
industry and associated settlement.

It was recognised early in the research process, that in order to define and analyse some of the more elusive causes of decline, an explanatory model outlining the various lines of interaction which affected the quartz industry, would be valuable in clarifying the explanation process.

The most fundamental points to be illustrated in such a model, were the dual motivating sources consisting of: a) the contemporary environmental effect factors, and

b) the contemporary attitudes to these environmental influences, and of the quartz mining industry and settlement itself.

As a direct consequence of the simplicity of aim, in seeking only to portray the interaction of influence within the total quartz mining industry milieu, the final model has incorporated a basic interflow of effect relationships, encompassing three principal phases. (Refer Fig.1).

(i) As contemporary perceptions of both the various past environments, and of the quartz mining industry, are assumed to have stimulated definite motivation in action related to the quartz industry, the first phase incorporates a 'generative' role. The perceptions of all classes of population, directly or indirectly affected by the fortunes of local quartz mining, must be acknowledged. In turn, it must be recognised that the individual class-attitude (being
the result of the contemporary perception of the industry and the reef environment), and the accumulated population attitude, were focussed either through public opinion vehicles such as the news media, or directly through individual group action, to ultimately affect the quartz mining industry. The news media is acknowledged as a primary generator of contemporary attitude, as exemplified in Chapter 6.

It is imperative that one recognises the subjective nature of the collation of attitude data, and the subjective nature of the contemporary attitude. The study can aim only at approximations of the viewpoint of the past.

(ii) The environmental influences on the prosperity of the quartz reefing industry are grossly generalised within the limited context of the explanatory model. The importance of the second zone lies in its recognition as a field of influence interaction, acting in corroboration with the primary population attitudes. The zones of attitude and environment are complimentary and entirely interdependent. In effect, this stage exhibits a role as the genesis of the public attitude, for here lies the complex interaction of influences, which is perceived and responded to by the quartz mining area population.

The various environmental effects essentially comprise the primary influence upon the prosperity
13.
of the quartz mining industry. Central to these
effects, was the actual productivity of the quartz
reefs, the unknown variable which remained the
ultimate motivating factor governing the industry's
very existence.

(iii) The resultant zone reflects the historical
fortune of the quartz mining industry and
associated settlement - its existence, decline
and eventual demise - and may be regarded as a
continuum over the years 1869 to 1885.

It must be reiterated that the model is explanatory
in object, and, as with the perceptual approach, strictly
employed as a means of facilitating understanding of
the causes which ultimately affected the quartz industry.
Consequently it presents a basic and simplified flow of
effects - all the recognised directions of contemporary
influence within the Cromwell quartz reef environment
and communities. Simplification is essential in the
employment of a model aid, or the qualities of assistance
and explanation dissipate.
Chapter 2

THE QUARTZ REEF ENVIRONMENT - EARLY INTERACTION AND PERSPECTIVES

A strange wild scene. Bleak and desolate enough, God wot, yet not without a certain grandeur such as Nature preserves even in her wildest moods.

Huge unshapely masses of rock - weather-beaten geological veterans - blackened and seamed and scarred by I know not how many centuries of conflict with the elements ...(1)

The schist rangelands of Central Otago constituted the physical core of the Otago quartz mining industry, the geographical centre of which included the Cromwell reefs area. The Cromwell reefs comprised quartz lodes striking in an east-west direction across the Dunstan and Carrick Ranges. (Fig.II). It is to these latter uplands and their associated lowland links that this study, tracing the rise and decline of the Cromwell quartz industry, must first be directed. An examination of the topographical and climatic nature of the reefing country is essential to an understanding of the operation of the reef industry(2) and of the physical constraints upon that industry. Similarly, the recording of early European contact with this area serves to indicate the related events which led to the discovery and exploitation of the quartz reefs in the area.


(2) The term 'reefing', or 'reefing industry', was in common use during the 1800s. The terminology has been retained, although it must be pointed out that both terms are synonymous with 'quartz mining' or 'lode mining'.
Fig. II  CROMWELL QUARTZ MINING REGION: 1872
The earliest European recognition of the existence of the Dunstan and Carrick Ranges, is in a map by John Arrowsmith dated 1850, (3) on which both ranges are represented on either side of what is now known as the Clutha valley. Only three years elapsed before the first sheepmen entered the Clutha valley in this area, introducing flocks of sheep which rapidly depleted the natural pastures clothing the river terraces and range foothills. Even as early as 1860 the sheep runholders had made easier the later work of the quartz miner, for sheep had cleared the ranges of much of the excess vegetation, facilitating the discovery of reef outcrops.

Regrowth of vegetation, even of pastures, on the range uplands was slow, due to the scanty soil cover and the climatic extremes. The area from Tarras to Bannockburn has an annual average rainfall of under 480mm. The climate is composed of bitterly uncompromising elements; on the lowest area-elevation at Cromwell, the temperature regime fluctuates between 36°C and -9°C throughout an average year, the diurnal range on the upland areas is such that a 30°C summer daytime temperature can fall to a mildly severe ground frost at the same altitude. (4) Such semi-aridity, enhanced by a prevalence of strong, warm, northerly winds in summer and bitter sou-westerly fronts in winter, was effective, together with the

---

(3) Arrowsmith, J. Map of the Colony of New Zealand, 1850. [Hocken Library].

runholding leasehold system, in inhibiting any settlement in the Cromwell reef area at all. The range country of the Pisa, Dunstan and Carrick systems experience the harshest of extremes, their height accentuating an already inhospitable climate.

John Goldie recorded a journey over the Dunstan Range via the Thomsons Saddle route, with the Provincial Surveyor James McKerrow in 1861, illustrating the nature of the country:

Mount Dunstan stands upwards of five thousand feet above the level of the sea. It consists of a double range of hills, very rugged and rocky ... I can assure you that I felt afraid even in looking back over the track we came with the horses, being so steep and stony ...(5)

This route, via Thomsons Saddle (or Morley's Pass), traverses the later quartz reef sites at Bendigo. The same route was used by three thousand sheep driven by W.G. Rees in December 1860, over an elevation of 5000 feet upon the Dunstan Range. (6)

Goldie later commented upon the existing vegetation of these upland regions, terrace and range-land, as already exhibiting the effects of runholding:

[The] ... appearance is pale and white, clothed in its natural tussock, a hard dry sort of grass which grows in small tufts, and in many places not very thickly sown, there is little scrub upon it, and

(5) Goldie, J. Three Journal-letters of his surveying trips in Otago, with James McKerrow, 1861-3. [Entry : December 26 1861, p.4].

General view of the Carrick Range quartz reef area, rising to 4,000 feet. This summer photograph is centred on Pipeclay Gully with the Carrick Spur to the left and the Bull Spur to the right of Pipeclay Gully. Bannockburn lies nestled in the trees to the left centre.
not a tree to be seen, the want of which will be greatly felt when it comes to be an agricultural district...(7)

These were prophetic remarks, for such paucity of scrub and absence of trees was later to be sorely lamented, initially by the goldminers long before the agriculturalists.

Even with the first indications of alluvial gold discoveries, the range land was not associated with gold. The great folded schist mountains of inland Otago were burdened with a reputation as omnipresent barriers to inland access:

... range succeeding range in monotonous uniformity, everywhere clothed in a sober livery of pale brown vegetation, relieved only by grim, grey rocks of fantastic form, sharing the desolation to which they contributed...(8)

Pyke was not the only nineteenth century writer to illustrate recognition of a fierce beauty of line and contrast in the reef area landscape. Rickard, in a visit to the Carrick and Dunstan reef areas, interpreted them with an eye more akin to that of the geographer:

We have here the basal wrecks, the stumps, as it were, of what were once mountains, perhaps as rugged as those further inland. Denudation has degraded them to uninteresting hillocks... but they are striking to the eye by reason of the very curious weathering which has left numerous isolated rocks standing above


(8) Pyke, V. History of the Early Gold Discoveries in Otago, 1887, p.21.
the surrounding level like an army in skirmishing order. (9)

Both accounts clothe the Upper Clutha schist ranges with an air of inhospitality. The earliest surveyors ignored these areas as being of no economic significance. The runholders used only their lower reaches due to the scanty vegetation cover and their susceptibility to unseasonal snowfalls. Routes of access to the lowland plains methodically threaded around them and filtered over their lower passes - the sculptured rock remnants serving as starkly tangible manifestations of the upland environment. When these percepts and facts are considered in association with a contemporary population concentration around Dunedin, and sparingly dispersed along the northern east-coast belt of Otago, it becomes singularly obvious why the uplands received no attention whatever.

Within ten years of Goldie's first journeys in the Upper Clutha, these same two ranges supported resident populations in excess of 200 persons, predominantly at heights of over 2000 feet, and did this at a time when the township of Cromwell, the primary service centre for the Northern Goldfields, housed only 366 inhabitants.

This transformation in attitude to the rangeland, from one which ignored it as of no economic use, to one


(10) New Zealand Census of Population, March 1874, p.22. The population of Carrick town and the Carrick Ranges was recorded as 113; the population of Bendigo Gully and area as 79.
which accepted the need to permanently inhabit the reef areas at high altitude, was remarkable in both its swiftness and scope. The recognition of both a valuable resource in quartz reefs, and a means of sustaining livelihood upon the barren Dunstan and Carrick Ranges, radically amended the human appreciation of this region.

In an imaginative illustration of the exploratory nature of the quartz reef prospector, and his relationship with a physically harsh environment, T.A. Rickard, a world-noted mining engineer of the 1890s reflected:-

These deposits [mineral] were not to be found near the smiling cornfield or the gentle hill slope, but in regions where geologic unrest had produced inequalities of contour and ruggedness of aspect, where the surface was bare of soil and the mountains exposed their heart of rock. The miner therefore, left the sheltered valley and plunged into the outer wilderness. And in his wanderings he found not only the metallic ore ... returning home he told the farmers and shepherds that fertile fields and flowery meadows awaited them across the range. They migrated thither, while he again adventured ... ever pioneering the advance. (11)

Although these thoughts were of American origin, they nevertheless exposed a recognisable parallel in the contemporary Otago experience. The earliest Government surveyors generally conceded that farming would eventually occupy the future populace of the interior; the mining predominance which preceded this, was not expected on either the numerical or the geographically dispersed scales which occurred in the following decades. The

quartz mining sector comprised only a fraction of this class, but embraced geographical extremities of the province both spatially and vertically.

The saga of the discovery and progress of the Otago goldfields has tended to verge upon the dubious sphere of lore-enhanced history, but is well documented throughout the last century in accounts, of which Pyke's history(12) was (and remains) an authentic standard. Such reports clearly follow the effect of gold mining within the province. However, a brief analysis of the pattern, together with the various attitudes and prejudices concerning the industry, would be beneficial, in subsequent comparison with and evaluation of, later reactions, when auriferous quartz was exploited.

The responses to the very first confirmations of gold findings in the province were reflected in the dampening remarks of Superintendent Cargill in 1856:-

... in no circumstances would it be advisable to allow any searcher to go upon a run without leave of the Lessee, or upon a native reserve without leave of the natives. (13)

Official attitude vacillated in a most unsettling manner. The Provincial Council as a body, instead of continuing their policy of ignoring the reporting of small gold findings, simply by means of a marked lack of interest yielded with surprising ease to public pressure the

(12) Pyke, History of the Early Gold Discoveries in Otago.

(13) Votes and Proceedings, Otago Provincial Council, Session V, 1856, Superintendents Address, December 2, p.2.
following year, in assenting to offer a large reward for the discovery of a 'remunerative Gold Field'. Fear of an emigration of labour to other goldfields stimulated this remarkable change in policy.

The Provincial Council, encouraging fresh interest to be directed toward the interior, thus aided the prospecting cause. It was mainly a lack of ready labour that had prohibited the province from letting flow its immigration pool in a series of diverging rivulets around the inland ranges, before 1861. Favourable reports had been accumulating since 1851. The inhibiting forces at this early time included the dearth of labour, and to a lesser extent, the desire of the Provincial Council to maintain a socially cohesive community, free of the 'dreaded cosmopolitanism' of goldfield immigration.

Although some of the earliest gold discoveries in New Zealand had been associated with quartz reefs, in the volcanic formations of Auckland's Coromandel Peninsula in 1852, the lack of heavy machinery in order to successfully work them, had occasioned frustration among the quartz miners, and general disillusionment in Auckland and on the Coromandel fields.

It is unlikely that the Maori indications of gold deposits referred to by Pyke, in such reports as that of Chief Tuawaiki, reflected their discovery of gold in

(14) O.W. December 12, 1857.
(15) Pyke, V. History of the Early Gold Discoveries in Otago, p.12.
quartz reefs. (17) The auriferous specks in such quartz matrices are barely discernable with the naked eye, except in the richest of veins. (18) However, the same Maori chief's report was the first indication that gold might exist in the Upper Clutha, a region referred to in particular, for its gold-bearing features. This is certainly plausible, as the Maoris made regular traverses to the west coast using the Upper Clutha valley and Thomsons Saddle as a means of access to the Haast and Maori Passes, signs of their habitation having been found near Bendigo. (19)

Recognition of the close association between gold and quartz is revealed in a letter dated 27 October, 1851, to Superintendent Cargill by two northern Otago sheepmen, who enclosed specimens of auriferous quartz found at Goodwood. (20) J.T. Thomson, during a survey of the Southern Districts of Otago in early 1857, illustrated the further association of quartz, with iron staining, later to become one of the major clues for prospectors, in the location of quartz reefs.

In these [southern] districts, quartz is disseminated amongst the cherty, schistoze and slatey rocks that abound; and the


(18) Such rich quartz reefs were commonly referred to as 'bonanza lodes', after American nomenclature.

(19) Roxburgh, Wanaka Story, p.17.

(20) Pyke, V. History of the Early Gold Discoveries in Otago, p.12.
quartz, when found on the surface, is much intermixed with peroxide of iron. (21)

This triadic bond between iron, quartz and gold, though not always faithful in its association, was to form a significant hope for potential mining prosperity in the 1870s but not before the alluvial workings had reached their maximum extent of spatial distribution.

Indication of gold near the Cromwell reef area was officially recognised by Alexander Garvie, an assistant surveyor under Thomson, in a report dated 15 July, 1858, in his simple statement that the metal was to be found where the Clutha River breaks through the Dunstan Mountains. (22) Although Thomson had found traces of gold on the northern flank of the Dunstan Range in July 1858 (23) it was three years later before Otago's first rush of any consequence took place. A party of roadmen, sent to the Lindis River to work in clearing a route for the entry of flock owners to the area, stumbled upon alluvial gold in quantities sufficient to capture the attention of some three hundred diggers. (24)

Alluvial gold was sought around the western face of the Dunstan Range, and it is unknown whether prospecting parties ventured as far down the Clutha Valley as the

(22) Thomson J.T. Original Exploration in the Scottish Settlement of Otago, 1878, p. 80.
(23) O.W. July 31, 1858.
Bendigo Gully; nonetheless, numerous such parties were, in May 1861, 'invariably' obtaining gold in the Dunstan Range gullies. (25)

Following the magnetic attraction of Tuapeka area gold in mid 1861, very little interest was afforded gold working in the Cromwell region. At least, any industry in existence was eclipsed in reports and official coverage by the magnitude in yield of its Tuapeka neighbour. Yet in December 1861, Goldie, in his capacity as Government surveying assistant, made the first reference to the existence of quartz reefs in the Bendigo Gully area. Upon descending the western flank of the Dunstan Range, following a traverse by way of Thomsons Saddle, his perceptive eye caused him to casually transcribe in his diary '... there must be gold here as there is a great deal of quartz mixed with the rocks.' (26) The remark was never published, and alluvial mining pursuits remained of paramount concern among the scattered parties of prospectors.

The revelations of the two pioneers of the Dunstan diggings, (27) in August 1862, served only to consolidate this preoccupation with the auriferous sands and gravels of the riverine regions. The range land lay stolidly


(27) Hartley H. and Reilly C., both immigrants from the Californian diggings.
splendid and respected in its oppressive bulk, challenged only when the rivers' and diggings' population density ousted the impatient. (28)

Both the Dunstan and Carrick Ranges were included as foremost areas of exploration during the summer of 1862-3. This movement stemmed partly from the spring flush of the Clutha River inundating beach workings, (29) the concentration of miners in one area, and, in the scaling of both these ranges, a belief that rangeland adjacent to the diggings must be in some way auriferous.

The Clutha rising helped the onward movement by sending the claim holders off right and left to prospect the big ranges ... the Carrick Ranges were scaled and ... added itself to the list of exceptional wealth. (30)

The Upper Clutha river was worked along many parts of its length during 1863, but the beaches in this area never attained anything like the returns won from those beside the Molyneux and Kawarau Rivers. This fact further supported the notion that the ranges adjacent to these latter two river gorges were indeed the source of the auriferous deposits, explaining in part, the early attention devoted to the high and terminal gullies of the Carrick and Dunstan Ranges. By mid 1863 some 1050 alluvial miners were estimated to be working the gullies

(28) Goldie, J. Letter to Mr Robert Barr from J. Goldie, Dunedin, May 1, 1863, p.37. [Hocken manuscript M1 109/4].


at the foot of the Carrick Range alone. (31) Of quartz reefs in the region, no reports had been furnished. Indeed, some of the early geological survey reports served merely as vehicles of dramatic irony:

The geological survey report of the Dunstan, already furnished, does not give much hope for the discovery of workable quartz reefs within that district. It is not impossible, however that auriferous lodes and the matrix of Dunstan gold may exist in the high mountains and glaciers not far from the tributaries of the Clutha and the large lakes. (32)

- an unfortunate choice of sentiment regarding a region which was to gross in excess of £500,000 from quartz reefing alone, within fifteen years. (33)

The optimism reflected in the latter portion of the above comment almost certainly stems from digger feeling at the time, especially among those immigrants from Victoria. The American influx, epitomised in the Dunstan pioneer alluvial diggers, H. Hartley and C. Reilly, adapted their modes of working to the Otago situation with ease. The Victorian diggers' experience was largely that of tunnelling - deep leads and quartz reefs on the waterless wastes of Bendigo and Ballarat. Pyke, recalling his own experience on the goldfields of Victoria, perceptively remarked in the early phase of the Dunstan rush:

(31) Parcell, Heart of the Desert, p.23.

(32) Wekey, S. Otago as it is, Its Gold-Mines and Natural Resources, 1862, p.66.

(33) From documentation of individual mine statements and Handbook of New Zealand Mines, 1887, p.41.
To the Australian miner Otago presents few of the ordinary characteristics of a gold-bearing country. He misses the quartz reefs, which serve as an index to the auriferous deposits ...(34)

In the same report he further highlighted the difficulty of reef prospecting in any case, citing the local vegetation and soil cover as largely concealing the quartz and schist rocks from view.

The first Otago quartz reef reported to a provincial authority was in May 1862, when Pyke revealed the discoveries at the Highlay diggings, on the Tuapeka and on the Waipori diggings. It is not difficult to recognise the close correlation between the spatial distribution of pioneer alluvial diggings and the reported quartz reefs during the 1860s.(35) Alluvial discoveries generally followed riverine workings such as the Kawarau and Dunstan gorges, but the pursuit of alluvial deposits to the rangeland - the supposed source of such auriferous deposits - gave rise to small parties of diggers working upon elevated uplands. These parties were small due to the insufficiency of such upland alluvial deposits to support high populations of goldminers. The elevated areas were turned to because of the desire to work ground in immediate proximity to the parent rangeland.

As yields from such areas waned, attention was


(35) For example, reefs were worked in close association with alluvial diggings at Waipori, Serpentine, Bendigo Gully, Rough Ridge, the Arrow and the Carrick Range.
Fig. III  QUARTZ MINING CLAIMS WORKED:

BENDIGO AREA  1869-84
**KEY TO FIGURE III : Quartz Mining Company Claims**

1. Cromwell Company No.1  
2. Cromwell Company No.2  
3. Knuteson and Company  
4. Aurora Company  
5. Colclough Company  
6. Butler and Company  
7. Golden Crown Company  
8. Richmond and Company  
9. Victoria Company  
10. Golden Link Company  
11. Anderson and Company  
12. Broadfoot Company  
13. Guano Company  
14. Reliance Company  
15. Energetic Company  
16. Wrightson and Company  
17. Bendigo Gully Company  
18. Parry and Company  
19. Hit or Miss Company  
20. Daniels and Company  
21. Aldread and Company  
22. Saxby Company  
23. Rise and Shine Company  
24. Lucknow Company  
25. Morning Star Company  
26. Leviathan Company  
27. Eureka Company  
28. Bendigo Deep Level Company  
29. Bee Hive Company  
30. Carlisle and Caledonian Company  
31. Great Britain Company  
32. Great Central Company  
33. Unexpected Company  
34. Kiss me Quick Company  
35. Rising Sun Company  
36. Forlorn Hope Company  
37. Come in Time Company  
38. Alta Company
directed towards the very heart of the rangeland itself; contemporary faith in the permanence of the gold/quartz relationship began to enjoy its lengthy reign.

Although Pyke quipped in 1864

slowly also, the miners are unlearning the experience gained in other countries, and beginning to understand the peculiar character of these [Otago] workings. (36)

not all miners were to alter their understanding of the gold extraction process, and adopt the predominantly alluvial techniques of Otago. This was widely evident in the areal diffusion of quartz reef discoveries, prospecting stimulus for which came principally from the Victorian experience of many of the early miners.

The aspirations held by many reef prospectors at this time, of developing a workable investment, were frustrated by the lack of available machinery and supporting services. Only at Waipori, where a prosperous alluvial mining community existed, was there enough common interest to support and erect machinery by January 1863.

The increasing attention paid to reported lines of reef, and attendant successes of perseverance, led mining surveyors and wardens alike, to cast a searching eye about their respective Gold Fields' Districts for possible reef occurrences. In the Cromwell area, Mr. Mining Surveyor Coates betrayed his fervour to Commissioner Pyke in a report on the range uplands:-

Between the Nevis and Clutha rivers, the vast extent of rude and elevated country, known as the Carrick Ranges, has received a general prospecting, from which it has been ascertained that many spurs and saddles of this area of mountains are auriferous; and it is the opinion of those who have been compelled by the severity of the weather to abandon these localities, that upon the return of mild weather, a large population will be attracted thither. Nor is it less reasonable to consider, that an equally bright future may be predicted for other elevated portions of the district, the Dunstan ranges ...(37)

His hopes, though general, were soon tangibly reflected in continued reef findings on the Carrick Range. This great range harboured the alluvial workings of the Nevis valley on the southwest and the Bannockburn on the northeast. Its massiveness hindered access to the Nevis, yet yielded gold early in the Dunstan rush, for the lateral ravines were first penetrated by miners in exile from the beach workings, ousted by the swollen waters of the Molyneux in September 1861. (38) The Otago Daily Times reported in late 1862 that a party of former Waipori miners, prospecting in the Carrick and Crown range areas, had intimated that they held evidence of auriferous quartz from the Nevis area. (39) This party, referred to as comprising 'thoroughly practical men', could suggest that the professional ability of certain prospecting parties was in question, or perhaps the comment reflected a cautionary approach to gold find proclamations. It is

(38) ibid p.5.
(39) O.D.T. December 9 1862, p.6.
significant in the light of earlier comments (page 26) that the party, in the main, consisted of veterans from the Victorian reefs.

In Pyke's Goldfield Report of 1864, he acknowledged the discovery of a quartz lode on the Carrick Range, but noted that the prospectors had not taken any action for working it. Later called the Elizabeth Reef, this discovery was situated on the Carrick Spur, which runs from Bannockburn to the top of the range, (Fig.IV), affording the most common route to the prosperous alluvial diggings at the Nevis. It was inevitable that at some time the quartzite pebbles which litter the spur should be noted and investigated by migrations of alluvial miners. However it is equally apparent that the preoccupation with alluvial mining, vested in the wide scope comprising the Bannockburn, Nevis and range gullies, allied with the lack of machinery and means to exploit the reef, gave rise to subsequent abandonment during the next five years.

The rationale behind this attitude is evident, in that as long as alluvial deposits were workable without the necessity for substantial financial and material means, and profitable in the 'individual' mode of operation, the attraction of alluvial mining prevailed.

Such easily worked deposits were quickly picked over by the early individual and small party groups of miners. The demise of the economic profitability of the individual

Fig. IV QUARTZ MINING CLAIMS WORKED:

CARRICK RANGE 1869-84
KEY TO FIGURE IV: Quartz Mining Company Claims

1. Royal Standard Company
2. Elizabeth Company
3. Towan and Company
4. Golden Phoenix Company
5. Heart of Oak Company
6. Star of the East Company
7. All Nations Company
8. Border Chief Company
9. Nil Desperandum Company
10. White Horse Company
11. Caledonian Company
12. Bannockburn Company
13. Young Australian Company
14. Goss and Company
15. Watson and Company
16. Golden Star Company
17. Black Horse Company
18. Rob Roy Company
19. Matchless Company
20. Excelsior Company (later Welcome Company)
21. Colleen Bawn Company
22. Terror Company
23. Jersey Company
24. Robert Burns Company
25. Duke of Cumberland Company
26. John Bull Company
27. Golden Gate Company
28. Green and Company
29. Vale of Avoca Company
30. Crown and Cross Company
31. Kohinoor Company
32. Carrick Range United Company
33. Leader Company
34. Welshman's Company
35. Oliver and Company
36. New Chum Company
37. Try Again Company (later Last Chance Company)
38. Perseverance Reef
39. Perseverance Company
40. Amateur Company
41. Tupker and Company (later Excelsior No.2)
42. Patience Company
43. Norwegian Company
44. New Royal Standard Company
45. Dawn of Hope Company
46. Heart of Lothian Company
47. Enterprise Company
48. Golden Crown Company
49. Bonanza Company
50. Stanley Company
51. Test Shot Company
52. Go by Company
miner operation method heralded population decline as miners moved to other provincial fields and back to Australia. Those who remained agitated for revision of the outdated mining regulations which favoured small individual claims, and proposed the growth of co-operative associations. (41) Associations of this order were rare in the Cromwell area; the capitalist spirit of the age favoured the establishment of the mining company.

The Bendigo Gully field mirrored this pattern in the mid 1860s. A dual movement of miners, one through the Dunstan gorge and into the Upper Clutha valley, the other via the Tinkers and Drybread diggings working up Thomsens gorge and over the Dunstan Range, (42) converged on Bendigo. These diggings at the foot of the western flank of the range bore out the expectation of many experienced miners, in recognising that gold particles, due to their high specific gravity, had been concentrated at the foot of the range uplands, where stream velocity wanes as the water discharges onto the plainland. (43)

By 1863 rich alluvial deposits supported a mining population in the order of 150. Although reefs were acknowledged in the immediate vicinity, Thomas Logan, the original prospector of the reefs could arouse no

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(41) Salmon, A History of Gold Mining in New Zealand, p.102.


interest in reefing. (44) The attraction of gold in the terrace alluvium - gold freed from the bondage of the maternal quartz matrix - prevailed, and strongly influenced the direction of mining interest in the mid 1860s. (45)

The potential wealth in quartz mining was acknowledged, if only in the zeal with which reef finds were publicly reported. But only the dedicated few, the men who had witnessed the great mining centres which mushroomed above the Victorian quartz mines, persevered, their chief want being capital and a means to adequately test their claim. By the mid 1860s many of the prerequisites for an infant quartz mining industry were in evidence. As outlined on page 27, many of the lucrative alluvial fields had generated the discovery of adjacent reefs, rarely developing beyond an embryonic state.

The reefs were known to exist, but testing had generally been crude, in the crushing by hand of small parcels of quartz. Nevertheless, their very existence induced the quartz prospector to remain, maintaining a faith in his line of reef, and biding his time in picking out the most promising projections of reef before taking up a lease. To take up such a mining lease and work it effectively required financial backing. The prospector could test and speculate but without capital, could do

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(44) Parcell, Heart of the Desert, p. 126.

(45) Otago Provincial Government Gazette, Session XX, 1865, Dunstan District Mining Surveyor's Report, April 1865, p. 77.
little else. The long-prospected but virgin reefs of Logan at Bendigo, and the Elizabeth at Carrick (Figs. III and IV) characterised this primary constraint upon the Otago quartz reef industry in 1865. Interest in reefing required a greater stimulus than that required by the alluvial industry.

Ironically, the alluvial industry itself was to offer that very stimulus. In the first place, at Bendigo, the superficial alluvial ground was rapidly worked (46) and attention diverted to more enduring modes of alluvial operation, such as sluicing. (47) With the decline in easily and individually worked material, attention could turn to sluicing, co-operative cradling enterprise and quartz prospecting. More importantly, the labour remaining on the alluvial fields, especially at Bendigo Gully, increasingly burdened by problems of falling gold returns, (48) were more receptive to co-operative enterprise and employment by leaseholders, on the basis of a daily wage. Furthermore, in a significant number of cases, financial returns from alluvial mining operations were accumulated by many working miner groups, and were later employed in the form of shares vested within local quartz mining companies.

(46) ibid, p.77.


(48) The exodus of miners from Bendigo Gully during the period 1865-8 was rapid. Parcell (p.123) considers the 1863 population to include 150 miners, falling to only 30 by June 1866.
The Goldfields Act of 1862 had laid down adequate provisions for the application and granting of mining leases, establishing a liberal term of fifteen years. (49) A subsequent amendment Act in 1865 outlined the maximum areas of Crown land available for lease to ten acres in an alluvial claim and an area 400 by 200 yards on a quartz reef, with an additional right over water supply. (50) The principal corollary to this legislation was the facilitation it afforded to the investment interests of the Dunedin and provincial businessmen. Investment in the gold mining industry could be direct, through the leasing of a claim and the hiring of both labour and management to work it. (51)

Perhaps of lesser importance than the former comments, but of no mean significance in the eventual establishment of the quartz reefing industry was the trend toward settlement and industrious activity in the Dunstan District, the population of which had shed to a certain extent, its transitory cloak. The Dunstan Mining Surveyor in June 1866 applauded the number of huts erected and gardens tilled by the mining population (52) as evidence of the permanency and prosperity of the gold industry. The Otago Witness recognised this same vitality within the region in a report on the latest quartz discoveries:

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(49) The Gold Fields Act, 1862, Session XXXII.
(50) The Gold Fields Amendment Act, 1865, Session XXIX.
(51) Otago Provincial Government Gazette, Session XX, April 11 1865, p.61.
(52) O.W. June 16 1866, p.9.
There is a steadiness existing in all pursuits which never existed before, and taking all things into consideration, there is a very promising future before us. (53)

The scarcity of provisions during the early phases of the Dunstan District diggings had, by 1866, been alleviated somewhat by the expansion in local agricultural practice. Hotelkeepers were among the first to take up agricultural land for produce supplies. For example, G.W. Goodger, a hotelkeeper and the primary financier of the prosperous Cromwell Quartz Mining Company in 1869, leased and farmed a large portion of the 230 acres taken up in the Cromwell area by 1866. The production from small localised plots was decreasing the necessity of importing produce into the district.

It is evident that during the transition years from 1866-9, when the mining fraternity's attitude toward quartz mining altered its perspective from one of a lethargic acknowledgement to one embracing wholesale involvement, that the infrastructure of services on the gold fields strengthened, and was to be in turn strengthened by the demands upon such services, issuing from the quartz industry.

As the turbulence of the initial alluvial rushes waned, the remaining Upper Clutha gold field population became aware of an ordered and prosperous future in quartz mining. The rapid exploitation of the easily-worked alluvium had acted as a natural sifting mechanism, shaking

(53) O.W. March 30, 1866, p.3.
free of the field those miners who could not or were not content to remain and work the more inaccessible auriferous leads and reefs. The gold fields settlement evident from the mining surveyors' reports, the overcoming of many of the former inhibiting factors before the reefing industry, the growth of agricultural and commercial services upon the Upper Clutha plains and within the Cromwell township respectively, revealed a community confidence, in spite of falling gold returns.

The press, the mining surveyors and the Government geologists all contributed to this confidence in the future of the mining industry. The Otago Witness reported Dr Hector in 1866 as considering the West Coast gold fields as 'trifling in comparison, not to be compared in point of permanence with those of Otago'. (54) The paper itself reiterated these sentiments by declaring of the Dunstan field:

A considerable number of miners are making their way back from Hokitika ... The fame of our quartz reefs has found its way to the West Coast. (55)

The power of the press in colouring the contemporary mining opinion regarding the industry must be acknowledged. Through a combination of reported fact with official and press opinion, the potential establishment of a local Cromwell quartz industry was to intensify in direct proportion to the length of time the fields remained in-

(54) O.W. February 3, 1866, p.2.
(55) O.W. March 30, 1866, p.3.
adequately prospected and untested. The Cromwell quartz reef fields had emerged. Their development awaited the infusion of capital, a liberal mining lease system, and a labour force sufficiently disillusioned with alluvial pursuits to work them. By the latter 1860s the exploitation of other Otago quartz reefs was directing the attentive focus upon quartz as the insurance of permanence. The premiums as yet were small - the industry stood by to await the capitalist.

These first fifteen years of European contact with the Cromwell reef area already indicate a transitory and diverse attitude to the differing environmental concepts. Although the evolution of this introductory section has tended to work from a general vista of human contact, narrowing into a focus upon the potential reef industry area and population, a number of relationships as indicated in the explanatory model have emerged. The attitude to the physical environment is clarified from the viewpoint of the mining class. (56) An alteration in mining class perception of the quartz mining industry and in the social environment becomes distinct during the years 1862-8. Finally, the medium of the press in its influence of contemporary attitude is discernible. As such, its importance must be borne in mind as central, and all-pervading due to its inherent ability to synthesise

(56) The mining class denotes that proportion of the contemporary population with direct interests in gold mining pursuits, including those people and their families, whose income was derived principally from gold mining occupations.
opinion and consequently sift information to produce a 'desired' end.
Chapter 3

THE CROMWELL QUARTZ REEFS: PRIMARY PHASES AND MODIFICATIONS IN CONTEMPORARY PERCEPTION

Mines are like the saints, for many are called and few are chosen. (57)

The economic health of the whole of New Zealand, prospering under the salubrious climate induced by the era of wide scale gold productivity, began to wane both in strength and in proportion to the fading of the 1860s. In the succinct summary of W.B. Sutch:–

By the end of the 1860s the golden flush had ended ... Diminished farming incomes and the contraction in employment on public works affected manufacturers. Capital was hard to raise and property values fell. Above all, the gold rush and free spending of the diggers had passed. (58)

Such general stagnation, and associated decline in investment activity may have begun to affect the national economy at this time, but in the commercial capital of Otago, the Dunedin businessmen displayed few signs of reticence in following investment pursuits during the early 1870s.

Even with the declining gold returns from the Provincial mining operations, (Table I) official opinion tended to blithely ignore the continual exodus of diggers to the West Coast and Victoria, and sought constant encouragement of the mining industry through the use of pamphlets and news media:–

(57) Rickard, T.A. The Romance of Mining, 1945, p.72.
(58) Sutch, W.B. Colony or Nation?, 1966, p.6.
### TABLE I

**EXPORT OF GOLD FROM OTAGO PROVINCE: 1861-69**

<table>
<thead>
<tr>
<th>Year</th>
<th>Gold Exported (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1861</td>
<td>727,321</td>
</tr>
<tr>
<td>1862</td>
<td>1,546,905</td>
</tr>
<tr>
<td>1863</td>
<td>2,380,750</td>
</tr>
<tr>
<td>1864</td>
<td>1,689,653</td>
</tr>
<tr>
<td>1865</td>
<td>1,004,163</td>
</tr>
<tr>
<td>1866</td>
<td>654,647</td>
</tr>
<tr>
<td>1867</td>
<td>623,815</td>
</tr>
<tr>
<td>1868</td>
<td>686,596</td>
</tr>
<tr>
<td>1869</td>
<td>613,456</td>
</tr>
</tbody>
</table>

Gold-mining is a much less precarious pursuit in Otago than elsewhere. No large nuggets or wonderfully rich claims, dazzle or delude the inexperienced ... a claim takes years to work out, a circumstance which effectually checks the roving propensities for which gold-miners are elsewhere proverbial. (59)

The brevity of time interval between the announcement of rumours from the Cromwell reefs, and the furore in wild speculation to which it gave birth, reflected three important local investment characteristics. Firstly, there was some validity in the above comment by Pyke. Despite the early Otago quartz mining investment disasters such as the Ida Valley Quartz Mining Company and the Macraes Quartz Mining Company, (60) there was sufficient confidence in the future of Otago quartz reef prosperity, to hazard further investment. Secondly, there was, in the face of claims of declining capital fluidity, sufficient finance invested in the Cromwell quartz area to stimulate gold returns and promise further development. (61) Finally, as evidenced in the failure of many companies, there was a great deal of capital recorded on paper, but which did not exist to support company operations.

Although appraisal of such phenomena is not the immediate concern of this chapter, it serves as a useful

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(59) Pyke, V. The Province of Otago in New Zealand; its Progress, Present Conditions, Resources and Prospects, 1868, p.27.

(60) O.W. July 10, 1869, p.1.

(61) Both the Cromwell and the Royal Standard Quartz Mining Companies attained successful results soon after their formation.
reflection of Otago capitalist feeling at the time, and must be acknowledged as the primary motivating force behind even the most rudimentary exploitation of the Cromwell and other Otago reefs at the close of the 1860s.

Early attitude to quartz mining during the height of the alluvial rushes has been discussed, the principal retarding factor to reef development being recognised as the superior ease of exploitation in alluvial mining. (62) Prior to the large scale quartz reefering investment of the early 1870s, an attitude of reticence characterised Cromwell area quartz mining investment, exemplified by the Cromwell Company's difficulty in obtaining financial backing. Although a more detailed consideration of the role of capital in reef economy and history is dealt with in Chapter 5, it is sufficient here to indicate that a stagnation of enterprise characterised the decline in Otago alluvial mining. Accusing the Province of complacency, the Otago Witness complained:–

In every province except Otago an unusual degree of excitement has prevailed of late on the subject of gold discoveries. Although the gold deposits in the province are probably not inferior to those in any other ... the people of Otago are apparently so indifferent to their own goldfields that excitement, with them, is out of the question. (63)

The continual publication of post mortems on the wrecks of former Otago reefering companies (of the Macraes Quartz Mining Company: 'grievously mismanaged, losing

(63) O.W. October 16, 1869, p.1.
and the warnings from the Thames gold field over bogus companies swindling innocent shareholders of their investments, both tended to counter and defeat the efforts of stimulating Otago quartz mining. It is not surprising therefore, to note that the capital for the first successful Cromwell quartz mine was of local (Cromwell) origin.

As a result of a favourable report by the local Mining Surveyor in 1865, a party of Dunedin capitalists took up an area of 16½ acres under a lease at Bendigo. The company sent a trial shipment of the quartz to Victoria, where it was crushed at Ballarat, but the result was not favourable, as the shaft had been sunk slightly to one side of the main line of reef. The six lines of reef in the area, all discovered by Thomas Logan, had been prospected by him for two years. However, this Bendigo Quartz Mining Company was short-lived, as Logan suspected the company to be treating him unfairly, he retaliated by deliberately losing the quartz leader for them. This move alleviated his personal complaint but did considerable harm in proclaiming the quartz field uneconomic and not as potentially productive as Logan had claimed. The field retained its alluvial mining

(64) O.W. February 27, 1869, p.6.
(65) D.T. November 5, 1869, p.3.
(66) O.W. August 22, 1874, p.7.
(68) Colloquially termed 'a duffer'.
population, but it was four years before Logan and his two partners could interest further capital in the area.

In August 1868, when the whole Bendigo region was almost deserted, Logan and Party accepted G.W. Goodger, a Californian living as a hotelkeeper in Cromwell, into the partnership for a modest investment of £30. (69) Goodger had experienced both the Californian alluvial and quartz rushes, and recognised wealth in the specimens from the Bendigo reefs. These reefs had thus required the combined characteristics of experience and capital in the recognition of their potential, for Goodger put up the capital necessary to purchase a second-hand battery for the partnership in September 1868. (70)

The very existence of Logan's long difficulty in raising capital and interest in the reefs, is significant in revealing contemporary miner and capitalist attitudes to the industry. The miner could not pursue the activity without means. Few of the 120 alluvial miners at Bendigo in July 1865 remained to test the adjacent reefs. Stimulation of the enterprise remained for the capitalist, but this was slow; a disillusionment with pioneer Otago reefs and a lack of experience in recognising high-yielding quartz samples retarded zealous or even cautious investment.

The pioneer quartz mining company at Bendigo bestowed upon itself the unpretentious title of the 'Cromwell Quartz


(70) The crushing battery of twelve stamp heads, driven by a thirty foot (diameter) water wheel, was purchased from the defunct Hindon Quartz Mining Company.
This plate illustrates the earliest methods of prospecting quartz reefs through the mode of trial shaft sinking. The simple windlass was the only mechanical device used by small groups of miners, aided by blasting powder, picks and shovels.
Mining Company'. Even this choice of title reflected the simplicity of operation style for which the company was later to become famous in Otago and New Zealand.

Because of the large water wheel, and amount of water necessary to drive the twelve heads of stamps (almost five sluice-heads), the whole set of battery and tables had to be installed at a low level where sufficient water power from Bendigo Creek was available. (See Appendix A for operation of stamper battery). Although the company expended £300 in the battery installation, only five heads of stamps were erected at first, with the intention of erecting two further sets of fifteen heads each if the crushings were successful. With a main shaft 82 feet deep, the company began stockpiling quartz at the battery site during the summer of 1868-9, having 500 tons of quartz at grass by the first crushing in May 1869. The first crushing yields were kept secret, although the Dunstan Times published the first return as 238 oz. (Refer Table II).

The Cromwell Company retained the original four shareholders at this time, with Logan as manager, and was, by late 1869, carrying the financial burden of employing 30 men in mining and carrying quartz to the

(71) Otago Provincial Government Gazette, Vol.XI, 1867, p.232. (Four sluice heads were sufficient to work ten heads of stampers).

(72) O.W. June 26, 1869, p.15.

(73) Quartz mining term for 'stockpiled on the surface'.

(74) D.T. May 21, 1869, p.2.
<table>
<thead>
<tr>
<th>Month</th>
<th>Gold (oz.)</th>
<th>Gold (oz./ton)</th>
<th>Days of Crushing</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>238</td>
<td>over 1</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>secret</td>
<td>secret</td>
<td></td>
</tr>
<tr>
<td>Sept.</td>
<td>157</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Nov.</td>
<td>300</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Dec.</td>
<td>216</td>
<td>2.5</td>
<td>10</td>
</tr>
</tbody>
</table>

Source: Documented reports in *Dunstan Times* and *Otago Witness*. 
battery. (75) The average weekly wage expenditure for the company at this time, was in the order of £100, in addition to other mine expenditure. Nonetheless, the gold yield per ton increased with each successive crushing (Table II), and in November 1869, the partners received their first dividend of £6,000 each. (76)

The preceding descriptive material tracing the development and success of the Cromwell Company has eclipsed any concern with other contemporary activity within the Cromwell reef area. Such activity almost universally reflected the success of this Bendigo reef company. The attitude of all sectors of the community to the reefs, altered. That is, perceptions of both the immediate environment, and of that environment as affecting the future of the Upper Clutha valley, were transformed, and manifested themselves in an intense interest in the new source of potential prosperity. The rangeland presented itself as a frontier of quartz reef potential, protecting the future mining prosperity of the Province.

The difference between this series of reef discoveries and any new alluvial field was that a productive quartz field was envisaged as ensuring permanence - 'the steady industry which true mining for gold becomes'. (77)

Demographic and service-function characteristics of the Upper Clutha valley had also altered by 1869, reflecting

(75) D.T. December 17, 1869, p. 3.
(76) Parcell, Heart of the Desert, p. 129.
(77) O.W. November 6, 1869, p. 3.
a consolidation of activity. The town of Cromwell had become an expanding centre of population. Greater facilities for the official administration of goldfield activity had appeared as regular and ordered establishments, in the form of gold-buying banks and receivers, contrasting sharply with the comment in 1862: 'There is more gold offering at 70/- per ounce than there is money to purchase it.' (78)

With the decline in alluvial returns during the latter 1860s, the Cromwell Gold Receiver had been recalled. However, the stimulation and anticipation of greater gold fluidity throughout the local economy induced the Goldfields Member of the House of Representatives to raise in Parliament the question of the reinstatement of the Receiver. (79)

The infrastructure of services had attained a broader base, and the local population began to assume this as a right, in return for their settlement and faith in the Cromwell reef area and Upper Clutha valley. Contemporary opinion regarded the supply towns as being necessary pre-requisites in the successful and large-scale development of a goldfield. (80)

As if to act as paternal overseers ensuring the legitimate exploitation of the Cromwell reefs, the local papers, with rare foresight, discouraged the free rushing of and speculation over claim areas that had characterised


(80) D.T. September 24, 1869, p.3.
Proclaimed in 1875 as the ‘rising quartzopolis of Otago’, Cromwell was well established by the mid 1870s, with double-storied stone and wooden buildings. The town’s role as the service centre for the Cromwell reefs and surrounding district, and its site on the arterial road routes to Wanaka and Queenstown, ensured its permanence.
isolated Otago reefs, and in particular, the Thames and Coromandel goldfields. In efforts to isolate the underlying causes of quartz mining company failures, the Otago Witness remarked in 1869:-

The great mistake of small companies and small undertakings lies in the impossibility of their being able to pay for competent management. This appears to have been the cause of failure in the case of almost all the companies we refer to. Let their non-success be attributed to its true causes, and not set up as a barrier against future enterprises. (81)

Although such comment reflected company problems, the implication conveyed was that large companies with substantial capital backing could make a reef pay. The Bendigo and Carrick reef areas were later to prove the slightly distorted vision of such attitude, as invariably the successful companies, which had better control over their internal management, had their genesis in small combinations of working miners aided by a minority of capitalists. (82)

Recognition that the elevated areas contained the sources of alluvial deposits, and that gold became more coarse in the heads of gullies, indicating its proximity to the quartz matrix, (83) enjoyed widespread adoption, with many miners turning their attention to the rock outcrops. The quartz prospector could carry out his

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(81) O.W. November 13, 1869, p.1.

(82) For example, the Cromwell, Heart of Oak and Young Australian Quartz Mining Companies.

task as an individual, until he struck a reef. To test the ore necessitated the sinking of shafts, in turn requiring labour. Consequently, miners tended to amalgamate their labour, working in parties of two or more miners, on quartz mining leases. This pattern characterised the early exploitation of reefs both upon the Carrick and Dunstan Ranges.

At Bendigo, the prospecting movement gathered momentum only gradually. Logan and Party were joined by the Aurora Company in 1866, although on a different line of reef, known as the Aurora Line. Sluicing at Rise and Shine Gully was the principal form of alluvial mining in the area at the time, being supplied by a large water race bringing in twelve heads of water from Thomsons Creek, on the east side of the range. Water race development in the reef area had therefore begun at the time of the Cromwell Company's first successful crushings, intensifying interest in the future of the area from all occupation classes.

The Dunstan Times welcomed the new industry as 'gratifying', (84) and as a means of population retention and permanent employment.

The success which has attended the first crushing of the Bendigo Gully company's quartz ... completely sets aside the almost universal prevailing opinion, that quartz mining in Otago cannot be prosecuted with profit. (85)

By October 1869, nine quartz mining claims had been

(84) D.T. February 19, 1869, p.2.
(85) D.T. May 28, 1869, p.2.
51.
taken up at Bendigo and the prospecting population was increasing as the spring months removed the winter snow cover and rendered habitation on the range more endurable. Although the Cromwell Company operations enhanced the attraction of the area, official and local attitude was cautious:— 

... it is to be hoped that people will not rush headlong into wild speculation, because one or two parties, after years of patient labour, have met with their just reward. (86)

A special reporter to the Bendigo reefs in December 1869 visited twelve different parties of working miners engaged in shaft sinking, besides the many other claim-holders and prospectors. By January 1870, 58 claims were in operation. (Table III and Figure III).

TABLE III

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cromwell Reef</td>
<td>13</td>
<td>19</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Aurora Reef</td>
<td>3</td>
<td>11</td>
<td>10</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Alta Reef</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colclough Reef</td>
<td>5</td>
<td>14</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Richmond Reef</td>
<td>1</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


(86) D.T. November 5, 1869, p.3.
The Aurora Company, having spent several fruitless years in the quartz prospecting stage, continued as a result of its water right ownership in the area. The partnership pursued reef working on the strength of financial returns from water race assets. In a classic example of quartz mining field underhand share activity, one would-be shareholder, rejected from the partnership by the Company, bought a second-hand crushing battery only a few hours before the Company representative arrived to undertake the same purchase. The Company reluctantly agreed to accept the battery in return for the grant of a half share in the Company (valued at £1,500). Both the value endowed upon the claim share, and the method of obtaining the share indicate the interest in share speculation within the industry as early as 1869, and the high relative importance attached to the possession of mining shares.

The Goldfields Secretary was particularly concerned that excessive speculation should not destroy this most promising of Otago quartz fields before it had been properly tested. Advocating sobriety in the careful development of the reefs, Pyke exclaimed:

... I trust it will be long before any speculative companies obtain a foothold on the Bendigo reef, for I feel assured that their formation would retard and not assist the development of resources of that locality. (88)

By October 1869, the movement of diggers from barely-

(87) Barry, W.J. Up and Down, 1879, p.224.

(88) O.W. September 18, 1869, p.18.
productive claims on alluvial fields, such as the Cardrona, Clyde and Bannockburn-Nevis areas, had produced an insatiable desire for shares in claims along the reef lines.

Evidences of a desire to force a new speculation era onto us are not wanting. The material is at hand in the shape of the reefs opened at Bendigo Gully and elsewhere. Already large prices are being paid for claims because they are on a supposed favorite line of reef. Here there is the germ of vicious recommencement of share speculation. (89)

Certain attitudes toward speculation reflected a toleration, and belief that the reefs were rich enough to support some indulgence in the practice:—

Almost every other man has got a [quartz] specimen in his pocket, which he is bent on exhibiting—sometimes with great affectation of mystery—to eager investigators. But although ... the mania is excessively developed, there now remains no doubt that the Bendigo Reef is a continuous lode of great extent. (90)

The telegraph columns of the Dunedin papers reported daily the continuing series of quartz find sensations from Cromwell. Such telegrams indicated local anticipation of enormous yields. Distortion of reality was far from infrequent: one telegram reported that stone from the lease of Colclough and Party would yield 100 ounces of gold per ton. (91)

The reefs were indeed keenly sought after. By

(89) D.T. November 5, 1869, p.3.
(90) O.W. October 23, 1869, p.10.
(91) O.W. November 2, 1869, p.12.
October 1869, the Cromwell Reef had been taken up in the statutory 400 by 200 yard leases (92) for over one and a half miles, (93) and the Aurora Reef had been tested as auriferous for a mile. The most sensational news from any of the reefs was that announced by Charles Colclough, a miner from Cardrona, who arrived in Cromwell with exceedingly rich specimens of quartz 'perfectly clotted with gold.' (94)

All of the adjacent ground to Colclough's was marked out soon after (some of it perhaps before) daylight ... and intense excitement prevails ... (95)

The Cromwell reporter for the Otago Witness cautioned that the exhibits of quartz were surface samples only, but overnight, on November 2, share values in all claims within sight of the main lines of reef, reached intoxicating proportions:- 'What changed hands last night with some difficulty at £20 to £30, rose this forenoon to £80, £90 and £100.' (96)

Such prices were paid purely for interest in the ground. Many claims contained virgin ground, as few shafts were sunk during the early months of the rush (Table III) although the large concerns such as the Cromwell, Aurora and Colclough Companies supported several exploratory shafts.

(92) Gold Field Amendment Act 1865, S.29.
(93) O.W. October 23, 1869, p.10.
(95) O.W. November 13, 1869, p.3.
(96) O.W. November 13, 1869, p.11.
55.

The speculative furore soon strangled itself, starved by inflated share prices and a lack of ready finance:

Holders of shares are indisposed to sell, except at fabulous prices, so that little speculation is going on. From £300 to £700 is asked for shares ... (97)

Official action in dealing with the unparalleled escalation of claim values was firm. Warden Pyke wielded a veto over speculation, based upon the strict enforcement of statutory requirements of the Mining Act, in stipulating that claimholders employ a certain number of men at the claim. The public notice issued, enforced sellers of shares in quartz claims to be working the claim with a minimum number of men (depending on claim size), at the time of sale, or the claim would be forfeited. The proclamation was successful in decreasing the rate at which shares were sold. (98)

The enforced share selling restraint enabled many of the facts regarding the reef exploitation and settlement to emerge. The flurry of excitement, when much of Clyde township was reported as being to let, most of the inhabitants having gone to the reefs, (99) had obscured the extent of work being carried out on the ground. When the clouds of excitement died, it was found that many people held expensively-purchased shares in untouched claims that

(97) B.H. November 10, 1869, p.7.
(98) O.W. November 20, 1869, p.13.
(99) B.H. November 10, 1869, p.7.
merely lay adjacent to proven reefs.

Many sobering facts emerged from this post-rush period at the turn of the decade. Of the 52 mining claims on the Bendigo reefs, and four quartz mining leases, \(^{(100)}\) only one battery of five stamps was in operation. This battery was in private hands, and furthermore, fully occupied with private company quartz stocks. Thus, the realisation that there existed no readily accessible means to test the individual quartz reefs and claims, cast a somewhat dismal cloud over the Christmas of 1869.

The Bendigo special correspondent to the *Otago Witness*, expecting a bright future for the local reef industry, claimed the population of the Bendigo reefs area to be 'about 400, but ere 12 months elapse it will not be less than a thousand.' \(^{(101)}\) Parcell claims that the year 1869 ended with 294 shareholders having invested in the reefs, and 56 hands being employed in the four main leases, the majority working for the Cromwell Company. \(^{(102)}\) The only activity remaining for the rest of the working mining population was the slow, arduous and unremunerative task of thoroughly prospecting the reef claims, through the sinking of shafts into the reefs.

In spite of assurances by a Dunedin capitalist, G. Murray, that he would erect a 30 stamp public crushing mill at Bendigo, \(^{(103)}\) several claims were already abandoned

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\(^{(100)}\) Parcell, *Heart of the Desert*, p.130.

\(^{(101)}\) O.W. December 17, 1869, p.3.

\(^{(102)}\) Parcell, *Heart of the Desert*, p.130.

\(^{(103)}\) O.W. December 17, 1869, p.3.
by 1870, shares being sold for any offered price. The old adage confidently propounded by the *Otago Daily Times* at the very beginning of the Otago gold rushes, was bearing well against the test of time:—'*... under the excitement of a rush, diggers are too impatient to prospect much.'* (104)

It was evident that amid the whirlwind of share buying, many diggers, tired of the physical task of mining, desired to attain the status of shareholder, and employ labour. This situation created a dearth of willing mine workers, witnessed by a Bendigo correspondent who noted with concern, the disposition of many shareholders to open up their ground by inviting tenders for work, and the lack of energy in mining classes to take up such tenders. (105) Much time was spent in dispute over the boundaries of claims, in many cases eclipsing the carrying out of actual work, and necessitating the employment of a District Surveyor to map out claims and reef lines using index references to facilitate Warden's Court decisions.

The main mode of testing the reefs was through the sinking of shafts, indicating the predominance of Victorian quartz miners in the area. Due to the level nature of many Victorian reefing areas, shafts were, by necessity the only means of extracting ore. The undulating nature of the Cromwell reef areas, failed to

(104) O.D.T. November 26, 1862, p.6.
(105) O.W. December 4, 1869, p.15.
suggest to the working miner, the comparative ease of testing the reef through the use of tunnel drives into the sides of reef-carrying spurs. Here, the mining perception had been significantly tainted by previous experience and succumbed only slowly to the translation of method offered by the Otago relief. Even as early as 1868, the Government Geologist Hutton, had noted this differential perception, in the working of Thames quartz reefs:

... the starting and working of most of the claims has been very unsystematic ... The country generally is admirably adapted for working by day-levels; but shafts on the steep slopes, and even on the tops of hills, are common. (106)

The pioneer company on the field, the Cromwell Company, had continued regular crushings, feeding upwards of sixty tons per week through the stampers, and averaging three ounces of gold per ton. On their two leases, totalling sixteen acres, they employed several shifts of miners in blasting out quartz from their three main shafts. The deepest of these shafts was 96 feet in January 1870, and still on highly payable quartz. Unfortunately the large gold returns and quality of reef possessed by this company tended to negate Pyke's efforts to keep claim values down. With the erection of the Aurora battery in January 1870, share values in that company greatly inflated, especially after sensational news reports such

The Cromwell Quartz Mining Company's buildings on their No.1 lease near Logantown, are dwarfed by the dominant outcropping of the surrounding schist rock.
as the following telegram published in Dunedin:-

The Aurora Company took out some stone last night, from 31 lbs. of which 1 lb. of gold was obtained. An extra issued by the Guardian says that a ledge like a jeweller's shop has been struck. This information is reliable. The excitement here is immense. (107)

Three days later, a one-seventh share in the Aurora Company changed hands for £1,000, closely followed by another one-seventh share sale for £1,350. (108) The same shares had been worth only £400 at the height of the 1869 speculation period. Jackson Barry, who reported first hand from Dunedin at this time, remarked that 'men's minds were distracted by visions of wealth to be gained from investments in quartz mines.' (109) Returning to Bendigo a month after the Aurora Company's first crushing in April 1870, Barry could raise only £250 for his one-seventh share in the Company. The first crushing, although yielding 2.8 oz per ton, paying equally as well as the Cromwell Company, had failed to accomplish the expected ten ounces per ton output. This example of gross over-reaction to an unexpected gold yield was the forerunner of several similar cases of an adverse attitude to reefing by shareholders, in the face of a favourable reality. Both the Colclough and Alta Quartz Mining Companies erected crushing batteries in late 1870, crushed quartz for a lower yield than anticipated, and

(108) O.W. February 26, 1870, p.11.
(109) Barry, Up and Down, p.226.
soon fell into liquidation.

The summer of 1869-70 revealed a distinct consolidation of effort in the work of prospecting the claimed reefs, taken up for a total 7½ miles, (110) and in constructing service facilities in the form of the three quartz mining townships at Bendigo. The township of Bendigo, sited on the old alluvial diggings three miles from the surveyed township at Wakefield, was simply an indicator of the reef area, and transient point in travel to the reefs. The townships of Wakefield, at a Clutha River ferry crossing, and Bendigo, were frequently confused as occupying the same geographical location. The site chosen by the Provincial Superintendent for the township of Bendigo constituted an amusing spectacle in 1870, being carefully surveyed and containing only two buildings, while the unsurveyed quartz mining settlement at Logantown, a mile up the Dunstan Range and adjacent to the Cromwell Reef, boasted a main street liberally endowed with cottages, stores, hotels, dining rooms and several service establishments. (111)

These settlements, together with the township of Welshtown, a half mile above Logantown, were a direct consequence of the influx of quartz miners to the reef areas. Their continued existence depended on the longevity of profitable employment of wage-earning quartz miners and prospectors. However, in the autumn of 1870,

(110) D.T. February 11, 1870, p.2.

the first of the disillusioned miners began leaving:

... a great many claims have been abandoned at Bendigo Gully, shareholders seeing no prospect of having their stone crushed ... Many have left the reefs before the winter sets in. (112)

The prospectus of the Bendigo Quartz Mills Company, being that of the proposed company to erect the public crushing battery, was still published in the Dunedin newspapers, with no indication of definite inauguration. It became evident that Dunedin capitalists preferred to invest directly in a mine, rather than a public service company; the proposed crushing firm quietly slipped into obscurity. (113) The Aurora Company decided in April 1870 to throw open their battery for public crushings, but the price demanded by the Company made many trial crushings unremunerative, as cartage to the Aurora mill was 12/- per ton of quartz, (114) in addition to the milling charges. (Refer Table IV).

**TABLE IV**

<table>
<thead>
<tr>
<th>Ton Parcels of Quartz</th>
<th>Price per Ton (£)</th>
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<tbody>
<tr>
<td>less than 10</td>
<td>2. 0. 0.</td>
</tr>
<tr>
<td>10-20</td>
<td>1.15. 0.</td>
</tr>
<tr>
<td>20-50</td>
<td>1.10. 0.</td>
</tr>
<tr>
<td>50-100</td>
<td>1. 5. 0.</td>
</tr>
<tr>
<td>maximum of 100</td>
<td>1. 0. 0.</td>
</tr>
</tbody>
</table>

Source: O.W. April 23, 1870, p.11.

(112) O.W. April 9, 1870, p.11.

(113) The Dunstan Times editorial of January 14 1870, issued a tirade of complaint against the lack of encouragement of the reefing industry by Dunedin businessmen.

(114) O.W. June 4, 1870, p.16.
The news was received favourably, however, in that this alternative to the abandonment of auriferous claims would not allow wealthy speculators to slip quietly into those abandoned claims known to be of value. As the Bendigo correspondent to the Otago Witness remarked:-

... without this timely aid, what was the poor man who had spent his time and labour to do? unless he sank (115) to the position of a wages man; and then he most likely would be compelled to surrender his claim. (116)

A roster system constituted the base for the trial crushings of quartz from the various claimholders. With the battery of ten stampheads at work by three shifts of workers, 24 hours each day, (117) 150 tons of stone could be processed weekly. The Aurora Company continued to employ hands in raising quartz from their mine shafts, but successive crushings failed to pay the expense of the necessary labour. (118) The Company shareholders never received a dividend.

Due to the extremely high expectations held of this

(115) The use of the term 'sank' suggests an attitude of inferiority with respect to the occupation of being employed by a mining claim partnership. This feeling prevailed throughout the 1870s in the working of quartz reefs, and may be regarded as a genuine portrayal of class-consciousness within the gold mining industry. It also reflects the importance attached to the pursuit of quartz reef prospecting, encouraging further expansion of the industry and active enterprise among the mining population.

(116) O.W. April 23, 1870, p.11.
(117) C.A. July 13, 1870, p.5.
(118) D.T. April 22, 1870, p.3.
company by both shareholders and the general public, and its subsequent failure to produce a financial return, an air of despondency affected the health of reefing investment and the day to day mining affairs on the field. Working spasmodically when quartz was available, the Aurora Company completed construction of a tramway from their mine to the battery, thus facilitating the cartage work previously executed by horse and dray. The innovation also enabled the Company to dispense with a number of mining labourers. (119) By November 1870, however, in spite of a reduction in crushing charges, ensuring the battery's constant supply of stone for day and night operation, the Company was financially struggling. Taking action over the losing concern, by discharging all employed labour at the Company's own mine, the shareholders elected to work the mine with their own labour. (120)

During the winter of 1870, diggers continued to leave the Bendigo quartz field. An independent reporter, in a private letter, related:-

I paid a visit to the Bendigo reef a few days ago. I was speaking to some old Cardrona men, who were very sorry they ever left there. Several parties are registering claims, and leaving ... Business is very dull at present, water scarce, and I fear when the frosts set in that all mining operations will cease for the winter. It is now very cold there, and only for the amount of alcohol consumed, I hardly know what would become of the inhabitants. (121)

(119) C.A. October 12, 1870, p.6.
(120) C.A. November 28, 1870, supplement page.
(121) O.W. May 7, 1870, p.11. (Private letter received at Queenstown from Cromwell).
An unusually mild winter in 1870 kept the batteries free from ice and snow, but the supply of water was threatened due to the lack of snow, and to the joint call on water stocks by the sluicing companies. A deputation of thirteen local Cromwell and Bendigo area officials met the Superintendent of the Province on May 25th, 1870, to discuss the necessity of steps being taken to obtain a supply of water sufficient to work the Cromwell reefs. (122) This step stemmed directly from the irregular character of the existing water supplies, and attempted to alleviate the friction between various mining interests in the reef area. The latter action reached an abrasive climax in a Warden's Court decision to compel a sluicing company to cease operations altogether, due to excessive wastage of water, and contamination of the water course which was used by a large quartz mining company further down the range. Fear of litigation and greater friction between reefing and sluicing interests ensued, especially as the proportion of new quartz companies considering erection of machinery increased. (123)

The emergence of a group of potentially large quartz companies, employing many more than the usual three or four hands per claim, induced to remain on the field many disillusioned claim prospectors who would not have otherwise remained on the reefs without wage employment. Such men had frequently stockpiled small parcels of

(122) O.W. April 2, 1870, p.9.

(123) D.T. June 10, 1870, p.3. (Case was Cromwell Company v. Alldread and Company).
auriferous quartz, but were forced to await an opportunity for trial crushings to be effected.

Due to the excessive cost of extraction by hand, carriage and crushing, the trial yield usually did no more than harbour costs. Gold yields under one ounce to the ton of quartz were regarded as poor at this time, although the average yield from quartz crushed in Victoria, and considered extremely profitable, was only 0.3 oz. per ton. (124) Furthermore, the substantial variation in crushed quartz yields, varying from 0.8 oz. per ton to 3 oz. per ton in successive crushings at the Aurora mill, caused concern among the claimholders. Official attention was drawn to these fluctuations, resulting in a sample of quartz reputedly carrying one ounce of gold to the ton, being despatched to Dr. Hector, the Provincial Government Geologist, for assaying. The subsequent report held that a gold rate of 30-33 oz. per ton had been extracted from this quartz sample. This result led Warden Pyke to remark:- '... there is reason to believe that either the machines, or the mode of working - perhaps both - are far from perfect. (125)

The staying powers of the various shareholders were fully tested during the first winter. Many claims were worked part-time, or shepherded by one partner, while the others worked for wages in the employ of one of the larger companies. Both the Colclough and Alta Quartz

(124) D.T. July 14, 1871, p.2.
(125) O.W. May 14, 1870, p.15.
Mining Companies were registered under the Mining Companies Limited Liability Act 1865, during 1870, and made public their plans to erect machinery. In the interim period, while their machinery was on order, miners were employed in laying down tramlines, deepening the shafts and extending drives, stockpiling quartz and preparing the water supply races. Wages in all quartz mining companies ranged from 10/- to 12/- per ten hour day, or £4 per six day week, compared to only £3 per six day week ten years later.

The heavy dependence for employment upon the two battery-owning companies was highlighted in August 1870, when a lack of water shut down all shifts on the Aurora machine, and a breakage in the driving wheel of the Cromwell Company battery forced the ceaseless 24 hour clatter of stamps to yield to the natural silence of the rangeland. The lack of active production had an adverse effect upon the economic outlook of the mining community (numbering 150 quartz miners alone, exclusive of families and business people).

The Bendigo press correspondent wistfully noted:

The township at the reefs, Bendigo Gully is said to be in state of deadly liveliness [sic.]; ... and each individual member of...

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(127) O.W. May 14, 1870, p.15.


(129) O.W. May 14, 1870, p.15.
the community waiting with much enduring patience for the better times ... the ensuing spring will witness a revival of the drooping glories of Logantown and its surroundings. (130)

Even by the autumn of 1870, the diligence of the mining population was being severely tested. The influx of destitute miners from many other provincial goldfields to Logantown and Bendigo was greeted by most employing companies as a potential threat to the security of leased ground. Many miners were consequently advised to return in spring, when more labour would be required. The passing of the first winter's inhabitation of the reefs failed to effectively contain the anxieties of a Bendigo resident who reflected in March:-

... the approach of winter seems to cramp conditions slightly. This is not to be wondered when our great elevation is considered. I anticipate a winter at this height will require some consideration. (131)

The number of miners on the Bendigo field dwindled away during the winter and following summer of 1870-1, although many sought fresh quartz mining careers on the sister reefs at the Carrick Range. The winter snow falls, the inability to process stockpiled quartz, the lack of ready wages-work (and more significantly, the impermanent nature of such work), the lack of capital to back a prospective reef claim and above all, the dearth of immediate and realisable gold as found in alluvial mining, precipitated the exodus of the individual working miner.

(130) O.W. August 6, 1870, p.11.
(131) D.T. March 11, 1870, p.2.
It is evident that inexperience in quartz reef working was a major role in the inability of the individual miner and partnership groups to successfully pursue the task of quartz extraction. Even larger companies became fatefully harnessed with the yoke of inexperience. The Alta Quartz Mining Company expended at least £4,400 into two shafts, machinery and a tramway system, some distance from the principal reefing area, on the evidence of hand-crushed samples only. The Company undertook no battery trial crushing before they erected their own machinery.\(^{132}\) Within a year, the Company bowed to liquidation proceedings.

The reports proclaiming prospects of unparalleled prosperity for the Cromwell reefing area continued to flow forth with predictable verbosity and grandeur, their hollow tone echoing like the thud of the stamper. Between sanguine editorials ran snippets of reality:–

\begin{quote}
Dunedin papers state that any amount of work can be obtained at the Bendigo Reefs. The very reverse is the case. There are some men here who have been idle 4 or 5 months.\(^{133}\)
\end{quote}

A number of men who abandoned their quartz claims, turned back to follow alluvial mining, and sluicing operations, both in Bendigo Gully and the rich auriferous terraces near Bannockburn, along the foot of the Carrick Range.\(^{134}\) In this way the inherent bond between the mining fraternities of the western Dunstan Range, and

\[^{132}\text{D.T. February 26, 1870, p.2.}\]

\[^{133}\text{D.T. January 13, 1871, p.3.}\]

\[^{134}\text{D.T. February 3, 1871, p.3.}\]
Carrick areas, strengthened. Wages on the Bendigo field fell from £4 to £3.10 for a ten hour shift in March 1871, reducing the attraction of wages labour. The direct consequence was the transferral of 'a goodly population' (135) to the Carrick Range quartz reefs where at least seven quartz companies were employing labour, on several lines of reef. (136) Local correspondents to the Dunedin press assured the public that the apathy and distrust regarding Bendigo was only the natural rebound from the previous year's feverish excitement:—

Men able to form a sound opinion on these matters think well of both districts ... Warned by the failures at Bendigo, people are cautious about investing at Bannockburn [reefs], and working miners there must really be working miners or they get no support. (137)

Official recognition of the declining interest in the Bendigo quartz field displayed a romantically optimistic faith in the future of the reefs. The problems began to be isolated:—

Quartz reefing is passing through only its infantile stage ... Several reefs have been already opened out ... and others must give profitable employment when brought properly into work. To develop this branch of mining, a large accession of population is required, as well as the introduction of capital, and from what I have seen, I feel assured that the same opportunities in other colonies would be eagerly availed of. (138)

(135) D.T. March 31, 1871, p.2.
(136) O.W. May 27, 1871, p.11.
(137) ibid.
Successive reports by Pyke on the progress of the Bendigo field, reflected waning interest. Indeed, in his report of September 1871, he felt indisposed to write:-

At Bendigo the reefing interest is ... languishing owing to the disappointments experienced by some of the most promising companies; in fact the tide is there at ebb ... (139)

The meteoric rise in fame of the Bendigo field led to the influx of a large population relative to that which preceded the rush, reflecting both mining and business interests. An outline of general attitude within the reefing population is examined in Chapters 4 and 6, but the basic trend of early settlement and population movement has been summarily traced. Basic motivating forces behind such movement have been suggested, although research of a more intensive nature in this direction is pursued in these same chapters.

The Carrick Reef region, although developed beyond the Bendigo boom period, nonetheless played a role in contributing to the decline in population on the Bendigo field. In the mid 1870s these two reef regions displayed a complimentary stature, focussing their interest on the common service centre of Cromwell.

The Carrick Range auriferous reefs are confined to

one continuous belt of range, longitudinally encompassing a north-easterly aspect from the top of the range down the spurs of the Adams, Smiths and Pipeclay Gullies. (Figure IV). With the increasing attraction of the Nevis and Bannockburn regions as alluvial fields of reputed permanence, traffic over the range, by way of these prominent spurs, increased. Three distinct quartz finds had been reported by 1866, (140) but the attraction of easily-worked alluvium, as at Bendigo in 1868, occupied the attention of the individual miner.

The opening of the dray road over the range to the Nevis in 1867 provided ease of access up the steep schistose spurs, but no systematic search for quartz reefs was undertaken until events at Bendigo had unmistakably demonstrated that quartz mining promised extremely favourable results.

The inimitable Jackson Barry, former mayor of Cromwell, increased interest in 1867, by rediscovering the reef at the head of Pipeclay Gully, and publicly displaying gold-flecked quartz specimens in Cromwell. (141) An extension of this reef had been prospected earlier, but the results found few interested capitalists. (142) Barry formed a prospecting party to begin work by driving a tunnel seventy feet into the reef in 1869, disclosing payable quartz, and commanding local interest. (143)

(140) Parcell, Heart of the Desert, p.81.
(141) Barry, W.J. Up and Down, 1879, p.223.
(142) O.W. June 16, 1866, p.13.
(143) O.W. November 27, 1869, p.14.
Almost every gully running down the Carrick Ranges had turned out payable gold, and, whether on the Nevis or Bannockburn side... gold alike exists... The actual locale of the reefs... was a mere matter to be determined by systematic search. This was made, and over a score of claims were quickly at work with promising prospects. (144)

Barry and Party formed a partnership called the Royal Standard Company, and in December 1869, called tenders for further driving. That the prospects were held in high local estimation was disclosed by the selling of a one-seventh share in the Company for £180. A few days later, £250 was refused for the same share. (145)

The winter of 1870 forced quartz prospecting parties down off the Carrick Range to huts in the sheltered gullies, thirty to forty miners being thus settled in Adams Gully in June. (146) Five parties were operating on shaft sinking and adit driving at this time. The All Nations Company had abandoned their first tunnel due to the instability of the rock structure and the lack of air inside the drive. (147) Work on the Elizabeth Company claim was commenced in February 1870, (148) while the golden colour of the Royal Standard Company's specimens had convinced the partners to construct a battery. A trial crushing in March 1870, on the Cromwell Company's machine some twenty

(144) O.W. August 29, 1875, p.6.
(145) O.W. December 4, 1869, p.15.
(146) O.W. June 25, 1870, p.9.
(147) O.W. June 18, 1870, p.11.
(148) C.A. July 6, 1870, p.4.
miles away, had returned the formidable yield of 42 ounces of gold from just under six tons of quartz. (149)

The mine of the Royal Standard Company was sited in a most inaccessible locality near the top of the Carrick Range, poorly endowed with water. In consequence, the Company decided to build the battery at the foot of the Smiths Gully spur, even although it necessitated the construction of four miles of dray road up 3,000 feet of rugged rangeland, in order to feed the mill with quartz from the mine. The siting of this mill at the base of the range acted as a focus for subsequent reefing and business activity, giving rise to the construction of the township of Quartzville. In addition, the construction of the road to the mine caused great excitement over the future of Carrick reefs, following the disappointing winter development of the sister Bendigo reefs.

The Bannockburn correspondent to the *Cromwell Argus*, commenting on the progress of the Carrick Spur road, 'unavoidably of a steep and circuitous nature,' (150) noted the local enthusiasm over the future of the area. A Cromwell publican was reported as intending to construct a public house at Quartzville, and another local capitalist intended to 'throw' a bridge over the Kawarau River, to accommodate heavier traffic to the reefs. (151) Both intentions, along with a host of other business construction

(149) Parcell, *Heart of the Desert*, p.81
(150) C.A. September 7, 1870, p.5.
(151) ibid.
projects, did eventuate.

The exploitation of the Carrick reefs was contrasted with that at Bendigo through the earlier and more extensive use of tenders in opening out claims. During September, 1870, the local press carried advertisements calling for tenders for the sinking of shafts and the driving of tunnels for four large Carrick Range quartz mining companies. (152)

The Royal Standard Company floated itself into a limited liability company in November 1870, with a capital backing of £8,400, contributed to by both local and Dunedin financiers. (153) Their battery of four stamp-heads, powered by coal-fired steam, was christened on December 19, 1870. From its inception the machine was received favourably as a vital community interest, as it undertook to process trial crushings for the increasing numbers of small local reefing partnerships, migrating to Carrick from the Bendigo field. In addition, the Company had a standard crushing charge of 7/6 per ton of quartz, which was far below the charges on the Bendigo reefs. (Refer Table IV).

Although none of the Carrick Range companies was large enough to rival the employment capabilities of the Cromwell Company, at Bendigo, the pattern on the former field was one of small scale concerns employing two or more permanent mining labourers on wages, at each quartz

(152) C.A. September 7, 1870, p.4; September 21, 1870, p.2.

75.

claim. Besides the numerous prospectors on the field, the following table illustrates the claims employing outside labour, beyond the immediate partnership:

TABLE V

CARRICK RANGE QUARTZ FIELD: MEN EMPLOYED ON WAGES, MAY 1871

<table>
<thead>
<tr>
<th>Claim or Mine</th>
<th>Number of men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Star of the East</td>
<td>2</td>
</tr>
<tr>
<td>Heart of Oak</td>
<td>6</td>
</tr>
<tr>
<td>Royal Standard</td>
<td>2</td>
</tr>
<tr>
<td>Elizabeth</td>
<td>2</td>
</tr>
<tr>
<td>Aitchison and Party</td>
<td>2</td>
</tr>
<tr>
<td>Watson and Party</td>
<td>2</td>
</tr>
<tr>
<td>Jackson and Party</td>
<td>2</td>
</tr>
<tr>
<td>Golden Phoenix</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: O.W. May 27, 1871, p.11.

Three recurring problems dogged the Carrick reef workers during their early exploitation ventures: claim boundary disputes, water shortages and high cartage costs. The close proximity to one another of many of the quartz claims and leases, especially within a few dozen acres near Carricktown, halfway up the range, necessitated the constant attention of the Warden in demarcating boundaries and settling fiery claim disputes. Court cases were frequently the only means of creating an acceptable authority, such as was exemplified in the encroachment suit involving the Star, Oak and Elizabeth Companies' leases, all three of which had a common, but elastic corner. (154)

(154) Parcell, Heart of the Desert, p.83.
In February 1871, following the disappointing inaugural crushing of Royal Standard mine quartz at their battery (yielding less than an ounce of gold per ton), the summer drought had become so severe as to affect the operation of the Company's steam engine. Furthermore, disputes over water rights compounded the litigious notoriety of many quartz claim companies and partnerships:

... the mining affairs at the Carrick Ranges are in a bad way, owing to water disputes. The Royal Standard Machine cannot get on at all at present for want of water, but I hope that in a few days some arrangement will have been come to that will suit all parties. (155)

The lack of sufficient water supplies to meet the varying requirements of both the quartz claims, and the sluicers on the Bannockburn terraces, had a logical outcome in the suggestion of constructing a water race to bring in water from the Coal Creek region, some fifteen miles to the southwest. A group of local capitalists envisaged the formation of the Carrick Range Water Supply Company, with a financial backing of £5,000 (a singularly inadequate sum, as time was to indicate), as early as June 1870. (156)

The proposed water supply company was never fully operable until March 1872, long after the scarcity of permanent water supplies had reached critical proportions, and ousted several aspiring quartz mining partnership companies from the field.

(155) D.T. February 3, 1871, p.3.
(156) O.W. June 4, 1870, p.16.
Many of the early gold yields lacked the lustre of the pioneer Royal Standard Company crushing. The following report on the Elizabeth Company's crushing of one ounce of gold to the ton of quartz, is not atypical of contemporary comment:

When the crushing is paid for, and all other expenses settled, but very little, I fear, will be left to divide among the shareholders. Nevertheless it is payable, and as long as it continues so, must do some good for the district. (157)

Most companies had to cart quartz over three miles to the only battery. Cartage costs were high owing to the dangerous nature of this occupation, in manoeuvering heavy dray loads down the sinuous track.

... the majority of claims which have been opened, would pay well for working were it not for the heavy expense of carting and crushing. £9 per day of 24 hours, or at the rate of 7/6 per hour is the charge made for the use of the Royal Standard machine ... the cost of cartage varies from 13/- to 23/- per ton. (158)

The need for crushing machines in the immediate neighbourhood of the majority of claims, conjured up grandiose schemes in the minds of many small partnerships, but only two machines, driven by steam, had been installed in the Carricktown area by January 1872. These were the Elizabeth Company battery, and the jointly owned Star and Oak battery. The latter two claims had been rewarded for their intensive reef exploitation and employment efforts, through constant yields of up to six ounces to the

(157) D.T. January 20, 1871, p.3.
(158) O.W. May 6, 1871, p.11.
These yields excited such interest that the Dunstan Times was inclined to note that so many new reefs were being discovered on the Carrick Range, through the influx of Bendigo miners, that it was difficult to tabulate them all. (159)

The movement to the Carrick, from Bendigo and other mining regions, accelerated during the spring of 1871, especially after a yield of almost five ounces to the ton was announced from one small claim. (160)

A regular stampede is anticipated from Cromwell ... towards the Carrick Ranges. The claims are looking up, and a quartz reef town is developing in the immediate locality ... The Bendigo Gully township is already almost a thing of the past, most of the buildings having already been shifted towards the Carrick. (161)

Towards the end of 1871, when building in the two Carrick quartz towns of Carricktown and Quartzville was at its peak, the range industry became afflicted by rash share buying and selling. Memory of the disillusionment produced by such activity at Bendigo faded, or was ignored. Local papers, previously critical of such unthinking action, reacted positively to the contemporary share sales with such disturbing irony as: 'the speculation is very promising'. (162)

Speculation carried the heady intoxicant which quartz

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(159) D.T. April 28, 1871, p.3.
(160) O.W. July 15, 1871, p.13. (Telegram recording trial crushing yield from Carrick Range Border Chief claim).
(161) D.T. September 22, 1871, p.2.
(162) D.T. October 6, 1871, p.2.
claims could fain afford to support - overconfidence. The examples of the once great quartz companies at Bendigo, such as the heavily financed Alta, and Colclough Quartz Mining Companies lay unheeded, as company share inflation flourished. The Nil Desperadum Company, confidence bloated by inflated share values (at £250 per half share) (163) had already arranged purchase and erection of crushing machinery for their ground in December 1871, on the strength of sighted quartz only, no trial crushing having been effected. (164)

Throughout 1872, the favourable yield prospects of the Carrick Range claims continued. The local papers referred, by name, to at least 24 working claims, several making regular crushing during the summer months. The Star and Oak battery, returning the virgin crushings of 3.3 and 2.2 ounces of gold per ton respectively, was capable of crushing up to 120 tons of quartz each week, on the basis of day and night continuous shifts. (165) By November, both the Nil Desperadum Company, and the Robert Burns Company (largely financed by Thomas Logan of Bendigo), had installed crushing batteries, bringing the number of batteries on the Carrick field to five, and the number of stamp heads to 38. (166)

The mining population engaged in active quartz mining at this time, in the Cromwell reef region, was enumerated

(163) D.T. December 8, 1871, p.2.
(164) O.W. December 9, 1871, p.15.
(165) O.W. February 24, 1872, p.10.
(166) O.W. November 23, 1872, p.15.
by the Warden of the Dunstan District as 250. (167) Although this figure included the Bendigo reefs' population and a few scattered prospectors around Alexandra, the number of quartz claims at work in 1872 suggested that the bulk of these men were employed on the Carrick. This was undoubtedly the peak year of the Carrick Range quartz mining industry, from the viewpoint of the number of miners at work, the number of claims opened out, and the prosperity of the quartz townships; (both Carricktown and Quartzville attained the status of Post Office centres in 1872). (168)

Investment in the reefs reached record proportions during the year, capital expended in the seven registered companies alone, amounting to at least £13,000. The speculative nature of such heavy investment is emphasized when it is further revealed that only four of these companies returned a dividend. Of the £4,430 thus returned, one company, the Heart of Oak, returned 75% of those dividends. (169)

Subsequent years witnessed the accentuation of many of the recognised physical constraints which had been considered of lesser importance before the blind enthusiasm of the earliest Carrick prospecting companies. The access to the reefs and machines was not facilitated by the precipitous nature of the country. The heavy loads

(169) Otago Provincial Government Gazette, 1872. (Statements of Affairs : Mining Companies).
of quartz and coal, daily carted up and down the privately constructed tracks, induced a large financial drain on the various companies, both in cartage and road maintenance. Cartage and crushing costs had risen in late 1872, the latter being between £1 and £1.10 per ton. (170)

The more productive mines, especially in the Carrick-town region, were continually hampered by flooding in their shafts, rendering the stoping out of quartz from drives and adits impossible until the water had been pumped clear. (171)

Deep shafting and low level driving into the reef, as opposed to the surface and overhand stoping which characterised the early Carrick reef development, revealed the most unsatisfactory and incomplete quality of the reefs. This revelation had dramatic significance in that the permanence of the reefs was in serious jeopardy. Mr Warden Simpson reflected the contemporary disappointment and confusion over reef technicalities in his 1873 report:-

On the Carrick a great deal of work has been done, which has revealed that the reefs there, so far, are merely fragments of reefs, tossed about in all sorts of positions, by some unknown agency. In consequence, prospecting is a most difficult task. Some miners are of opinion that the main reefs will be found in the locality, while others hold that there are no indications to justify that conclusion, but offer no explanation of how the fragments got to their present location. (172)

Lines of reef could not be relied upon to maintain

(171) O.W. June 7, 1873, p.15.
continuity. The small 'shoots' of surface quartz prospected and fed into many of the early crushings, disappeared at depth. Crushing returns cast a gloom over the reefs, as they approached uneconomic levels. Contemporary publications reporting poor yields under an ounce to the ton of quartz, offered numerous excuses for the decline in high yields. Discontent among miners and shareholders reigned, especially as the monthly crushing from the large Star of the East Company plummetted to a record low yield of 0.3 ounces per ton. (173)

False reports, calling into question the honesty of the intentions of the management of one of the larger mines, were circulated. (174) Such underhand rumours did immeasurable damage to confidence in the quartz mining industry, faith in which, through declining gold yields, had already approached a precariously low level.

The varying fortunes experienced by claimholders on the Carrick field failed to provoke the large scale emigration from the reefs as was the case at Bendigo. Carrick quartz miners lacked the magnet of another adjacent quartz field, although it is true that a number dispersed throughout the Otago provincial goldfields to prospect. Some Carrick miners did invest on occasion, in new companies established on both quartz fields, such as in the ambitious enterprise floated to cut a deep level drive through all the Bendigo reefs, thus tapping all available auriferous

(173) O.W. November 1, 1873, p.6.
(174) O.W. November 1, 1873, p.6.
In this way, the imbalance of reefing activity between the two Cromwell reef areas, gradually disintegrated.

The Carrick Range, during the mid and latter portion of the decade, retained the greater number of claims, and small partnerships. The Bendigo field, largely through the industrious perseverance of the Cromwell Company, commanded the bulk of the Cromwell district gold return from quartz. The field retained a role as the nursery of the heavily-financed macro-company, wielding an unabashed intensiveness of operation.

The brief years of heavy speculation in the Cromwell reefs, 1869-72, traced a pattern of human interference upon the rangeland of the Upper Clutha region, unparalleled in its extravagance. The clustered assortments of wagons, machinery, shaft tailings and mine and dwelling buildings, offered faint indication of the capital expended in the reefs. Accurate figures are available for the registered quartz mining companies only, but in the ten so registered on both the Carrick and Bendigo fields until 1872, some £13,642 of shareholders' capital had been called upon and received, for a return of only £5,740 in dividends. It is of further economic significance that the majority of this dividend return was to shareholders in one company, the Heart of Oak Quartz Mining Company.

As an inevitable and natural consequence, capital

(175) Bendigo Deep Level Quartz Mining Company (Fig.III).

(176) Otago Provincial Government Gazette, 1870-72. (Statements of Affairs : Mining Companies).
investment declined during the latter 1870s, although a brief stimulus was injected into investment following the inspection and favourable report on the Cromwell reefs, by a prominent Victorian geologist, Professor G.H.F. Ulrich, in 1875. Declining financial support of the reefing industry provoked long years of lamenting newspaper articles. In one of many such articles, the *Cromwell Argus* complained in 1879:—

> Capitalists (both local and foreign) seem to have given up all idea of further prospecting for quartz lodes ...(177)

Capital was considered the prime mover in quartz field development; conversely, the lack of it was considered the protagonist force directly accounting for the decline in reefing industry economy.

The misapplication of capital constituted the bane of the reefing company, although a myriad of physical, social, political and technical factors interacted with human attitude to produce the uneconomic shadow of an industry, which it later became. The boom years sustained the sanguine expectations of the contemporary quartz mining population. The decline was to be long and unkind, fettered by false hopes, and the ubiquitous spectre of impermanence.

(177) C.A. August 12, 1879, p.4.
Chapter 4

THE SETTLEMENT AND THE MINE: A COMPLEMENTARY VISION

The colour of energy began to tint the blank spaces on the map. (178)

As our alluvial workings become exhausted, we must have recourse to the reefs to make good the deficiency, as experience teaches us that there is the real matrix of the gold ...(179)

The principal areas of alluvial exploitation within the Otago goldfields had all been delineated by 1868, and occupied to the point where population in the interior of the province was falling by the latter years of the decade. The townships erected as centres of service and social activity upon the various alluvial fields were already indicating their valuable worth to the mining community by 1870. A few townships, such as Cromwell, in the Dunstan District, were retaining and even internally expanding their population base. Other centres, the service function of which was dictated purely by the physical extent of the associated diggings, such as the Nevis, were of faltering health, while many lesser centres, as exemplified by Hindon, on the West Taieri diggings, had expired altogether as existing settlement entities. (180)

The decline in the number of goldfields' settlements attested strongly to the failing yields of many alluvial

(179) D.T. March 25, 1870, p.2.
areas. In the Upper Clutha region, the Bannockburn township had struggled to retain even a permanent location. The town site was moved about the Bannockburn Terrace at the whim of the resident mining population. (181) Fingers of settlement extended up the auriferous alluvial gullies of the Carrick Range, only to dissipate as gold became worked out.

The Bendigo alluvial field conformed to a similar pattern of settlement life. Alluvial deposits, if worked intensively and on a scale sufficient to place pressure on the amount of available claim area, could be rapidly exhausted. The auriferous deposits of the gully regions in the schist ranges, such as the fluted flanks of the Dunstan and Carrick Ranges, afforded no vast area for claims. Consequently, the alluvial rushes to such areas, especially to Bendigo in 1864, were short-lived.

The initial influx of miners to Bendigo, deriving payable returns for a moderate effort, was waning after the peak of 1864-5, when an estimated 130 miners populated the field. By 1865, greater effort was required to extract the gold content, and as the yield approached the critical line whereby it paid wages and sustenance only, the interest in the area declined rapidly, for only 30 miners remained in June 1866. (182)

The initial centre of social and township activity on the Bendigo alluvial region tended to agglomerate around the ferry terminal at Rocky Point (sometimes referred to as

(182) ibid. p.124-6.
Wakefield), some four miles from the diggings, and at the Government-surveyed township of Wakefield, situated between these points.

The evanescent quality possessed by many of the alluvial diggings in the Dunstan District created an adverse effect on the population which desired permanent settlement. A goldfields settlement could not be relied upon as remaining permanent for even a few years. The larger service centres were not immune from a threatened decimation of population either, and although the population of Cromwell was not based entirely on alluvial digging occupations, a correspondent remarked in 1869, that, 'At [Cromwell], unless engaged in business, one must either dig for gold or leave.' (183)

The costs of living at the turn of this decade were still inordinately high, especially in comparison to the east coast towns. (184) In consequence, to retain a population of gold rush proportions, the goldfields required to support employment on permanent auriferous workings. Individual and small partnership workings in the scattered rangeland gullies had failed to support such permanence - nor did the larger sluicing companies which moved from claim to claim as each terrace was washed over.

Each successive rush bred new hope as a potential permanent field. Around the Upper Clutha area alone, the pattern of transient settlement was evidenced in the passing

(183) D.T. June 11, 1869, p.2.
(184) Votes and Proceedings, Otago Provincial Council, Session XXVIII, 1870, p.28.
prosperity of alluvial settlements at Bannockburn, Kawarau, Quartz Reef Point, Lowburn and Bendigo. The actual motivation of the rush itself was recognised as the inherent destructive force in undermining permanence:—

A man comes to a place sometime after it has been 'rushed' ... knocks about for a while, idle, and then perhaps, hears of a rush, knows that if he is not among the first he stands a poor chance in comparison with those who are ... (185)

Under these conditions, this blanket roll, shovel and tin dish society could not be expected to give rise to stable settlement. Only with the adoption of more complex methods of gold extraction, commanding considerable investment and heavy machinery, could settlement take place on a more permanent basis.

The possibility of large scale exploitation of quartz reefs in the Upper Clutha rangeland created considerable excitement within the local population in 1869, as the area was languishing under the lack of new alluvial fields. None of the previous quartz mining operations on Otago had supported any quartz-specialist townships. It became apparent that only the estimated size and extent of the Upper Clutha reefs gave ground for the propitious future held of the area. No alluvial field had given rise to such local excitement.

The initial reef-prospecting forays at Bendigo Gully were generally individual efforts, and in most circumstances, conformed to the alluvial rush pattern, where each digger

worked for his own gain, in staking the most likely-looking ground. The resultant settlement pattern emulated that of the alluvial rush township. At Bendigo Gully, the old township on the hillfoot terrace was revived primarily as a service centre for the reef dwellers higher up the range, and as a social centre. In 1869, this particular region had not totally assumed the status of a remunerative quartz mining field, as many of the prospectors still relied upon the earnings of alluvial mining to support them in their search for payable reefs.

By the end of 1869 the rush phase of the Bendigo reef discoveries had subsided. The field had absorbed all the possible claim area on the lines of discovered reef, and miners were experiencing the effects of being unable to liberate the gold entombed within the quartz.

The business community, which had traditionally followed the alluvial rushes, prospering on the wave of inevitable and immediate gold fluidity among the mining population, had misunderstood the implications of quartz reefing. The miner too, had largely failed to comprehend the investment necessary to realise the gold content beneath his feet. An Otago Witness correspondent at Bendigo sagely remarked in December 1869 that 'A few good practical miners will obtain employment at wages, and the rest nothing, unless they are in a position to take up ground and work for themselves'. (186)

Many miners were in the position of holding ground

(186) O.W. December 18, 1869, Supplement p.4.
quartz claims, but few possessed the means to work the ground. In consequence, the individual miner had the alternative of working an alluvial area, or to work for wages on another quartz claim. Both cases would necessitate the forfeiture of his claim, as under the strict letter of the law, enforced by Pyke, in an ordinance proclaimed in November 1860, the claim was required to be continuously at work. This official pressure, both through legislation and rigid enforcement, precipitated the large scale formation of the partnership system of operation.

Partnerships directly contributed to, indeed escalated, the speculative spirit, for shareholders were accepted as partners in quartz claims at demanded prices, in order to form parties ranging from two to a dozen shareholders. In this way the claim could be worked and shepherded by a token force of shareholders, thus conforming with the regulations. Other shareholders could carry on with normal business or alluvial mining pursuits.

The majority of such parties, having occupied reef leases, commenced work on shaft sinking, using windlasses and the ordinary appliances of the miner. Some parties, possessing sufficient capital, such as Colclough and Party, were able to employ labour at these tasks, although at the high rates of wages relative to other mining pursuits (mining labourers commanded £4 per week), few


companies could afford this extravagance.

Two townships appeared as a direct result of the Bendigo reef discoveries. Both were distinctly primitive in their construction, as apart from the one productive mine in 1869, that of the Cromwell Company, no other financial return in the district was derived from quartz mining. The pattern of township establishment emulated the trend perceived by Pyke in his long years of goldfield experience:-

Goldfields' townships like Chinese citizens, undergo sundry mutations of name at successive stages of their growth. First comes the miner, 'Full of strange oaths and bearded like a pard', and bestows upon his camping-place some designation often more significant than classical. Close upon his heels follow the storekeeper and the purveyor of strong drinks - licensed or otherwise. (189)

G.M. Hassing, who operated the Rocky Point ferry during the height of the adjacent alluvial rushes at Bendigo, described Bendigo Gully in 1868 as all but deserted. (190) Referred to as nestling in country of the wildest description, (191) the Bendigo quartz reefs' township developed first at Bendigo, where the Bendigo Gully Hotel was revived amidst the deserted alluvial diggings, but within the range foothills.


(191) O.W. October 30, 1869, p.16.
The township of Wakefield,\(^{(192)}\) formerly existing solely on the trade from the Rocky Point ferry, received an economic boost through the siting of the first Cromwell Company crushing battery against the range, two miles from the town site. A large hotel, designed to intercept traffic to the reefs, several stores, and a few of the Cromwell Company buildings constituted the total extent of Wakefield in 1869.\(^{(193)}\) The township possessed a negligible residential function.

Contemporary goldfields' population recognised the rapidity with which the businessman or 'mercantile class' shadowed the miner, frequently out of all proportion to the numbers of miners and residents on the respective fields. In a letter to the editor under a heading suggesting more effective means of settling population on the goldfields, a *Dunstan Times* correspondent considered:-

> The mercantile class have but little scope for the exercise of their abilities, the want of population being an insurmountable barrier. They may be classed as storekeepers and publicans, their functions being confined to supplying the

\(^{(192)}\) The township of Wakefield was frequently confused in the period 1869-72, with the location of Bendigo, or Bendigo Gully. The first Cromwell Company battery, was regarded in contemporary reports as being located at Wakefield, (D.T. July 22 1870, p.3) but was, in fact, located near the Bendigo Reefs Hotel (C.A. December 1 1869, p.2.). In turn, this hotel was described as being located about a mile up Bendigo Gully Creek from the mouth of the gorge. The contemporary Government survey map of Bendigo indicates a crushing battery adjacent to the town. (Refer Fig.V). The Cromwell Company battery was the only such piece of machinery on the Bendigo reef region in 1869.

\(^{(193)}\) *O.W.* December 18, 1869, Supplement p.2.
Plan of the Town of

BENDIGO,

W. Arthur, District Surveyor,
Nov. 1869.

NOTE: A circular area 20 f. diameter over each Trig Station and right of way thereto is reserved by Government. A £50 penalty is incurred by persons removing or destroying Trig Stations or Survey Pile.
people resident on the goldfields with provisions ... Business, as a rule, is very much overdone, so few outlets for the employment of capital existing. (194)

The community at Bendigo was, at this time, regarded as an exception. The rush of quartz miners and the fame of Bendigo reefs had induced many prospective business people to move to the old township of Bendigo, erect business houses, and reinhabit the deserted shells of buildings. A Cromwell Argus reporter in 1869, was dismayed to find so many business establishments based upon mere speculation and the yield from one private quartz mine:

In the last three weeks, a number of stores, hotels and buildings of all descriptions have been erected. At present, there appears to be more places of business than the trade of the place warrants. It does appear that buildings have been put up rather prematurely without due consideration of the actual requirements of the place. (195)

The early business community underestimated the movement of miners and the potential production of gold on this new goldfield on two counts. In the first place, all the preceding goldfields settlements in the Upper Clutha and Dunstan District area had been based upon alluvial gold finds. These townships had also developed under gold rush conditions, but where rich strikes of actual gold yield had drawn miners, who in turn set about the relatively uncomplicated task of extracting the free gold from the alluvium.

(194) D.T. September 24, 1869, p.3.
(195) C.A. December 1, 1869, p.2.
The former site of the Government surveyed township of Bendigo. Stone walls still delineate some of the few sections sold. Sluicing tailings to the left and iron piping, denote the other form of mining which characterised the locality.
In contrast, the fame of the quartz reefs had spread on the strength of crushings from one company, the perseverance of which over six years, had enabled them to invest in efficient machinery for gold extraction.

Other attractions of the field had been the encouraging quartz specimens hewn from the reefs and the fact that a multiplicity of reef lines existed. This gold was inaccessible. The initial quartz township grew in magnitude on the strength of a misconception over the rate of time in which gold would be circulating among the 'rush' population.

The second constraint upon the prosperity of the early quartz township at Bendigo was the fact that the majority of quartz miners preferred to inhabit the immediate reef environment. This was for reasons of convenience as well as security, as in the early phase of the quartz rush, so many disputes arose over quartz claim boundary pegs, that Warden Pyke was compelled to take up residence in the immediate vicinity, in order to adjudicate over dispute hearings. (196) The business community, eager to intercept the wealth of prospective shareholders and miner-shareholders, set up hotels and stores on the hillfoot region in the early months of the rush, whereas the bulk of the residential population began to locate and settle along a level area high in the heart of the actual reef workings.

Many business enterprises lost little time in re-locating in the residential area, known as Logan-
Nonetheless, it is of significance in the study of the past attitudes to the reefs, that the contemporary attitude to the reef settlement pattern had altered. The action of the quartz mining population, in locating residences on the reef uplands, had not been anticipated by the business community. This misconception, together with the underestimation on the part of the business community, of the slow rate of financial return from auriferores quartz reefing, serve as evidence of the alteration of a class attitude.

Elevated Reef Settlement

The realisation of the potential need for an upland township adjacent to the reefs was swift. Hotelkeepers and storekeepers, seldom tardy in recognising potential trade, erected the first business premises along the range terrace of Logantown. The mile of road from Bendigo to the reef town had been graded and hewn from the basal rock in parts, at the sole expense of the Cromwell Company, which used this steep thoroughfare as the medium for conveying their quartz from mine to battery.

The first building erected, of timber and corrugated iron, was the general store of J. Beare, a pioneer in the field who commanded much of the early trade. By December, the township confidently supported a host of business establishments. (Refer Table VI). All such business houses

(197) Founded in mid 1869, when Thomas Logan, shareholder in the Cromwell Company mine, and manager of the Company's battery, erected a stone cottage adjacent to the Cromwell line of reef. (Fig.III).
The residential township of Logantown lay along this terrace amid the steep gullies of the Dunstan Range. A few stone buildings, scattered fruit trees and residence boundary walls remain to outline the former main street. Several quartz reefs and leaders were discovered and worked to the left of this photograph. The Pisa Range rises in the distance.
at this time reflect an abundance of strictly functional service activities.

The population of the reef area in late 1869 was estimated at 400, many of whom had inhabited calico and rock shelters high on the reefs themselves. The summer heat kept night temperatures warm, which encouraged settlement at this high altitude (over 2,000 feet). Once again, through an inadequate perception of the effects of the cold temperatures of the ensuing autumn and winter, the business community failed to foresee the migration of miners down to the lower terraces, and indeed, back to Cromwell and the more sheltered alluvial regions.

The turn of the year 1869-70 witnessed the addition of a number of more specialist and socially-oriented institutions in Logantown. More hotels were added, with such novel attractions as a public dining room, and a billiard saloon. A correspondent at Logantown remarked upon the township's convenient location adjacent to the reefs, but admitted that the town was 'badly off for water', from a residential point of view. He further commented on the opening of a bowling saloon and public restaurant as indicative of the prosperous expectations held by businessmen of the new quartz mining class.

The frivolous propensity with which contemporary mining communities sought to impress neighbouring towns

(198) D.T. December 17, 1869, p.3.
(200) D.T. December 17, 1869, p.3.
**TABLE VI**

**BUSINESS FUNCTION ANALYSIS: BENDIGO GULLY AND LOGANTOWN**

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* Insufficient data

**Source:** Cromwell Argus 1869; Mackays Almanac 1870-80.
Two veteran residences in Welshtown on the Bendigo reefs, face the former main street. The majority of buildings, which were of wood and iron, were removed with the exodus of miners during the 1880s, or succumbed to the harsh climate of the rangeland and were blown away. The snowclad Pisa Range lies across the Upper Clutha valley.
and goldfields should, however, be borne in mind. The buildings at Logantown and the higher reef settlement of Welshtown were reported as all being of corrugated iron and after the true diggings style - the utilitarian settlement. (201) Such settlements possessed the ability to remain and be reconstructed with stone establishments if the field productivity became regular and of consequence, or uproot and transfer building and stock overnight if misfortune befell the diggings. Nonetheless, the combined number of hotels in Bendigo Gully and Logantown in 1869 totalled ten, (refer Table VI) as against seven in the long-established town of Cromwell. (202)

The fame of the Cromwell reefs, especially in Dunedin during this period, (203) induced the ubiquitous Cobb and Company stagecoach line to enter a daily coach service between Cromwell and Bendigo. This line, under the auspices of a local coach operator, carrying the insignia - 'Cunnard's Line of People's Coaches', ran a daily return service to Bendigo and to Logantown, in the midst of the reefing country. (204)

A party of prospective quartz miners and capitalists could leave Dunedin on the Cobb and Company line, and reach Logantown on the 'forenoon of the 3rd day.' (205)

(201) O.W. December 18, 1869, supplement p.2.
(204) C.A. December 22, 1869, p.2.
(205) O.W. November 20, 1869, p.13.
direct service ensured a steady influx of prospective miners and capitalists to the hotels upon the reefs. There is sufficient data to surmise that the rapidity of hotel construction originated in the migration of the capitalist and speculator classes (as opposed to the miner and prospector classes) to the region. (206) A correspondent to the <b>Bruce Herald</b> remarked on this trend in November 1869:—

... a number of persons, supposed to be speculators, arrived here ... and proceeded immediately to the reefs. (207)

Cromwell is busy with new arrivals from Dunedin. Property is changing hands at the reef, and buildings going up rapidly. (208)

This observation may be of further validity in that the proportion of hotel accommodation fell away rapidly after the summer quartz rush. The capitalist sector, their immediate task of prospecting the share field over, left the area, and as most of the remaining population was engaged in prospecting only, the extravagance of hotel accommodation was beyond the means of most.

Competition among the existing hotels, especially on the reefs at Logantown, became intense. Both the Provincial and the <i>Reefer's Arms</i> Hotels echoed one another, each proclaiming the 'largest and most comfortable hotel in the district.' (209)

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(207) B.H. November 10, 1869, p.7.
(208) B.H. November 17, 1869, p.5.
(209) C.A. May 25, 1870, p.6.
The increase in the numbers of vacant hotel beds obviously startled the local proprietors, for as miners began abandoning claims in favour of the promising Carrick reefs, so too did the business community. Displaying a lack of confidence in the future Bendigo reefs, the number of hotels dropped considerably, from ten to five during 1869 and 1870 respectively. During the year 1870, at least six Bendigo and Logantown business establishments transferred their trade to the new quartz township at the foot of the Carrick Range - Quartzville.

Throughout the winter of 1870, various quartz claims ceased work or were abandoned, some through lack of funds, others through a 'dread of hard times in the winter.' (210) An imminent onslaught of severe winter conditions, when not even alluvial mining could be relied on for work, was feared by a majority of the quartz field residents. During this period, only two large companies, the Cromwell and the Aurora Companies, were employing hands in mining and crushing. In May 1870, part of the Cromwell Company machine fractured, necessitating its closure for the winter, and precipitating the discharge of a large number of machine attendants and quartz carters.

The reaction to unemployment and claim abandonment affected the business community severely, as it was recognised that as long as there was large scale wages-employment in the larger companies, then there would remain a steady populace, and capital circulation within the total

(210) D.T. May 6, 1870, p.2.
community. The months of August and September witnessed the sale of business establishments at Logantown, and the bankruptcy of some Bendigo residents, including the proprietor of Tait's Bendigo Hotel. (211)

Only with the ensuing spring came the realisation that both mining and business interests had over-reacted in the face of winter. The Cromwell Company, having installed a second battery and stockpiled over a thousand tons of quartz at the mine during the winter, displayed every facet of the prosperous yet benevolent company. Employing a large number of new hands in mining, carting and crushing, the company treated all the men to a plentiful supply of refreshments at the opening of the new battery:— '... success and prosperity to the pioneer company of the Reefs was drunk with great enthusiasm. Flags and other insignia of joy were everywhere in Bendigo.' (212)

Both the Cromwell and Aurora Companies were employing three shifts of men working day and night, mining and crushing quartz, while other lesser companies such as Aldread and Company had engaged enough men to work around the clock in shifts, driving and stoping out quartz. (213) The Cromwell Company had three teams of carters on the road in daylight hours, to ensure the continuous supply of quartz to the battery. All horses in the district were reported to have been engaged in carting for this Company, (214) and

(211) C.A. September 14, 1870, p.4.
(212) C.A. July 20, 1870, p.5.
(213) C.A. October 12, 1870, p.6.
for the month of September 1870, the Company returned a record 1,000 ounces of gold. (215)

Two other companies, the Alta and the Colclough, were erecting machinery on their ground; the sight of investment of this order gave a genuine cause for excitement.

The pace of mining life had settled in 1871, to a steadiness of regular industry on the Bendigo reefs, and with a more realistic air of hope in the future than had characterised the earlier rush.

The heavier investment in the reefs, and the established business and service centre of Bendigo and Logantown, evinced an attitude whereby solidarity and permanence in settlement were assured. (216) Indeed, settlement in the whole of the Upper Clutha goldfields' region, reflected a keen awareness of the potential prosperity of the neighbouring reef regions:

We find that with local residents, there is increased confidence in the stability and prosperity of our goldfields townships; business people are everywhere improving their premises. Nor is the personal comfort of the inhabitants neglected ... (217)

In the reefing settlements, this complacency was short-lived. The long years of uncertainty and disheartening company failures had begun, during the winters of

(215) D.T. October 14, 1870, p.2.

(216) In May 1870, the Wakefield (Bendigo) Post Office agency was opened near the Cromwell Company's crushing mill, with the promise that a Post Office would be established at Logantown. The promise was never carried out. (D.T. May 27 1870, p.2.).

(217) D.T. March 25, 1870, p.2.
1870 and 1871. The only pattern established was that of the continual reports hoping for better times. Tirades against various idle sectors of the mining community, and the delegation of blame for the unsettled industry were published with increasing frequency and vehemence at this time:—

Business is languishing, not because the place [Bendigo] is not prosperous, but because there are too many business people on the ground. Over-rushing a place with business people is becoming so common now that it may be mentioned that the criterion of the prosperity of a place is not the prosperity of the individual storekeepers ...(218)

In the goldfield context, the presence of business premises was, as illustrated above, the medium through which the prosperity of a quartz field was frequently gauged.

By mid 1871, the interest in Bendigo as a potentially large quartz mining region and as a base of permanent settlement was waning. The Cromwell correspondent to the Otago Witness, observed in a somewhat perplexed vein,

'In quartz mining, although Bendigo possesses the best claim yet discovered in the province ... the interest manifested by the people of the district in Bendigo affairs has somehow declined, or been transferred to the Bannockburn side. (219)

Although the number of business premises in the Bendigo locality declined in 1870 (Table VI), this is, in part, accountable. Firstly, there were a number of

(218) D.T. October 28, 1871, p.9.
(219) O.W. May 27, 1871, p.11.
hotels in particular, advertised for sale during 1870, the proprietors having left for the Carrick quartz field. Not all of these owners physically transferred their premises. In addition, the numbers of hotels open in 1871, (Table VI), indicates that the decline in such accommodation was more of a business over-reaction, with hotel-owners, deserting the field as soon as was practicable.

On the Carrick Range reef area, the pattern of settlement echoed the Bendigo reef development, with the same, predictable problems of excess business premises:-

Quartzville ... is rapidly extending, some of the Cromwell trades-people, unmindful of their experience at Logantown ... having added to the number of establishments by erecting branch stores etc. As if to warn them to be careful of rushing into rash expense in that way, the miners appear to favour another township, Carricktown, situated about 800 feet higher up the range ... (220)

The faith evinced in the future of the Carrick reefs was insecure and distinctly cautious. The current newspaper reports, while recording the local expectations of a 'regular stampede', (221) were wary of printing anything without verifiable foundation. Bendigo, for several months in 1871, was mentioned only in relation to the latest calamity on that field, such as the stunning effect on the local population of the low yield from the first crushing at the Colclough Quartz Mining Company's battery.

(220) O.W. October 28, 1871, p.9.
(221) D.T. September 22, 1871, p.2.
The service township of Quartzville lay in the vicinity of these twin poplar trees. Watercourses, stone ruins and old residence sites betray this town site at the foot of the Carrick Spur. The Royal Standard Company's crushing battery was sited in the gully to the right of the photograph.
Such a reversal of mining industry sentiment was far from reassuring. The movement of relocated Bendigo businessmen, and of miners dismissed from failing quartz mining companies, towards the Carrick Range, intensified interest in the latter field, and increased the suspicion with which the Bendigo reefs were regarded.

In an attempt to make a fresh and determined effort in developing and settling upon this new quartz field, the local correspondents had no hesitation in expressing their strength of purpose:—

We are all indulging in 'great expectations.' We consider that our shares and 'shows' (222) will make up for many losses and many mishaps; and that without the aid of much imported capital we shall succeed in opening up not a new goldfield but a very valuable addition to the wealth of our district, by persistent hard work and patient perseverance alone. (223)

This conviction, that a concerted application of labour would be the pinion around which the success of the field would revolve, soon displayed tangible evidence.

By November 1871, two crushing batteries were at work on the range, one other was in course of erection, and another had been ordered from Dunedin manufacturers. At least twenty houses were constructed in Carricktown alone;

... the settled appearance which everywhere distinguishes the 'residence areas' of the miner ... each one declares,

(222) A 'show' was a colloquial term used in the quartz reefing industry to indicate a rich auriferous quartz discovery, especially where gold specks were clearly visible in the quartz.

(223) D.T. November 24, 1871, p.2.
by its enclosed and cultivated
garden, the owner's intention to make
it a home. (224)

With hopes for the prosperity of the ensuing summer
of 1871-2 raised, reefs being regularly prospected,
discovered and claimed, the townships on the Carrick were
well established by late 1871. In a proud pronouncement
of the potential return from these reefs, the Dunstan
Times boasted in November:-

There is one fact that cannot be too
widely known. The lowest yield of
any stone yet crushed has been 10 dwts.
[0.5 oz.] to the ton. Heavy crushing
machinery is our great want - our
patience will perhaps yield us even
this result. (225)

The definitive nature of such comment reflected not
only the intensity of renewed interest in quartz reefting
after the Bendigo disappointments, but the very inadequate
premise upon which the whole quartz field at Bendigo had
been developed. The early employment of a public crush-
ing battery (the Royal Standard Company machine) facil-
itated the carrying out of trial crushings of up to 100 tons
of quartz, rather than the reliance on hand crushing of
very small quartz samples, as in many cases at Bendigo.
The former process afforded a much more predictable estimate
of the probable gold yeild from any particular claim,
allowing adequate budgeting measures to be effected.

By the end of 1871, the Carrick field had been pro-
spected in a cursory fashion from Quartzville to the top

(224) O.W. November 4, 1871, p.5.
(225) D.T. November 24, 1871, p.2.
of the range. Twenty three major claims, many employing labour unconnected with the claim, were at work, besides an undefined number of small prospecting parties, individual claimholders and working shareholders. Although only one company, the Royal Standard, had sought protection under the Mining Companies Limited Liability Act 1865, at this time, a number of companies were gaining considerable size in scale of operation and capital investment.

The shareholder composition of the Royal Standard Company reflected a strong interest from Dunedin and Cromwell capitalists. This company was directed solely by outside and absentee interests. It is consequently of significance that although grossing good returns from its own quartz mine and from public crushing charges, the company had become bankrupt by 1873, without ever having paid a dividend. The prospective profits had all been dissipated in labour and fuel costs, and in management fees.

Although only seven companies had taken advantage of the readily available public crushing facilities by 1872, the ease of rendering access to such trial facilities effective so early in the Carrick field's development, compared to the Bendigo field experience, created a solidarity on which to base settlement. All of the trial crushings on the Carrick reefs had satisfied the efforts in stoping out quartz from virgin mines, through universal indications of payable returns. As a consequence, a number

of quartz companies decided to pursue their mining operations on a large scale, several ordering crushing machinery.

In analysing the heavy rush of quartz miners to the Carrick field, the impetus of potential gold existed as the prime motivating factor, but it should be acknowledged that the attraction of regular employment for wages was singularly important in the rapid and steady development of settlement in this region.

The security of employment in an established and tested quartz claim was infinitely more attractive, especially if on a regular wage basis, after the Bendigo experience of wasted labour on poorly developed reef lines. This is not to say that prospecting suffered any because of this trend, for a vigorous prospecting class did exist, but only with the reassuring knowledge that employment for wages could be had when prospecting credit became exhausted.

The entire process of settling mining and business enterprise and communities in the Carrick reef area was executed with notably less speculation over the future of the reefs than occurred at Bendigo. The mining undertakings, apart from the occasional report of a record trial crushing, were pursued in a steady and generally unsensational manner. Local wardens and the press reported on the day to day fortunes of the mines, and settlement had stabilised in cottages dispersed over the reef area, and in concentrations around Carricktown and Quartzville.

Well balanced service functions, manifested in a spectrum of business premises, had agglomerated in both Carricktown and Quartzville, their declining existence throughout the 1870s following the waning fortunes of the quartz field. (Refer Tables VII and VIII).

By 1873, the rush phase had faded with the rapid incorporation of regular industry, ordered settlement foci upon the reefs themselves, and the declining activities of the speculators.

Mine and Settlement: the failure to consolidate

The number of miners engaged in the industry of quartz mining within the Dunstan District underwent a significant decline in the years after 1871. Although four hundred persons had been reported as inhabiting the Bendigo reefs in 1869-70, this figure would not approximate the number of persons effectively engaged in quartz mining activity.

No official records of the numbers of quartz miners engaged in either the Bendigo or Carrick reef regions exist until 1872, when the rush phases on both fields had lapsed. (Refer Table IX). Although it is unlikely that the enumeration of quartz miners includes individual prospectors, and does not include the business fraternity and family populations, the evidence of gradual decline in resident populace is readily discernable.

The figures in Table IX fail in their assessment of accurate quartz mining class populations, for one company alone, the Cromwell Company, during the years 1870-76, employed an average of eighty working miners. The census periods were taken during winter months, when labour was
The windswept ridge which supported the township of Carricktown during the 1870s. The flattest portion of the entire Carrick Spur, this area of a few undulating acres formed the service and residential area for the upper Carrick Range quartz mining industry. All of the dark prominatories in the photograph are the remains of stone buildings.
often laid off, and only the principal mining companies were approached for employment returns.

The reflected trend in employed labour (Table IX) is a useful indication of contemporary mining community prosperity, for in a labour-intensive industry such as quartz mining, any major fluctuation in gold return is correspondingly mirrored in the employed labour component. A number of the larger mining companies illustrated this trend, especially on the Bendigo field, when retrenchment measures were frequently introduced to ensure that the wages account - the greatest single item of expenditure - did not jeopardise the economic viability of the individual company. (228)

The years following 1871 witnessed a gradual depopulation of both reef areas. The Bendigo field, its New Zealand-renowned name supported almost solely by the expanding Cromwell Company, continued to contribute most of the gold from quartz, not only for the Cromwell reefs, but for the whole Otago Province. (229) However, the gold-producing claims, apart from the occasional prospecting claim (230) trial crushings on the Aurora Company battery, totalled only three in 1874.

The Cromwell Company continued to steadily expand its

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(228) The Cromwell Company frequently laid off staff during periods when crushings were held up due to lack of water, insufficient stone or broken machinery.


(230) A quartz claim was regarded as still being prospected in the stages of shaft sinking and adit-driving, unless quartz was being stockpiled or crushed.
# TABLE VII

**BUSINESS FUNCTION ANALYSIS: CARRICKTOWN**

<table>
<thead>
<tr>
<th></th>
<th>1870</th>
<th>1871</th>
<th>1872</th>
<th>1873</th>
<th>1874*</th>
<th>1875</th>
<th>1876</th>
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<td></td>
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</table>

* Insufficient data

**Source:** Bruce Herald April 10 1872; Dunstan Times 1871; Mackays Almanac 1870-80; Mills Dick and Company's Otago Provincial Almanac and Directory 1875.
TABLE VIII

BUSINESS FUNCTION ANALYSIS: QUARTZVILLE

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<th>Year</th>
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<th>1872</th>
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* Insufficient data

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</tr>
<tr>
<td>1884</td>
<td>359</td>
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</table>

scale of operation, gradually taking up adjacent and abandoned leases, such as the former Golden Link claim in 1870, and the Morning Star Company's reef, in March 1872. The Company assumed, by a wide margin, the role as the largest employment body on the field, and virtually solely supported the working populations of Logantown and Bendigo; the former through the mine operations, and the latter through the battery workings in the Bendigo Gully.

A census in March 1874, failed to enumerate the population living at the upper Bendigo region townships of Logantown and Welshtown (the principal residential portions of the reefs), but the township of Bendigo supported a resident population of 79, comprising 50 males and 29 females. The proportion of females to males (1:1.72) was inordinately high for a contemporary goldfields community, the average ratio for the well-established service centre of Cromwell at the time, being only 1:1.62. This figure also indicates a useful contrast with the Carrick Range reefs, where the contemporary ratio of females to males was 1:2.66, representing 48 females and 128 males.

Ages are not specified, but it is clear that with the movement of most of Bendigo's prospecting population to the Carrick, the settlement of Bendigo township may be seen as attesting to a more settled appearance than the corresponding Carrick townships. The Bendigo population

(231) Census of New Zealand 1874, Distribution of population, p.22.
stability was based upon the relatively secure employment in the Cromwell Company, in the Dunedin-based and heavily financed Lucknow Quartz Mining Company, engaged for six long years in tunnelling for an elusive and subsequently poor quality reef, and in a few smaller companies, such as the tribute operations on the Aurora Company ground and the large scale sinking operations of the Reliance Company.

In comparison, the Carrick field was characterised by a large number of small-scale mining enterprises, which, apart from a few of the more wealthy concerns, did not remain in existence for very long and did not permanently support employed labour. Consequently, employment was available, but was of a more casual and seasonal nature than in larger, battery-owning enterprises. Family settlement was thus discouraged, especially when the mines failed to undertake regular crushings, and thus lost regular returns to the shareholders. The Cromwell Company on the Bendigo field was a notable exception to

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(232) The system of letting a mine 'on tribute' was the process whereby a leaseholding company, instead of selling up their mine and plant, tendered the working of the mine to a party of miners, who would operate the mine and battery, taking a certain percentage of any gold returns won. The Aurora Company, faced with the alternative of company liquidation, let their claim of 16½ acres and battery in April 1871. By August 1872, the tributors had made only two crushings, realising only 0.1 oz. per ton. A second party of tributors continued, made two good crushings averaging an ounce of gold to the ton, but abandoned the claim in October 1873. (C.A. October 21 1873).

this trend, its scale of operation, (234) regularity in crushing, and magnitude of gold yield all tending to favourably mould contemporary opinion as to the future of the Company's works and reef.

Although accurate returns of reef area population are not available for most of the 1870s, it may be asserted that the overall population gradually declined, yet received a slight impetus with the increase in claim working following Professor G.H.F. Ulrich's inspection of the Cromwell reef area mines in 1875.

In all the Cromwell reef communities, the proportions of business premises slowly declined. (Refer Tables VI, VII, VIII). Regular public sales of town sections in Bendigo failed to draw many purchasers, no sections being sold in some of the advertised sales. (235) Of the 188 surveyed sections within the Bendigo township, only 32 were ever sold, most of them during the early 1870s. (236) (Refer Figure V).

The Dunstan Times, echoing a local community anxiety to retain population on the reefs and in quartz mining, because of the accompanying heavy local capital investment, attributed a steadiness in mining activity to the local quartz mining population desire to settle:-

(234) O.W. August 22 1874, p.7. (By 1874, the Cromwell Company held lease rights over 33 acres of reef line, were stoping out quartz from three shafts, the deepest being 270 feet, and were mining over 200 tons of quartz per week).

(235) D.T. March 21, 1873, p.2.

(236) Official records: Otago Land Registry Office, Dunedin.
... mining prospects have not been so promising for some years ... this pleasing state of affairs is not to be ascribed to any fresh discoveries, but is to be traced to a spirit of contentment on the part of the miners, who appear to have learned that the rolling stone... [sic] (237)

With seasonal delays in crushing, through lack of snow rendering spring supplies insufficient, floods, or drought, the reefing industry fluctuated in productivity. Year after year failed to bring struggling quartz claims to fruition. Newspaper reports continued to print edicts of encouragement, which became increasingly predictable in genre: 'Bendigo is looking up, and it is expected that in the summer months, a large population will be located there.' (238)

In a peculiar reversal of contemporary expectation, which in 1870 had all but dismissed the Bendigo reefs and community as defunct and proclaimed the Carrick settlements as the new quartz centres, the Bendigo mining townships persisted as independent residential entities long after the Carrick Range townships had begun to decline in importance. The Cromwell Company was the lifeblood of the Bendigo townships. The diligence and vitality with which the latter Company executed its mining operations, and the lucrative economic returns extracted from the mine through this efficient management, impressed a number of Dunedin and local capitalists. In consequence, a number of large scale quartz mining operations were financed for

(237) D.T. April 25, 1873, p.2.
(238) D.T. August 22, 1873, p.2.
several years at Bendigo, affording additional employment for the local populace.

Examples of ambitious enterprises were the Lucknow Quartz Mining Company, formed in 1872 with a nominal capital of £7,800 to resurrect the bankrupt Colclough Company's reef, and the Bendigo Deep Level Quartz Mining Company formed in 1874 to cut a deep adit through all the known Bendigo quartz reefs. Other large companies, such as the Reliance, the Eureka and the Carlisle and Caledonian Companies all expended large amounts of capital and labour, mainly in determined but futile attempts at deep sinking after elusive reefs and quartz leaders.

The pattern of fluctuating settlement, ebbed and flowed in rigid harness with the fortunes or otherwise of the reef exploitation during the 1870s. The very existence of the quartz reef township depended on the mine and the corresponding value of the auriferous quartz output. In turn, the mine depended on the labour of the experienced quartz miner and the general mining labourer, both of whom were loath to settle in an area unless the worth and prospects of a mine had been adequately proved on the tables of a crushing battery.

After the massive failure of heavily financed and poorly managed companies such as the Alta Company at Bendigo, little time was expended on claims which failed to indicate payable ore on the first crushing. Such a claim would be abandoned rapidly by any shareholders, with the subsequent dismissal of most of the
employees. (239)

The fine balance in the complementary nature of quartz reef development and quartz reef settlement development had not been lightly regarded by the contemporary quartz mining community. The business sector had amply illustrated characteristic acumen, and anticipation of reef mining progress. Conversely, the reefing companies and partnerships had experienced the effects of labour shortages, especially in the early rush phases when capital was freely available for investment in reefs, but labour was hesitant to engage in mining work when alternative possibilities of gaining shareholder status existed.

In effect, the plethora of claimholders and shareholders had starved the labour market. Thereafter, both aspects of the quartz area activity - mining and settlement - occupied a mutually-recognised relationship, each sensitive to the other's fortunes and expectations.

Although the quartz mining industry, with the lowering of wages in 1870 and 1873, effectively illustrated a decreasing dependence upon large scale reef township settlement, both aspects of the upland human environment succumbed, of necessity, to external physical, social technological and even political constraints upon the industry.

(239) D.T. July 4 1873, p.2. (The Caledonian Company on the Carrick Range (Refer Plate XX), originally formed with twelve worker/shareholders in 1870, was managed by one remaining shareholder for the following five years. In the first twelve months of crushing, during 1873, the lone shareholder had mined almost a thousand ounces, and was confidently employing nine regular mining labourers).
Auriferous quartz extraction was the established industry; the associated township settlement and invested capital were the means through which that industry could be pursued with effect. Such a relationship became intimately respected by all affected parties and communities, as exhibiting a strong and essentially mutual interdependence.
Chapter 5

CAPITAL, COMPANY AND MINE

It has been estimated that of every ten mining companies started, only one has proved a success ... it is his [the prospector's] duty to thoroughly ascertain the value of his discovery before he enlists the assistance of outside capital or spends his money on machinery. (240)

The above estimation was borne out with humiliating accuracy on the Cromwell reefs during the 1869-84 period. The outcome was further compounded through the large scale failure to observe the simple precautions and duties appended to the above comment.

Since the earliest contact with quartz reefs in Otago, it was realised that the most efficient, and indeed, the only practicable method of operating this branch of mining, was through the formation of working partnerships and companies. In the early Cromwell quartz reef rushes of 1869 and 1870, the principal means of opening out new claims was to form a small group of shareholders, either with or without capital, to arrange for adequate reef testing.

The several years from 1865-8, during which time Logan and Party (later the Cromwell Company) of Bendigo attempted to secure capital backing for their thoroughly prospected and prepared claim, indicate the initial lack of investment enthusiasm on the part of both Dunedin and local capitalists. Consequently, the initial trend in taking up quartz claims was through working miners staking fresh claims or buying

their way into a claim, by offering either capital or their labour in return for a share. Shares were necessarily limited, in order to retain their value, and in order to secure a larger proportion of any profits should the mining venture be successful.

The unfortunate circumstances which had befallen the earlier, isolated Otago quartz mines, had numbed the Otago investment market from the point of view of quartz mining. Following the collapse of the Ida Valley and the Macraes Quartz Mining Companies in mid 1869, the Otago Witness remarked in a leading article:—

On the one hand, the speculators who have already been unfortunate can scarcely be expected to hazard more capital; and on the other hand, it is little expected that other speculators will take their place. We have only the practical miner left. (241)

The practical miner, in the case of Logan and Party, had illustrated the necessity to prospect adequately, and show potentially productive results, in the form of opened-out ground and genuinely-auriferous quartz samples, before capital could be attracted to any region. Even in this case, the Californian quartz mining experience of the financier-shareholder, G.W. Goodger, was the major persuasive factor in his decision to mortgage his property to raise capital for a first crushing battery. (242)

It is probable also, that the relative ignorance of the Cromwell quartz fields - an ignorance of reef value and

123.

a lack of fame - in comparison to the reputed richness of the Coromandel and Thames quartz fields, tended to inhibit capital investment in the unknown Cromwell reefs. While this situation was rapidly disappearing due to the sensational crushing yields from the Cromwell Company's works at Bendigo, (£4,000 being returned to the four shareholders for one months' work), (243) the Otago press carried frequent reports cautioning against rash overspeculation on the part of intending capitalists.

In the matter of the frantic purchase of quartz mining shares which characterised the large scale opening of the Auckland reefs, Warden Pyke reiterated a strong hope that no speculative companies would 'obtain a foothold on the Bendigo Reef.' (244) The Otago Witness, concerned about possible speculation over the Cromwell reefs, later printed this sobering comment:-

... the actual state of affairs at Thames was not what it appeared to be. There was no sufficient basis for the magical superstructure that was dazzling men's eyes. (245)

While reef claims were being marked out at a previously unrivalled rate on the Bendigo lines of reef in 1869, almost wholly by poorly financed miners, the capital interest of the district was becoming alert to the seemingly latent bonanza in auriferous quartz:-

(243) O.W. September 25, 1869, p.9.
(244) O.W. September 18, 1869, p.18.
(245) O.W. October 16, 1869, p.1.
Dunedin capital will no doubt in a short time flow into the district to test the whole of the ground in Bendigo Gully and other places in which reefs have been struck. (246)

... a number of persons, supposed to be speculators, arrived here [Cromwell] and proceeded immediately to the reefs. (247)

The erstwhile quiet town of Cromwell was reported in November 1869 as being bustling with new arrivals from Dunedin. (248) The town's accommodation services were fully occupied, while hotels in the reef townships of Bendigo and Logantown were under construction.

The fact that several capitalists purchased shares in quartz claims while they were in Cromwell, and without having inspected the reefs or the claims, indicated that foundations were being laid for a repetition of the tragic Thames experience, where many investors lost money in poor and even non-existent claims. A number of investors visited the Cromwell reefs, but with a lack of experience in recognising a quartz reef, or auriferous quartz samples, where the gold is not usually visible to the naked eye, the journey was often futile, and any sale usually depended on the lubricated tongue of the seller.

The number of shares in any one quartz claim was usually limited to a figure in the order of from four to eight. However, it is evident that in cases where the

(246) O.W. October 30, 1869, p.16.
(247) B.H. November 10, 1869, p.7.
(248) B.H. November 17, 1869, p.5.
mining shares were in particularly high demand, half-shares were often sold, mainly in an attempt to boost the capital backing of the enterprise, and to raise its speculative value.\(^{(249)}\)

A *Dunstan Times* editorial in January 1870 suggested that:-

Associated companies for quartz mining might number as high as 12 members, 10 sleeping and 2 working ones; this would make the payments light, and would induce persons to speculate in opening up claims, or prospecting for a reef.\(^{(250)}\)

Although this pattern of working claims, based upon the contributions of working and sleeping shareholders, was in extensive operation in both the Bendigo and Carrick fields early in the rush phase, the system, especially among small partnership groups, did not endure the months of non-productivity.

At the end of 1869, 52 quartz claims had been opened out, in partnerships totalling 294 shareholders,\(^{(251)}\) or an average of 5.6 shareholders per claim. Many of these claims were never worked, or worked by more interested shareholders, before being abandoned when the finance, ostensibly supplied by sleeping partners, was exhausted.

Wasted time over claim demarcation disputes, lack of adequate knowledge in shaft sinking and adit driving

\(^{(249)}\) For example, the Aurora Company, in January 1870, split the seven full shares in the Company, giving rise to the sale of one-fourteenth shares.

\(^{(250)}\) D.T. February 4, 1870, p.2.

\(^{(251)}\) Parcell, *Heart of the Desert*, p.130.
operations, and general disillusionment with the amount of preparatory effort required in the testing of quartz reefs, discouraged many. Employment was then often sought in the large leaseholding companies (in 1869 comprising the Cromwell, Colclough, Aurora and Richmond Companies), who were employing at least 56 hands directly in quartz reef prospecting and actual mining. (252)

Under the Gold Mining and Agricultural Leases Regulations' sections relating to quartz mining, claims could only be protected for 14 days, provided they had been legitimately worked for one month previously. The effect of the abandonment of many claims, often on a temporary basis, while wages were worked for in adjoining mines, led to many claims being forfeited. Action by sleeping shareholders frequently followed in the Warden's Court, in attempts to reinstate the legitimacy of such claims, and to extract the share capital from deserting miners. This pattern continually recurred in the early Cromwell reef area development, usually culminating in a loss for most parties concerned, and a lack of adequate prospecting or testing of the many small reef claims.

The Capital-backed Companies

Several claimholders, both on the Bendigo and Carrick reefs, were, early in the quartz rush phase, able to command the attention of sufficient capital backing to develop their claims with a minimum of wasted time. Although the Cromwell Company (Logan and Party), the Royal Standard

(252) ibid.
Company (Barry and Party) and the Aurora Company (Barnes and Party) had long prospected their quartz claims, a number of companies were quickly formed in 1869 with very little such preparatory work on their respective quartz reef lines.

Of these early-financed companies, formed principally by working miners and local capitalists, five were in the Bendigo region, and one in the Carrick field, by the end of 1869. (253) It is significant that all of these claims were on distinct lines of reef, unlike the subsequent rush pattern, when claims were frequently closely surrounded by adjoining claims. This suggests a contemporary recognition of tardiness in capital investment. That is, in order to effectively secure financial backing, it was necessary to discover an untapped line of reef, and offer tangible evidence of an unsurpassed auriferous quartz potential.

Both the Aurora and the Colclough Companies indulged liberally in a method of securing public interest and consequent financial backing, by ensuring that the press had every facility open to them in order to inspect and sensationalise favourable quartz samples. (254) From the Carrick Range, Jackson Barry, a local quartz miner-prospector, brought in some exceedingly rich quartz samples to display in Cromwell, in 1869. His hitherto-small working partnership soon attracted sufficient Dunedin and

(253) Bendigo: Cromwell, Aurora, Alta, Colclough and Richmond Quartz Mining Companies. Carrick: Royal Standard Quartz Mining Company.

local capital to endow itself with the grandiloquent title of the Royal Standard Quartz Mining Company, to install a steam powered crushing battery at Pipeclay Gully, and 'put on a lot of miners to raise stone.' (255) This Company continued to be a regular employer of labour, opened out two quartz mines, and facilitated the subsequent development of the whole Carrick reef area through its public crushing services.

Of these initial, and larger companies, all except the Cromwell Company were financed in part by Dunedin capital, (256) and with the promise in 1869 of the establishment of a public crushing mill at Bendigo, by Dunedin businessmen, faith in the continued liberal application of capital to Cromwell reef enterprises was considered assured:-

Dunedin capital is once more directed towards the goldfields - the Bendigo Quartz Mills Company. Dunedin people have for a long time been charged with a want of sympathy with the mining population, amounting to a decided unwillingness to invest in mining speculations ... As yet mining speculation through the medium of Joint Stock Companies has proved anything but satisfactory - quartz companies both at Waipori and Skippers have turned out egregious failures. The case will be different now, the reefs at Bendigo have been proved by repeated and thorough trials of their richness. (257)

The unfortunate irony in the basis upon which the increase in direct investment had been made, was borne out in the fact that few of the reefs had been proved by repeated and

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(255) Barry, W.J. *Up and Down*, 1879, p.224.


(257) D.T. January 14, 1870, p.2.
thorough trials of their richness.

Most of the early companies established on both reef fields, had derived their financial backing from either the display of auriferous quartz samples, or from the results of single hand crushings of a few lumps of quartz. The Aurora, the Alta and the Nil Desperadum Companies, with access to crushing facilities at hand, decided, on the evidence of hand crushed samples of quartz only, to dispense with a proper trial crushing and instead, erect their own machinery. The Alta Company shareholders thus ordered their machinery and were, in February 1870, employing upwards of twenty men, on the basis of the visible gold in some of their quartz samples. (258) The Aurora Company perceived in their reef, a value of gold per ton of vastly greater proportions than actually existed. (259)

Over-enthusiasm, and the desire to become an independent and self-sustaining concern, characterised the larger of the early quartz mining companies. The contemporary opinion evinced by a number of early capitalists was that once the means for working the mine were provided, in the form of a leased claim, mine workings, machinery and regularly employed labour, this would suffice in the securing of regular and permanent dividends. (260)

(258) D.T. February 26, 1870, p.2.

(259) A correspondent to the Otago Witness in 1869, reported:- 'I selected a small piece of stone weighing 4 oz., and ... pounded the same, to yield 2½ grains or a total of 46 oz./ton.' O.W. November 20, 1869, p.15.

Inadequate backup capital to continue the mines’ operations over the periods of poor crushings, courted disaster, led to the withholding of further capital by disillusioned shareholders, eventuating in the total collapse of the company and the loss of existing investments. Most of the latter were unrealisable, being in the form of wages for labour. In addition, machinery deteriorated badly during the long periods of indecision regarding the future of mines, as shareholders often held up the production of a mine while tributors were advertised for, and companies folded up.

A number of the larger companies, heeding the ultimate failure of several pioneer investment enterprises on the Cromwell reefs, reorganised the composition of the companies to include a proportion of working shareholders. Through this method, if a group of legitimate quartz miners formed a company on an existing lease and with a well ordered mode of operation, it was envisaged that capital would be more readily attracted. In 1871, an ambitious attempt both in securing capital and in planning to extract quartz from a number of auriferous Carrick Range reefs

(261) **Votes and Proceedings, Otago Provincial Council, Session XXXIV, 1875, p.80.**

(262) A mining community outcry resulted in the temporary closure of the Aurora Company's operations, while the state of the company's affairs was inspected by the shareholders. The Dunstan Times remarked: '... it is a disgrace to the shareholders to allow such a splendid mill to be idle.' D.T. January 13 1871, p.3.

(263) Such as the Alta, Aurora, Colclough, Royal Standard and Victoria Quartz Mining Companies.
by means of a low level adit, was publicised:-

The opinion that all the mountain is 'one mass of quartz reefs' has gained so much ground here that a company of 18 has formed and started to thoroughly prospect the hill by a tunnel driven from the head of Adams Gully to the head of Pipeclay Gully ... There can be no doubt of the bona fides of the men who form the company.(264)

Private enterprise, genuine intent and perseverance were regarded as the necessary virtues of mining company formation. Of the successful operations in a mining company at Skippers in 1871, the local press correspondent remarked with good intent, but in an unfortunate oversimplification:- 'Not one single individual ... envies them the good fortune they so well deserve.' (265)

Although there is indication that every encouragement was given to the mining company to begin operations, the contemporary press especially reflected a pro-capitalist image, regarding the demands of the employed miner as a major economic constraint upon the activities of the average quartz mining company. This attitude was amply illustrated following the reduction in mining wages on the reefs in 1871. Speaking of the 'exorbitant rates of wages hitherto paid,' (266) the Dunstan Times remarked:-

This reduction of wages will, we are sure, be of great benefit to the district, and will probably induce many companies,

(264) O.W. August 12, 1871, p.17.
(265) O.W. November 18, 1871, p.14.
(266) D.T. March 10, 1871, p.2.
who have suspended operations, to resume their workings. (267)

The rates of wages initially escalated as a result of the shortage of skilled quartz miners, in turn dictating the exploitation by companies of only the richest reefs of quartz. Failure to allocate time and money to only the most productive of quartz reefs, often resulted in economic troubles:

... this [Colclough] Company cannot be expected to make a fortune, as in consequence of the thinness of the reef, they are compelled to employ a large number of hands to keep the battery at work ... (268)

Thus, a vicious cycle, based on the work demands of the expensive crushing machinery, and the labour required to meet such demands, caught several quartz mining companies in the subsequent and uneconomic stalemate. The proportion of finance expended in wages for the high labour costs, was without exception, the greatest single burden on any quartz mining company or partnership. (269)

Company shareholders: the emergence of the working miner-shareholder

The small scale quartz mining claim operators, fettered in their scale of operation through lack of capital, consequently comprised of groups of practical miners, frequently

(267) D.T. March 31, 1871, p.2.
(268) D.T. April 14, 1871, p.3.
(269) For example, in the half year to March 12 1872, the Royal Standard Company's expenditure of £3,193 comprised 67% labour costs. (Otago Provincial Government Gazette, 1872, p.194).
with little quartz mining experience, but willing, through trial and error modes of work, to test their segments of reefs. Many of these groups failed after less than a year's work. During the years 1869-80, 76.2% of all quartz mining partnership claims on the combined Cromwell reefs ceased operation within two years of taking out their claim. (270) (Refer Table X).

TABLE X

<table>
<thead>
<tr>
<th>DURATION OF QUARTZ CLAIM COMPANY AND PARTNERSHIP WORKINGS 1869-80</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bendigo Reefs</strong></td>
</tr>
<tr>
<td>No. of Claims</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>1 year or less</td>
</tr>
<tr>
<td>1 to 2 years</td>
</tr>
<tr>
<td>2 to 3 years</td>
</tr>
<tr>
<td>3 to 4 years</td>
</tr>
<tr>
<td>4 to 5 years</td>
</tr>
<tr>
<td>over 5 years</td>
</tr>
</tbody>
</table>

Source: Refer Footnote (270) below.

In addition, of the 22 Cromwell reef quartz mining companies which eventually became registered under the Mining Companies Limited Liability Act 1865, 20 remained in operation for more than two years. The number still in active mining pursuits after five years operation was 12, a proportion significantly higher than that of all mining claim groups in general.

It is certain that the greater longevity of these

(270) This percentage is based on the number of claims with traceable records, through public newspapers, mining surveyors' and Wardens' reports, and Otago Provincial Government Gazette records.
companies was a direct response to the capital invested in them. The registering of mining companies under the Act was, as the Otago Witness noted, 'not for speculative purposes, but for judicious prudence ...'. (271) The Act provided protection not only to shareholders in the event of company failure, but of greater practical significance, capital calls upon company shareholders could be enforced, upon sanction of share forfeiture. (272) The act of registering a quartz mining company also endowed such a concern, however small or inefficient, with an air of public respectability, as all company financial dealings were required to be published bi-annually.

In the Cromwell quartz reefs area, there flowed two successive waves of quartz mining company registration. (Refer Table XI). This pattern evolved in corroboration with the bi-nodal peaks of quartz mining claims in operation during the years 1869-85, (Refer Figure VI) reflecting the initial quartz rushes of 1869-70, and the Cromwell quartz reefs area inspection in 1875, by the eminent Victorian geologist, Ulrich.

Such interest in registering of quartz mining companies was hitherto unknown in Otago. The Dunstan Times regarded the increase in the number of registered mining companies as indicative of a closer co-operation between 'labour and capital,' (273) the nexus being a mutual confidence.

(271) O.W. December 10, 1870, p.10.
(272) New Zealand Statutes, 1865: The Mining Companies Limited Liability Act 1865, ss.6, 37, 38.
(273) D.T. March 7, 1873, p.2.
Fig. VI  QUARTZ MINING CLAIMS
IN OPERATION: 1868-80
### TABLE XI

**CROMWELL QUARTZ REEFS : QUARTZ MINING COMPANIES REGISTERED UNDER THE MINING COMPANIES LIMITED LIABILITY ACT 1865**

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1870</td>
<td>3</td>
</tr>
<tr>
<td>1871</td>
<td>2</td>
</tr>
<tr>
<td>1872</td>
<td>6</td>
</tr>
<tr>
<td>1873</td>
<td>1</td>
</tr>
<tr>
<td>1874</td>
<td>1</td>
</tr>
<tr>
<td>1875</td>
<td>4</td>
</tr>
<tr>
<td>1876</td>
<td>4</td>
</tr>
<tr>
<td>1877</td>
<td>1</td>
</tr>
<tr>
<td>1878</td>
<td>1</td>
</tr>
</tbody>
</table>

**Source:** Otago Provincial Government Gazette 1870-6; New Zealand Gazette 1876-8.

In the first phase of quartz mining company registration, from 1869-72, the impetus for the formation of mining companies stemmed mainly from non-mining class sources. During this period, 85% (274) of the scrip value was held by shareholders with occupations other than mining. (Refer Table XII). The balance of shareholder interest attained more equitable proportions during the next three years, when the respective figure was 57%. The years 1875-8

(274) It should be recognised that these percentages (as in Table XII) are based on the published share lists of the registered quartz mining companies only. Other companies were floated, unregistered, but complete records of shareholders cannot be traced, as no statutory enactment provided for such tabulation. These figures then, must be regarded as approximations of the contemporary trend.
TABLE XII

CROMWELL QUARTZ REEFS

LOCATION AND EMPLOYMENT STATUS OF SHAREHOLDERS IN COMPANIES REGISTERED UNDER THE MINING COMPANIES LIMITED LIABILITY ACT 1865; 1870-80

<table>
<thead>
<tr>
<th>Phase</th>
<th>Shareholders derived from mining classes</th>
<th>Shareholders derived from other classes</th>
<th>Dunedin and other shareholders outside Dunstan Mining District</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nominal value of shares (£)</td>
<td>Nominal value of shares (£)</td>
<td>Nominal value of shares (£)</td>
</tr>
<tr>
<td>1870-71 Rush Phase</td>
<td>5,050 (15%)</td>
<td>28,550 (85%)</td>
<td>24,450 (86%)</td>
</tr>
<tr>
<td>1872-74 Consolidation Phase</td>
<td>19,475 (43%)</td>
<td>24,725 (57%)</td>
<td>15,987 (65%)</td>
</tr>
<tr>
<td>1875-78 Ulrich Phase</td>
<td>60,150 (42%)</td>
<td>81,500 (58%)</td>
<td>52,300 (64%)</td>
</tr>
</tbody>
</table>

| Totals | 84,675 (39%) | 134,775 (61%) | 92,737 (69%) | 42,037 (31%) |

(1) Excluding mining classes.
[ ] Denotes percentage if the Cromwell Quartz Mining Company was excluded.
(The Cromwell Company was initiated by local mining class capital in any case).

Source: Otago Provincial Government Gazette 1869-76; New Zealand Gazette 1876-9
witnessed the total reversal of quartz mining company share interest, in that only 7% (275) of mining share capital was held by people other than those in mining classes. (276)

In the early years of Cromwell quartz mining, although the South Island was in the midst of an economic slump following the prosperity of the 1860s, (277) the rapid establishment of several capital-intensive companies on the reefs was indicative of a readiness to invest in gold mining. An Otago Witness editorial in January 1872, confidently asserted that 'There is no plethora of capital, but there is a very fair supply of it, and any really promising undertaking can hardly fail to find support ...' (278)

Of the five quartz mining companies registered in the years 1870 and 1871, only two were still in active operation in 1873. Many smaller companies traced a similar trend during the early years of the 1870s. Thereafter, the shareholder composition of quartz mining companies increasingly tended toward a more balanced dichotomy of business and

(275) This figure represents the percentage capital held by all registered companies excluding the large Cromwell Company, which was floated and registered in 1876. The Company's assets were contributed initially (in 1868-9) by miner/shareholders - consequently the sold shares represented in the 1876 registration application convey a false impression as to the true development influences of the Company.

(276) 'Mining class' denotes those persons acting in the capacity of miners, mine managers and quartz mine machinery operators.

(277) Clark, A.H. The Invasion of New Zealand by People, Plants and Animals, 1949, p.126.

However, a Carricktown resident, in a mining classes.

In the quartz mining investment arena, the working miner/shareholder began to assume greater importance in the development of the Otago quartz mining industry. Evidence stems initially from the minor storm of protest, in 1874, following Warden Simpson's report which held that:-

... the payable mines are gradually falling into the hands of companies, who [sic] diminish the labour as much as possible, the shareholders pocketing the surplus so caused. The individual miner is gradually becoming a mere wages man. (280)

The comment was largely valid, as a large proportion of the labour employed in quartz mining was, in fact, labour for wages, especially in the case of the larger companies. (281) However, a Carricktown resident, in a letter to the Cromwell Argus in May 1874, cited the Heart of Oak, the Young Australian, the Royal Standard, the Leader, the Kohinoor, the United Carrick and the Try Again companies as but few examples of paying companies owned and operated by working miners. (282)

This transition in the shareholder morphology of contemporary quartz mining companies was a response to two major limitations. Firstly, disillusionment in quartz reef mining, particularly following colossal failures on the Bendigo field in the form of the Alta, the Colclough


(281) Besides the Cromwell, Aurora and Colclough Companies, many others employed labour. Even mines owned by working miner/shareholders, employed labour from time to time.

(282) C.A. May 19, 1874, p.5.
and the Aurora companies, had convinced much of Otago's capitalist source that this mode of mining was an extreme financial hazard. In a confident but ironic tone, the Cromwell correspondent to the Otago Witness wrote in 1872:— 'Capitalists in Dunedin and elsewhere in many instances seem to labour under the mistaken idea that quartz reefing in Otago does not pay ...' (283)

Secondly, the scandalous mismanagement which had been the hallmark of several such failed companies had concerned both prospective capitalists and employed quartz miners, as insecurity undermined confidence:—

The bane of all the companies consists in the inordinate desire of shareholders, through their directors, to divide every £ as fast as it is made, and the want of information to the outsiders as to the financial position.' (284)

Quartz mines continued to be opened out, and their companies subscribed to, but at a reduced rate, until Ulrich's visit in 1875. The emergence of the miner/shareholder renewed confidence in the reefing industry. Dunedin and local capital continued to be invested, but apart from the much-vaunted Lucknow Quartz Mining Company, subsequently an embarrassing and expensive failure, the working shareholder possessed the majority of shares in companies during the latter portion of the decade.

The contemporary revival of faith in the quartz mining industry during the 1875-80 period indicated a greater emphasis on local support than previously. Tiring

(283) O.W. July 6, 1872, p.16.
(284) O.W. May 26, 1877, p.4.
after the years of persuading Dunedin capital to continually invest in the local reefing industry, the press concentrated on inducing local capitalists to invest. The existing local financial resources, applied to reef country by the local mining class indicated an understanding of the base whereupon the future of the industry lay:-

Capitalists ... seem to have given up all idea of further prospecting for quartz lodes; but, fortunately for the future prosperity of the place, some of the hard-working sons of toil(285) who live in our midst have determined to prospect on a more expensive and extensive scale than has been attempted hitherto. (286)

The failure of many quartz mining companies during the post-rush phase had induced many prospective capitalists to watch carefully for mines opened out by working miner/shareholders. Such an example was the Perseverance Company, successfully opened with the care for detail universally applied in such private concerns, supported by miner/shareholders:-

It is in instances such as this that capitalists might safely invest their funds, as it is self-evident that when men of limited capital expend it and their time in a work of this nature, they must have a pretty good idea it will turn out right in the end. (287)

This mode of operation, adopted increasingly as quartz miners shunned the reckless mismanagement and attend-

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(285) 'Sons of toil' was a colloquial term for gold miners, in particular those who worked below ground.

(286) C.A. September 2, 1879, p.7.

(287) C.A. May 7, 1878, p.6.
ant insecurity of employment in absentee-shareholder companies, gained popularity on the Cromwell reefs following Ulrich's visit. Self management and co-operative mining was regarded as the only satisfactory method of attaining a secure and permanent industry, where invested capital and labour could be carefully expended to the greatest advantage. (288) Only the productivity of the reef and the accumulated capital backing, limited the security of the concern.

In many cases, the reefs became auriferously extinct only a few feet beneath the ground surface, and the capital assets of many public and private miner/shareholder companies were meagre or non-liquid, but this failed to detract from the formation of these small shareholder-participant companies. The geographical pattern of reef workings mushroomed once again over every known reef line in both mining areas. Small companies, no longer restricted to 'favoured' lines of reef and to particular modes of mine exploitation by dictatorial absentee shareholders, sited themselves to re-work, in their own way, abandoned workings, and to open out claims along isolated and virgin reef lines.

Foreign and local capital: investment misapprehension and decline

Apart from the duration of the three main rush phases on the Cromwell reefs, indicated in Figure VI, capital investment in the reefing regions was predominantly slow and wary. The lack of investment was held as being the principal factor inhibiting the permanent and remunerative

(288) O.W. March 30, 1878, p.4.
From the main street of Welshtown, the Dunstan Range rises upwards of 4,000 feet. The major Cromwell quartz reef was traced for almost a mile up the spur on the left of the plate. Evidence of the many quartz claim prospecting sites is very clear along the spur.
industry, considered to be the future of quartz mining.

Foremost among the contemporary complaints were the excessive demands for financial returns by the shareholders. The necessarily slow and tedious nature of exploiting a quartz reef was infrequently recognised by many shareholders, every available crushing return being required for recycling into the shareholder's pocket rather than into the company.

The other shortcoming related to company formation, was the action of floating companies, with the view of merely selling scrip at high prices, often retarding the genuine work at the company mine. (289) This tended to lead to insecure company employment, and gave rise to the later co-operative movement of working miner/shareholders. Miner attitude to the large company was abundantly clear: '... the true digger having a strong repugnance to companies, which he looks on - and very often with truth - as only humbug.' (290)

The quartz mining population frequently (and unjustly) regarded Dunedin capitalists as being the main instigators of the disillusionment over company workings. It was indeed true that repeated and unrewarded calls of finance would soon wind up even the most promising of mining ventures. However, Dunedin shareholders were assumed (by the local mining population) to constitute the bulk of Cromwell reef non-mining class shareholders. This assertion was totally unfounded, for of all the registered quartz mining companies

(290) O.W. April 12, 1879, p.8.
in the Cromwell reef region, only 31% of the original capital subscribed for, was in shares outside the Dunstan Mining District. (Refer Table XII). In consequence, a large proportion of the withheld capital which created so much disappointment in the industry, was of local genesis. This contemporary misconception failed however, to alter the declining faith in the company mode of operation.

The failure of the Bendigo Deep Level Company, a public company of local origin, and widely subscribed to in 1874, further depressed public faith in the role of the large company in reef exploitation. This company, all 40,000 shares (5/- each) of which were taken up on the first day of issue, obtained an especially large lease of 56 acres, and planned to drive a low level adit into the Dunstan Range, thus cutting through all the known quartz reefs at Bendigo. (291) The good faith of the Company's promoters was called in question early in the company-formation process, as the Cromwell shareholders were accused by Dunedin businessmen of allocating all the shares among themselves, because the claim had prospects of turning out successfully. (292) Within four years the Company had collapsed, having expended at least £6,000 in labour costs alone, with no dividends returned.

Few companies were sufficiently well endowed with quality of workmen and quantity of capital to pursue the steadiness of enterprise expected from quartz mining. The notable exceptions included the Cromwell Company, the Heart

(291) C.A. May 12, 1875, p.5.
(292) O.D.T. November 25, 1874, p.4.
of Oak Company, the Star of the East Company and the
Elizabeth Company - but few of the scores of quartz mining
partnerships inaugurated on the Cromwell reefs. Although
these companies had all collapsed by 1884, the physical and
auriferous characteristics of the respective reefs, allied
with a universal disillusionment with quartz mining, had
been the determinant causes of abandonment.

Companies were still being formed in the early 1880s,
on the dubious premise of single and slender 'bonanza' veins
of quartz. The Come in Time Company was hastily floated
at Bendigo in 1880, the party of local working shareholders
purchasing a ten stamp battery, and employing an additional
eight men to stope out quartz. (293) The crushings during
the Company's short existence yielded an average of 0.51
ounces of gold per ton. Although the neighbouring Cromwell
Company was frequently operating profitably on a similar
return, the Come in Time Company had budgeted on a higher
average return of gold. The shareholders grew dissatisfied,
and within a year, the Company mine was abandoned as a
failure.

These latter attempts at permanent company formation
heralded the decline in any investment spirit. Dunedin
capital had ceased to flow into the Cromwell quartz reefs
in 1876, when the Carlisle and Caledonian Quartz Mining
Company had been formed to work a Bendigo line of reef.
By the end of the decade, even local capital was either
exhausted, or particularly wary of quartz mining investment
prospects. Only the working miner/shareholders, with

(293) C.A. October 5, 1880, p.5.
dwindling assets, and the consequent lack of large scale operation, remained to attempt to preserve the last vestiges of the failing industry.

Hope deferred had succeeded in rendering the investment heart sick. The impetus of the legendary permanence accredited to quartz mining, had died in the disillusionment and attendant national depression of the early 1880s. Export prices had fallen with a devastating effect upon farmers' incomes, lowering the national standard of living, and in turn, paralysing investment enthusiasm.

Of the future trends in quartz mining investment and industry, a New Zealand scholar reflected in 1885:—

What the people can do to legitimately aid the developing gold mining is to abstain from wild speculation, to look for returns from the mine itself and not from market 'spurts'; ... to remember that none of the famous mines were ever worth the highest price their shares have reached, that with ordinary prudence, gold mining will pay, and that losses need be comparatively small; ...(295)

The advice was sound, but belated. It portrayed, in part, the sources of decline evident in the Cromwell reef investment sphere. The large scale investment in the Cromwell reef area had, in the early 1880s, irrevocably expired in unprecedented local embarrassment. Irresponsible enthusiasm, company mismanagement, unjustified accusations and the relentless seeking of scapegoats, had all attended


the investment trend throughout, continuing until its final demise. With it, or perhaps because of it, collapsed the long-cultured credibility of the quartz industry.
Chapter 6

ENVIRONMENTAL CONSTRAINTS AND THE ROLE OF RETARDING RESPONSES TO THE LOCAL ENVIRONMENT

It is said that Victoria only wants fenced in. This island wants hammering out flat. [of Otago goldfields] (296)

... the prospector must have an eye for colour, ... and the colour must not be in his eye, for if he be green from lack of experience, he will fail. Nor must the shades of pink or of blue be present to excess in his perspective, for too much optimism may blind his discernment, as too much pessimism may darken his vision. He must have a clear eye to see things as they are ...

T.A. Rickard (297)

The significant transformation in public attitude to the upland reef regions, before and after the reef discoveries, has been approximated and documented where possible, during Chapters 2 and 3. The importance of analysing this change was in order to attain a greater comprehension of the expectations held of the auriferous reef regions, by the past population. In turn, it was necessary to briefly examine the roles played in the quartz reefs' development by the various mining, business/service and capitalist classes.

Bearing the relative import of these approximations in mind, it is now essential to consider both the intrinsic and direct effects on the quartz mining industry, of firstly, the actual physical and social environment, and secondly, some of the discernable contemporary responses derived from


(297) Rickard, T.A. The Romance of Mining, 1945, p. 22.
past attitudes to these environments.

The current study is essentially concerned with analysing the rise and subsequent decline of a mining industry and associated settlement. Consequently, it is of great practical relevance to place particular emphasis on the malevolent environmental influences affecting the industry, and the retarding influence of selected contemporary responses to that perceived milieu.

The financial investment required to establish and operate a quartz mine, self-sufficient with crushing machinery, water race supplies, dray road access and regularly staffed with experienced labour, during the 1870s, was of no mean magnitude. It was furthermore expected that when such an infrastructure had been instituted, it would provide a sound basis for continuous and productive operation.

This presumption was later manifested in the fact that at various periods in their operating life, all of the Cromwell reef area crushing batteries were set continuously in motion, being tended 24 hours each day. The battery of the Cromwell Company, for example, was pounding quartz for a number of months in 1871, continuously from Monday 1 a.m. until Saturday 11 p.m. (298) The ensuing summer witnessed the total closure of crushing operations for various intermittent periods, due to the lack of water. Men were discharged and re-employed as they became required, disrupting faith in the security of reef and large company employment.

On the Carrick Range, the problem of summer drought was partly alleviated through the use of steam engine power to

(298) O.W. June 24, 1871, p.11.
drive the batteries. The extra cost involved in the engine, and special recirculatory systems to conserve water for the boilers, compounded with the high cost of coal and cartage to the machines were, paradoxically, considered essential to the economic exploitation of the Carrick mines.

The compounding problems associated with this attitude were illustrated in the fact that the auriferous content of the quartz required to be of a higher order (at least over one ounce per ton) to be an economic proposition. A further problem was that winter months generally closed operations at the boilers and crushing machines in any case. A report from the Heart of Oak Company in 1872, remarked with a melancholic sobriety:-

The Oak battery, situated 2,400 feet above the sea, is now frozen up - in fact, so frozen, that the gold from the last crushing remains on the tables, and in the stamp boxes, unable to be cleaned up. (299)

Heavy snowfalls did not affect underground work, but the stockpiling of quartz and mullock in such conditions became a burdensome task, lowering labour morale as workmen were dismissed because of the lack of work. In 1879, for example, the Cromwell Company was the only company able to continue stopping out operations in the snow, Logantown having been under ice and snow for over ten weeks. (300) During the previous winter, the Star and Oak battery was


(300) C.A. August 5, 1879, p.6.
149.

completely snowed in for several months. In September, the machine house was choked with four feet of snow, quartz could not be got down to the mill, nor coal up from the Bannockburn coal pits. (301)

Although the seasons did not vary excessively in severity, the winters of 1870 and 1871 were recognised as inordinately mild. These same years were also those embracing the establishment of the quartz mining industry in both the Bendigo and Carrick regions. It is not imprudent to suggest, therefore, that during initial experience with the Cromwell reefs' climatic regime at this time, an incomplete comprehension was formed, of the local upland climate. The resultant perceptive naivety was subsequently displayed in the haste to erect machinery and dwellings in areas of adverse climatic extreme.

Water availability, both as motive power and processing aid in washing the ripple tables below the crushing machines, was recognised as of paramount importance early in the reefing industry's establishment. Yet the limitation in supply of water was also recognised as being rigidly dictated by winter snowfall and infrequent summer rainstorms.

As early as April 1870, a deputation from the Cromwell township and reefs visited the Superintendent of Otago, in order to request a loan for permanent water supply construction. The deputation was adamant in its expectations of the future prosperity of the reefs:—

He had no hesitation in stating that if a sufficient supply of water were obtained,

(301) C.A. September 3, 1878, p.5.
the results arising from an increase in the number of the population and in the gold returns would more than equal the most prosperous days of the old Dunstan ... His conviction was that quite 5,000 or 6,000 miners could find profitable employment in the Bendigo Gully district for twenty, and perhaps fifty years to come. (302)

The deputation, in spite of such unabashed optimism, failed to obtain any share of the £100,000 earmarked by the General Assembly for goldfields' water supply.

The individual companies had recourse only to their own resources and engineering ingenuity, for their necessary water services. A great deal of expensive labour was consequently expended on such work, and in addition, a continuous labour complement was required to maintain water races, dams and fluming.

These small scale water supply systems were often subject to dispute over rights to water and to race access routes. Furthermore, the engineering expertise was frequently lacking, especially in the precipitous reef regions:

The dam lately constructed by Goodger and party seems to be remarkably faulty, and an immense quantity of water is daily lost by percolation, to the great detriment of the tunnellers below it. (303)

The direct physical effects on the quartz mining operations of a lack of water, were omnipresent in scope, but of equally disastrous consequence were the erratic and heavy rainstorms in the range uplands. A goldfields'
correspondent gravely indicated the nature of this problem during the long summer upland drought:—

A heavy fall of rain at the present time would cause immense damage ... owing to the ground being so parched and baked, that the water would be unable to penetrate the soil, would run along the steep sides of the ranges, carrying everything before it in the shape of dams, fluming and water races. It must be understood that we are not drawing upon our imagination, but simply applying former experience. (304)

Effects of the shortage (and infrequent excess) of water supply, the lifeblood of the quartz mining industry, tended to transcend the scope of purely physical limitations. The Otago Witness remarked in 1873, (305) that water scarcity and floods depressed the gold escort values, which in turn inhibited commercial operations in the reef and service townships. Credit extension and debt invariably increased as a result, dampening the investment spirit of the business community and disillusioning the quartz mining fraternity.

The high elevation of the ranges, and, in the case of the Dunstan Range, westerly aspect, were uncompromising and formidable constraints in their interception of adverse weather conditions. Of the Carrick reefs area, a quartz miner wrote in 1871:—

The forenoon may be as calm as the Agean sea ... while p.m. has wind enough to blow the hair off a man's head and congeal the marrow in his bones. It rains, hails snows respectively ... if a man wants anything novel in the way of climate, recommend him to come here. He can be accommodated during the week to a long variety; (306)

(304) O.W. March 2, 1872, p.2.
(305) O.W. June 28, 1873, p.16.
(306) D.T. December 8, 1871, p.2.
The changeability of the weather frustrated attempts at work planning, but fostered an urgency in all operations, in taking advantage of any combinations of favourable water supply and weather conditions. However, the labour force often revealed a wary and outrightly sceptical view of quartz mining employment; the opportunities offered literally changing with the whim of the weather.

The lack of mining activity resulting from the climatic extremes of the upland ranges created a dearth of employment for mining labour, and a population drift away from the reefs area due to the lack of alternative work. Implications of both the direct and indirect influence of climate were thus far-reaching.

Contemporary comprehension of climatic effects were clearly incomplete, and lacked the dimension of anticipation. The injudicious siting of the heavy and expensive crushing machinery high upon the ranges (307) and the establishment of townships at similar altitudes were but two examples of the underestimation of climatic severity.

The principal constraint imposed by the physical isolation and ruggedness of the reef country terrain was in the form of access for such vital quartz mining components as fuel and working materials. Although the Otago uplands were not encumbered with the dense forests of the West Coast, the precipitous terrain rendered road formation difficult.

All of the access roads to the Cromwell reef claims (307) Apart from the sitings of the Cromwell Company and the Royal Standard Company batteries.
were of private company origin, few subsidies being received, even for the publicly used roads to Logantown and Carricktown. The Cromwell Company and the Royal Standard Company formed the dray roads to these localities respectively, in order to provide the means of bringing down their quartz for crushing. Only after continuous pressure on the provincial government was the subsidy of half the £662 expended on these roads refunded to the companies. (308) The reefs area roads required heavy maintenance expenditure, due to their steep nature, their susceptibility to washouts, and the heavy traffic of quartz and coal-laden drays which relentlessly plied upon them.

Parcels of trial quartz from prospective reefs were frequently several weeks in being conveyed to a battery for test crushings. In some cases, iron tramways were incorporated as being safer and more efficient because of decreased maintenance costs. (309) Wire ropeways had to be used to ferry the quartz loads across deep gullies, (310) while on some claims, payable auriferous quartz lay abandoned due to the inaccessibility of the batteries from the mine.

Regardless of the various companies' economic resources, labour had to be expended in roadwork formation, upgrading tracks to accommodate the four and six horse dray teams:

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(308) Votes and Proceedings, Otago Provincial Council, Session XXX, 1872, pp.94-5.

(309) For example, the Star of the East, the Alta, and Colclough Companies all made use of tramways.

(310) For example, at Aurora Gully, on the Bendigo reefs.
The Cromwell Quartz Mining Company’s buildings at the main shaft, near Logantown. The crushing machinery and steam boiler were housed in the buildings to the left. The large mound of quartz and mullock tailings is one of the many which litter the Cromwell reef area.
All that remains of the Cromwell’s Company’s crushing machinery site and main mine shaft near Logantown are the battery foundations and the 300 foot deep vertical shaft (foreground). The schist outcrops heavily disguise the numerous mine tailings sites, visible in the background.
... until our batteries are connected by good roads with our quartz mines, which at present the majority are not, Bendigo will never come up to the position which its resources warrant. (311)

The access problem contributed to the unwitting establishment of quartz crushing batteries high on the reefs themselves, with the object of eclipsing the cartage necessity. On the Carrick Range, in particular, this was important due to the distance involved from the mines to the base of the range, but the lack of water power necessitated steam engines, subsequently requiring local cartage. The lack of foresight evinced by this action has been referred to, but was certainly precipitated in part, by the road and transport problems.

Road access from Cromwell to the reefing regions became one of the major scapegoats standing for the lack of quartz mining prosperity in later years. The road from Logantown to Welshtown was simply 'the hills in their primevil condition,' (312) and accidents on this road became more frequent with increased use.

Local agitation for road upgrading reached feverish proportions in 1871, when a fire in a Bendigo general store burnt many provisions owned by Logantown and Welshtown residents, who had been unable to convey them up the range to their homes, due to the state of the roads. (313)

In spite of continual public reaction over roads and

(311) C.A. October 13, 1875, p.6.
(312) C.A. April 29, 1879, p.7.
related taxes, the access facilities to the reefs, and from reef claims to batteries, were largely privately financed, privately maintained, and deteriorated through private company use.

The price of fuel was high, including both coal for the crushing machine boilers and wood for domestic cooking in the treeless upland residential areas. The cartage charges were a direct function of the state of the roads – their distance from the fuel supply, and their degree of vertical gain.

At Bendigo in 1880, for example, when the Cromwell Company was operating a large steam powered fifteen stamper battery, and the residential population on the reefs was enumerated at 110, (314) coal could be purchased at a coal pit near Bannockburn for 12/- per ton. In Cromwell the price was £1 per ton, and delivered on the reefs at Bendigo, £4.10 was asked and paid for the same ton of coal. (315) Eleven pounds were parted for a bullock load of firewood on the Bendigo reefs. (316)

Steam engines were established on the Carrick Range upland area, principally as a response to the abundant coal measures on the Bannockburn flank of the range. The cartage costs were still extremely high. In 1871 the two crushing batteries near Carricktown, the Star and Oak, and the Elizabeth machines, were consuming 25 tons of coal each week, the cartage cost alone exceeding £1,000 each year. (317)

(314) New Zealand Census of Population, 1881, p.54.
(315) C.A. June 29, 1880, p.4.
(316) C.A. April 3, 1877, p.6.
(317) ibid.
The heart of the Carrick Range quartz reefing the area. The series of tailings heaps issue principally from the shafts of the Heart of Oak and the Star of the East mines. The crushing battery and service buildings were formerly sited to the immediate right of the vehicle. The line of rocks in the right foreground supported the Star of the East tramline, which ran through rugged country for almost half a mile.
The crushing battery and revolving amalgamating barrel (refer Appendix A) of the Young Australian Quartz Mining Company, near the top of the Carrick Range. The stamper rods and box are clearly visible. The drive pulley to the left was connected by belt to a large 30 foot water wheel driven by the Carrick Range Water Supply Company Race.
Illustrating the variable climatic characteristics of the Cromwell reefing areas, these two photographs present the same area of rangeland near the top of the Carrick Range, but in different seasons. The quartz mines of the Elizabeth, Heart of Oak and Star of the East companies, continued to operate in this area under heavy snowfall conditions.
An ambitious project was proposed which sought to erect a three mile long wire tramway, gaining 1,500 vertical feet to Carricktown, in order to facilitate the transport of coal and wood supplies. The alternative, recognising a degree of folly in erecting the crushing machines so far from coal supplies, was to site the machines at the base of the range, after the Royal Standard Company's example at Quartzville, and dispatch the auriferous quartz down long shoots to the battery hoppers. (318)

The physical obstacles were not the only constraints upon the material access to the reefs. Both reef regions were burdened with toll fees; the Carrick reefs with the Bannockburn Ferry, and later, the Bannockburn Bridge, and the Bendigo field with the ferries at Wakefield. Although the Bannockburn Bridge was eventually purchased by the Vincent County Council and the tolls abolished, the Bendigo area was always subjected to prejudices and additional costs through the ferry toll barrier.

Small domestic provisions became major items of expenditure. A four pound loaf of bread which sold in Dunedin for fivepence, was selling in Bendigo (which boasted a prominent bakery) for fifteen pence in 1878. (319) The principal object of blame for many of these minor, and the more substantial, ailments of the reefing industry, was the ferry at Wakefield, which was regarded as the reason people only visited Bendigo out of 'absolute necessity.' (320)

(318) D.T. December 15, 1871, p.2.
(319) C.A. March 26, 1878, p.6.
(320) C.A. April 2, 1878, p.2.
Working materials for the mines, the main items being machinery and mining timber for props, experienced compounded cost through access difficulties. Machinery came from Melbourne, Dunedin, and various abandoned quartz mining sites throughout Otago. Mining timber was, in the early years, cut from the forests at the head of Lake Wanaka, and floated down the lake and the Clutha River in rafts. One of the problems with this latter mode of transport, which cut cartage costs considerably, was that the logs required four months to dry before they were of sufficient buoyancy to float effectively. As a result, timber was often required to be carted, at enormous cost, from Dunedin. (321)

As a corollary to this financial burden, props were frequently economised, re-employed and even dispensed with altogether. The lie of the reef country was of a beneficial high dip formation, and of very hard quartz at Bendigo, rendering the supporting of the workings very cheap and simple. (322) However, in many claims, especially at Carrick, the stone was soft and friable, requiring secure props and supports. (323)

In 1873, a serious cave-in accident in the Elizabeth Company mine called attention to the ill effects of economising on timber supports:-

... very few props are used - perhaps too few - as may be found when more quartz

(321) C.A. August 27, 1878, p.4.


is taken out at deep levels.

Too much care cannot be taken to support ground by filling up and the use of props and caps. Miners often get too fool-hardy in their confidence of the firmness of the ground, particularly in places like the Carrick and Bendigo, where timber becomes a large item in the expense, and dispense with support ... Often the danger is seen by the workmen, but fearful of their services being dispensed with if they make any remark, they remain silent. (324)

The physical impediments weilded by the rangeland offered a continual challenge to the successful pursuit of quartz mining. Its constraints upon the industry, frequently complemented by imprudent action and misinterpretation of the environment reality by the quartz mining community, were of a harshly direct and ubiquitous nature. These, along with the erratic capital investment, the uncertain reef productivity and the technical inadequacies in the understanding of reef exploitation, were the primary and indeed the obvious, constraints.

Reef characteristics and technological constraints

The Cromwell reef character, outlined in Appendix A, constituted a unique and diversified set of lode formations. Of the Central Otago reef region in general, Park stated:-

Gold bearing quartz is found in this district - a. in the form of lodes that occupy great fault fractures, b. as small veins or leaders traversing the microschist, and c. as laminated quartz in the schist. (325)


All these structural forms were evident within the Cromwell reef area, each requiring particular technological approach methods in extracting the auriferous quartz content.

While it is acknowledged that the quartz mining industry in the Cromwell reef area was the largest such field in Otago, it should also be recognised that the field assumed a pioneering role. The technical knowledge from Australia, California and Coromandel, regarding reefing activities, accumulated only gradually, and principally during the 1870s and 1880s. Although the quartz mining fraternity frequently requested the Otago Provincial Council and the Central Government to supply expert opinion on the most desirable means of opening up the reefs, such information was limited through official hesitation and lethargy.

In the prospecting phase of exploitation, an imprudent haste besought many prospective quartz mining operations. With the hindsight of many years of reefing fortune and folly during the initial reef rushes, the Handbook of New Zealand Mines published in 1887 the following on the subject of new reef discoveries:

... the prospector must guard against being over-sanguine, and ought to carefully consider the probable cost of working the mine, and the surrounding facilities. Before he begins to build castles in the air he should take out about 50 to 60 tons, from different parts of the lode, and have the parcels crushed separately, taking care not to deceive himself by sending

(326) O.W. April 2, 1870, p.10. (In a deputation from the Cromwell reefs area to the Superintendent of Otago Province).
This plate illustrates a narrow quartz reef, striking almost vertically, as was characteristic of the Bendigo area reefs. The photo looks down a shaft, from which adits have been driven off only a matter of 15 feet below the surface, in order to extract quartz from this reef. A problem with the Cromwell quartz reefs, the varying width of the lode, is clearly evident.
out only the best stone ... and rejecting the, in his opinion, poorer stone;

Ample evidence of the transcending of this vital step in setting up quartz claims abounded on both the Carrick and Bendigo fields. The Bendigo reefs became particularly notorious for the establishment of companies on claims which had been denied even as little as one trial crushing. The sight of auriferous stone after the cursory collecting of surface samples, was often sufficient to whet the investment appetite.

Systematic surveys of the reefs were not undertaken by official geological parties until the visit of G.H.F. Ulrich, a Victorian geologist, in 1875. Hector had indicated the sagacity of such a step as early as 1869, but the clamour for reef claim titles during the quartz rushes swiftly preceded any extensive geological or mineralogical testing.

This retarding phenomenon was not peculiar to the Cromwell reefs - most New Zealand quartz reef fields exhibited the consequences of unsystematic prospecting. As early as 1868, a Government geologist, referring to the quartz rushes at Thames remarked:--

As might be expected, when so many of the miners knew little or nothing about mining, the starting and working of most of the claims has been very unsystematic. In very few indeed has the ground been


properly explored, and some companies are leasing the land and putting up machinery previous to exploration. (329)

The intrinsic physical nature of the quartz reefs themselves, was perceived by the contemporary mining population in a fashion which restricted the genuine development of the actual reefs, and rendered the quartz mining investment climate very wary of the reputed auriferous content of quartz. It was commonly believed within Otago mining circles during the mid 1870s, that as quartz was accepted as constituting the matrix of gold, then all quartz must contain payable auriferous content. Ulrich, in his 1875 visit, noticed this latter misconception and remarked that it had '... led to their being erroneously mistaken for true reefs or leaders; and a considerable amount of money and labour has been wasted in their exploration.' (330)

The reefs themselves tended to deceive the quartz mining prospectors. Samples of quartz rich in gold content were the foundation of many quartz mining partnerships. Surface reef samples, broken from outcrops of the lode, were frequently crushed by hand, the gold content measured, related to the original weight of the quartz sample, and converted to a prospective rate per ton. On the strength of such dubious 'proof' of a claim's worth, several quartz claims gained financial backing.

It was not until the 1880s, when the declining output of gold from quartz mining (refer Table XIII) had induced retrospective examinations of the chequered development of the industry, that it became recognised that the richest portions of auriferous quartz reefs were the outcrops and superficial feet of the reef line.

Countless quartz mining partnerships, formed on the strength of such superficial samples, collapsed due to the rapid impoverishment of the reef at depth. Trial crushings, which were by no means always executed, fell short of true gold content indications in many cases, as the quartz sample parcel was usually taken from the few surface feet of the reef. Most exploratory shafts seldom exceeded twenty feet, this depth being sufficient to stope out enough quartz for a sizeable trial crushing. (331)

As the number of quartz companies failing on the Cromwell reefs increased during the latter 1870s (refer Figure VI), and the gold yield declined, shareholders and miners alike, disagreed on the question of reef working method. The Cromwell reefs in 1877, were considered as 'imperfectly understood.' (332) Warden Simpson, in his annual report in 1878, aggravated this disputed topic by chiding the mining fraternity:-

The quartz mining in this district has rather retrograded during the year and will, I think, continue to do so until

(331) Thirteen cubic feet of quartz approximates one ton. (Cox, S.H. Prospecting for Minerals, 1912, p.229).

(332) O.W. November 17, 1877, p.3.
TABLE XIII

OFFICIAL GOLD ESCORT RETURNS
QUARTZ AND ALLUVIAL COMPONENTS (ozs.)
1873-84

OTAGO DUNSTAN MINING DISTRICT

<table>
<thead>
<tr>
<th></th>
<th>Quartz</th>
<th>Alluvial</th>
<th>Quartz</th>
<th>Alluvial</th>
</tr>
</thead>
<tbody>
<tr>
<td>1873</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>1874</td>
<td>14,744</td>
<td>118,715</td>
<td>12,733</td>
<td>35,598</td>
</tr>
<tr>
<td>1875</td>
<td>*</td>
<td>*</td>
<td>14,000</td>
<td>29,823</td>
</tr>
<tr>
<td>1876</td>
<td>*</td>
<td>*</td>
<td>11,889</td>
<td>33,547</td>
</tr>
<tr>
<td>1877</td>
<td>*</td>
<td>*</td>
<td>5,179</td>
<td>29,633</td>
</tr>
<tr>
<td>1878</td>
<td>*</td>
<td>*</td>
<td>4,066</td>
<td>35,018</td>
</tr>
<tr>
<td>1879</td>
<td>4,752</td>
<td>100,251</td>
<td>3,814</td>
<td>28,200</td>
</tr>
<tr>
<td>1880</td>
<td>9,374</td>
<td>98,117</td>
<td>4,197</td>
<td>33,257</td>
</tr>
<tr>
<td>1881</td>
<td>7,097</td>
<td>*</td>
<td>3,602</td>
<td>25,973</td>
</tr>
<tr>
<td>1882</td>
<td>7,042</td>
<td>*</td>
<td>2,535</td>
<td>*</td>
</tr>
<tr>
<td>1883</td>
<td>7,396</td>
<td>*</td>
<td>2,400</td>
<td>*</td>
</tr>
<tr>
<td>1884</td>
<td>5,473</td>
<td>*</td>
<td>850</td>
<td>*</td>
</tr>
</tbody>
</table>

(1) This figure comprises the Cromwell quartz reef area component.

* Figures unavailable or unrecorded.

Source: A.J.H.R. 1873-85
the miners direct their energy to prospect for the main reefs on the tops of the ranges, instead of the slopes and spurs of these ranges, with which they have been satisfied at present. (333)

Whether this consideration was valid or not was largely auxiliary to the point that the reason why quartz reefs on the lower flanks of the ranges had been pursued was due to the less severe climate, and the consequent greater number of possible working months. Quartz reefs had been discovered on the crown of both the Dunstan and Carrick Ranges, but were only spasmodically prospected, or very small concerns, reflecting the inability to attract labour to work at such extreme altitude (upwards of 4,000 feet).

A fundamental limitation in extracting the auriferous content of the reefs, especially on the Carrick field, was the chemical content of the quartz itself, the high impurity level inhibiting the liberation of the gold. The phenomenon also explained the auriferous richness of the surface lamina of the reefs, but was not widely understood until the latter 1880s:-

... the ore near the surface becomes oxidised, and the gold is almost invariably in a free state, and therefore easily extracted from the stone. Wherever this metal is found in a free state, a large percentage of it can be saved by the ordinary process of crushing and extraction now adopted; but as the lodes go down some of them contain a large percentage of sulphur and arsenic ... the action of which on quicksilver is such that it sickens the

Example of surface stopping out of quartz along a Carrick Range reef line. The surface extraction, which often yielded very rich quartz, was followed in this instance for over 200 yards. The soft and friable nature of the rock is clearly visible.
The winding and pumping gear erected in the early 1880s over the Cromwell Company’s main shaft. The elevated tramline to discharge waste rock, is at left centre.
The Caledonian Quartz Mining Company's buildings on the Carrick Range, with the entrance to the Company's mine at right centre. Pipelines indicate the reliance on sophisticated water supply systems. The difficulty of forming dray roads and tramlines on this steep terrain is widely evident.
mercury, and causes it to lose its affinity for gold. (334)

This chemical action rendered the ordinary gold-saving apparatus used at that time - the mercury amalgamating barrel - ineffective in saving a large proportion of the gold. (Refer Appendix A).

Certain companies, especially the larger Carrick Range companies which had invested heavy finance in sinking and driving operations, such as the Crown and Cross Company, attempted to roast the quartz on fires before crushing, in an effort to burn out the impurities. (335) The process was of doubtful value, and many companies affected by the impurity problem (only encountered at depth below the water table, where the quartz had not yet become oxidised), were forced to abandon their workings. (336) In his inspection of the Carrick and Bendigo reef goldfields in 1875, Ulrich considered that in claims so affected by quartz impurities, only one third of the gold was being saved. (337)

Flooding of the mines, was in part, allied to the problem of sulphur and arsenical pyrites in the quartz. The mines were frequently flooded on the Carrick reefs, especially when the mines attained depths of over a hundred feet, and in the vicinity of Carricktown. Due to the propensity to use vertical shafts for the testing and stoping out of the quartz, the flooded shaft had no water outlet (compared

(335) C.A. March 9, 1880, p.6.
(336) C.A. September 2, 1879, p.7.
(337) O.W. March 27, 1875, p.11.
to mines using adit-driving methods). Expensive pumping
machinery had to be employed, the shaft abandoned, or else
the mine had to close and wait for the water table to drop
during the summer months.

Quartz taken from below formerly-flooded levels was
frequently heavily contaminated with impurities, rendering
the further sinking and stoping out of the mine at depth
uneconomical. Both of the largest Carrick Range companies,
the Heart of Oak and the Star of the East, were affected
by flooding during the latter 1870s, the problem contributing
to the selling out of the formerly rich Heart of Oak mine
in 1880." (338)

Durability of the quartz reef was a further retarding
factor in the successful development of the industry.
Although the Carrick reefs' country was generally of frac­
tured and easily mined quartz (refer Appendix A), not all
reefs exhibited this trend.

In 1875, contractors working on the drives in the
Perseverance Company mine on the Carrick Range, threatened
to abandon operations due to the hardness of the rock, unless
a better price was offered. (339) The reefs on the Bendigo
field were extremely hard, accounting in part, for the
early desertion of so many prospected mines. The ordinary
pick and blasting powder of the quartz miner were vital
elements in driving and sinking. The Lucknow Company
expended over £4,500 in tunnelling operations totalling

(338) C.A. March 9, 1880, p.6.
(339) C.A. October 16, 1875, p.17.
544 feet, through country of 'the very hardest description.' (340) The Bendigo Deep Level Company, in attempting a 1,000 feet drive, encountered extremely hard rock, which precipitated the eventual abandonment of the work. In this type of reef country, it was considered a good week's work when four feet was driven. (341)

Although dynamite was employed by the Cromwell Company in the late 1870s, the expense precluded its general use. Rock drilling equipment was suggested for use on the Bendigo field as early as 1875, but the machinery was considered either too expensive or unobtainable.

Extraction of the quartz, mullock and waste rock was by far the greatest single item of expenditure, even with the reduction in wages in the years 1870, 1876 and 1881. Profound social unrest was generated by company efforts to maintain economic viability by economising on extraction costs, although wage reductions and retrenchment policy effects will be later discussed. It is suffice to say here that there is every probability that, had all the auriferous reefs of Bendigo and Carrick been of the more friable and workable nature of many of the Carrick reefs, the industry, supported by intensive working in both regions, would have attained a greater degree of the desired long-evity.

(340) O.W. April 3, 1875, p.9.
(341) O.W. April 3, 1875, p.9.
Technological constraints through misconception of the actual characteristics of the Cromwell reefs and incomprehension of forces within the local physical environment, were evident in several aspects of the quartz mining industry.

Contemporary geological opinion regarding the auriferous quality of reefs at depth, vacillated with remarkable frequency. The Victorian quartz mines had proved themselves intermittently auriferous at depths of over 400 feet, which tended to colour the attitude of those miners acting in a managerial capacity upon the Cromwell reefs. (342)

When the auriferous content of a small leader failed, the tendency in the Cromwell reef situation was to pursue the leader, at great expense, on the presumption that its auriferous qualities would be rejuvenated at depth. This latter occurrence was seldom realised. The predominance of broken and irregular quartz reefs was widely evident, especially on the Carrickfield, and should have discouraged the pursuit of elusive quartz leaders. The inherent and pre-determined mining perception of this facet of reefing, failed to allow adequate adaptation of existing knowledge to the local environmental situation.

Influence from Californian quartz mining rushes found itself manifested in the notion of a 'mother lode' of quartz, from which all the reefs so far discovered were

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(342) Quartz miners with experience on the Victorian reefs were in demand by quartz mining companies. Companies endeavoured to employ such men on the strength of the successes of the Victorian quartz mines.
derived, was also evident in the Cromwell reefs. Described by May as 'the energising myth' which protracted failing quartz industries, (343) the concept was recognised in the local Cromwell reef community: - 'In a country like Bendigo, where quartz veins ... are to be met with every few feet on the surface, the inference is that a large and payable reef exists somewhere in the hill ...' (344)

The Bendigo Deep Level Company, designed to intercept all the known and unknown reefs within the Dunstan Range, was a direct derivative of this idea; to pursue the known quantity (the existing, discovered reefs), but with the additional incentive of the perchance discovery of a hitherto-unknown lode - the 'mother lode'. The extraordinary zeal with which all shares in this company were bought on the first evening of issue, (345) tangibly highlighted the popularity of the speculative spirit attending the scheme itself, and the concept of the 'mother lode'. No such lode was ever found, the company failing in 1877.

Flat and largely featureless plains dominated the Victorian quartz mining landscape in the 1860s, necessitating the use of the deep vertical shaft as the only practical means of extracting the quartz. The rangelands of Central Otago and the Cromwell reefs constituted the physical antithesis. Uniformity of aspect was unknown.

As all the Otago reefs were of vertical inclination, frequently following as backbones, the spurs of the ranges,

(343) May, P.R. On the Mother Lode, 1971, p.32.
(344) O.W. November 21, 1874, p.9.
(345) O.W. January 2, 1874, p.7.
the country was admirably suited to the use of adits. Adits were simply horizontal drives into the sides of spurs, in order to tap the main reef and develop subsequent lateral adits to extract the auriferous quartz. The economic desirability of this method, whereby tramways could be employed to facilitate the extraction of the quartz, is clearly evident, as opposed to the expense of the necessarily slow and arduous incorporation of winding gear set over vertical shafts.

An added advantage of the use of adits, reflected in the Lucknow and the Bendigo Deep Level Companies' workings, was the ease of draining the mines of excess water. The alleviation of this phenomenon called for the use of expensive pumping gear (which was installed only by the prosperous Cromwell Company on the Cromwell reefs), or abandonment of the workings.

The majority of mines on both the Bendigo and Carrick fields, instituted, from their inception, the expensive shaft extraction system. Although adit tunnel extraction and abundant cross-drives did exist, especially on the Carrick Range, the quartz mining fraternity appeared loath to employ this more expedient method. (346) Once again, the contemporary attitude, conditioned by the predominant use of shafts in Victoria, conflicted with the physical environment to contribute to unnecessary economic burden, loss and subsequent decline in the industry's existence.

Limitations through the physical character of the reef

In quartz mining, much progress has been made, after years of disappointment, through want of experience; this industry promises to become both permanent and profitable ... the days of wasted labour, coupled with a large expenditure are over - dearly bought experience has pretty clearly demonstrated where the golden stone lays, and we may safely opine that none but what is reasonably payable will for the future be brought up to the surface. (347)

To the local quartz miner or investor of a decade later, the report would have waxed as hollow as the last blow from a retired stamper battery.

The Role of Political Frustration

[The diggers]... had their demands to make, and in obtaining satisfaction, they made their inroads upon established institutions ... Materially they wanted police, roads and bridges - safe communications with the outside world - and the provincial governments hastened to provide them. (348)

On the local scale - that of the Cromwell quartz mining fields, the mining fraternity failed to secure the

(347) D.T. December 19, 1873, p.2.
'goldfields franchise' which Oliver (349) has attributed as being held by the goldrush communities. The 1870s witnessed declining gold returns and increased demands on the Otago Provincial Council for subsidies, loans and public works upon the goldfields. The quartz mining sector of the industry had yet to prove itself as being a worthy recipient of goldfields aid.

Trammelled by physical and technical constraints, and a restrictive leasing system, the quartz mining industry was largely shunned by provincial aid until the latter 1870s. By this time the depression engendered by disillusionment in the industry's future, negated to a great extent these official efforts at salvaging the declining gold output from quartz.

Of a political nature, three principal problems affected the quartz mining industry during the 1870s. Legislation concerning quartz claims and the entire operation of quartz extraction, proved to be both insufficient and inefficient during the inaugural phase of the quartz rushes. Modifications to local goldfields district rulings, and amendments to Provincial Regulations were enacted during the decade, but Wardens Courts (the local judiciary bodies with power to amend regulations) remained singularly occupied hearing quartz claim disputes for much of the portion of their time devoted to quartz mining.

The regulations concerning quartz claims prior to the Cromwell reef rushes, provided for quartz claims not exceeding 100 feet along the course of the reef and not

(349) ibid.
exceeding 100 feet on either side. (350) The legislation had been borrowed from Victorian law, but the geological nature of Otago reefs had not been sufficiently well recognised to provide for irregularities between the two areas.

In Victoria, the lodes were almost vertical, or ran at a small angle of inclination, whereas in Otago, the dip of the reefs frequently attained as much as 45 degrees of inclination. (351) The local quartz mining class recognised this misconception on the part of the legislature, and called for greater flexibility in the delineation of quartz claims, in order to cover the reef through its irregularities in dip, dislocations, and faults. (352) The call was endorsed by the Otago Mining Conference in 1872, which stated: '... the right should be given to follow such veins with all their dips, variations and angles, to any depth, although they may enter the land adjoining.' (353) The ground within the quartz claim was increased in 1871, to 150 feet on either side of the reef, but discontent reigned, although the Wardens Court continued its preoccupation with quartz claim and reef line demarcation disputes.

In 1873, the passing of the Goldfields Bill heralded the abandonment of the lineal measurement of quartz claims,

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(350) Regulations of the Otago Goldfields, s. III(i), Otago Provincial Government Gazette, Vol.XII, 1868, p.148.
(351) D.T. December 15, 1871, p.2.
(352) ibid.
(353) B.H. December 24, 1872, p.4.
substituting the old system with a standard goldmining lease of fifteen acres, (354) especially designed for the encouragement of company operation. The considerable expense attending the prospecting of quartz reefs had forced many of the individually-held claim areas into a dilatory state of stagnation. With the larger lease areas, and the consequently greater control afforded over the reef by a leaseholding company, the legislative intention revolved around encouraging company formation, in turn securing permanent employment for miners, and regular gold production. (355)

The expectant aura surrounding the quartz mining industry, especially within the local district, caused the successive Wardens to view this mining sector with leniency, especially with regard to protecting unworked leases and claims. Due to the high elevation of the reef country, and the impracticality of working the reefs all months of the year, the Court was not loath to grant protection for claims, for periods up to three months, on account of the 'inclemency of the weather.' (356) This obviated the otherwise statutory requirement that the claim be rendered void, and allowed open for selection by other miners.

The last in the series of benevolent gestures on the part of government attitude, was the reduction of the yearly rental for gold mining leases to one pound per acre, in 1878, although this measure was mainly an attempt to reduce

(354) O.W. July 19, 1873, p.6.
(355) C.A. August 11, 1874, p.6.
(356) C.A. June 29, 1870, p.4.
the burden of overheads on the many faltering quartz mining companies and partnerships in the Cromwell region. (357)

Statutory limitations remained, however. Some quartz mining groups considered that 'far larger areas should be granted on quartz reefs due to their poor quality and large blocks of poor mullock.' (358)

The mining lease legislation was also bitterly opposed by mining companies and indeed, openly flouted, in that the lease was required to support, within six months of registration, the employment of at least eight men along every ten acres of reef lease. (359) This law, also designed to promote employment, disregarded any consideration of the ability of a mining company to become sufficiently well developed to support employment. The arbitrary stipulations were regarded as discriminatory in that agriculturalists with many hundreds of acres could employ no one if they so desired, and were labelled 'injurious' (360) to the local quartz mining community.

Large scale non-adherence to these employment regulations was generally successful in that enforcement was seldom exercised, although the Warden held the right of lease forfeiture. Because of the local community interest in the industry, this was one significant case where the local law enforcement procedure ignored the open breach of statute, thus transcending the direct impact of this

(357) C.A. January 1, 1878, p.4.
(358) O.W. June 1, 1878, p.4.
(359) O.W. February 16, 1878, p.4.
(360) ibid.
particular political constraint.

A further political burden, although affecting the individual gold miner to a greater direct degree than the quartz mining company, was the special tax on gold sales, of 2/6 per ounce. At a time when the price of gold, in the Dunstan District, was £3.16.0. per ounce, the duty only became significant and objectionable when the cost of crushing quartz failed, or just succeeded in balancing with the auriferous return.

Agitation throughout New Zealand goldfields succeeded in securing a reduction of the Gold Duty to 2/- per ounce in 1872, and although the House of Representatives concurred in 1876 that the gold mining industry should have been relieved of the exceptional tax, it later decided to retain the tax, and abolish the rating of mining property.

Local agitation was intense throughout the decade:

... each man fails to see why he, as a miner, should be called upon to pay a special tax for permission to work at his own proper calling, any more than a ploughman, carpenter or shoemaker should be called upon to do so for working at his.

Official attitude was frequently found to harshly retard the miner's cause, through vehement condemnation of

(362) A.J.H.R., August 7, 1872, p.56.
(363) A.J.H.R., August 23, 1876, p.133.
(365) O.W. August 2, 1873, p.1.
the mining industry and indeed, the mining classes. From the Parliamentary Debates, the Cromwell Argus reported in 1876:-

Whitmore said the making of water races on goldfields was a waste of money. The country would have been more prosperous if gold had never been discovered. Captain Fraser said it was most unfortunate for the country that the Government was never strong enough to resist 'the horse-leech cry' of the miners. Mr Holms also objected to the miners having votes. He was in Otago when miners first came there, and they 'utterly revolutionised society' and 'put back the settlement of the country many years.' (366)

Constant petitioning of Parliament over the gold tax bore success in 1881, when the Gold Duties Abolition Bill was passed, ordering the cessation of the tax as from January 1st, 1883. (367) The move failed to have any significant effect on the Cromwell quartz industry, for the latter was by then, all but defunct. The additional tax of 3%, small though it may have appeared, constituted a further burden upon an industry attempting to satisfy shareholders, labour and management. The release of the tax after the demise of the industry, endowed nothing but a mocking shadow.

Government aid in the form of subsidies to quartz mining was tardy in coming forth, and, in the Cromwell reefs region, so late in appearing as to be of limited value. Early attempts at securing Provincial and Central Government aid in the form of loans for water supply to the

(366) C.A. October 17, 1876, p.4.
(367) A.J.H.R., August 11, 1881, p.203.
Bendigo reefs, in order to help with the establishment of crushing batteries when they were most required, were spirited, taking the shape of an official deputation to the Provincial Superintendent, on March 25, 1870. The discouraging sequel was that no government finance was ever expended on the extensive water supply systems later constructed by private companies, on the Bendigo reefs.

The first recorded public call for a government-sponsored practical mining survey of the Cromwell reefs area was in 1871:- '... it is incumbent on the State to foster and direct investigations and experiments for the general public good.' (368) The only official attention endowed upon the reefs until this time had been the mapping of claims and reefs on the Bendigo field in 1869. No government or private geologist had visited the area.

Following the failure of several heavily-financed companies, especially in the Bendigo area, greater agitation ensued over demands for authoritative opinion on the reefs themselves, and on the most expedient and remunerative means of exploiting them. The Otago Provincial Council negated a motion in 1873 for the sum of £1,000 to be set aside for the scientific ascertaining of the mineral wealth of the Province's quartz reefs. (369)

However, further increase in the number of local bankrupt and failed quartz mining companies, finally induced the Provincial Council to secure the services of a prominent

(368) D.T. December 15, 1871, p.2.
(369) Votes and Proceedings, Otago Provincial Council, Session XXXII, July 24, 1873, p.78.
Victorian geologist, G.H.F. Ulrich, to report on the Otago quartz fields in April 1875. The visit and subsequent report (370) undoubtedly boosted the interest and faith in the industry's future: 'Cromwell looks very lively, and there exists great confidence in the quartz reefs. Mr Ulrich's visit has given great satisfaction.' (371)

Despite this renewed interest, the industry had received severe setbacks in the form of investor reluctance, lack of adequate and cheap motive power for machinery, and excessive labour costs. (372) Political influence, in the form of Ulrich's geological survey, had encouraged the industry in the form of precipitating a further wave of intensive prospecting, (Refer Figure VI), but the interest waned rapidly as the constraints of inaccessibility, lack of water power, cost of transport and labour demands, persisted.

Roads to the quartz reefs were reluctantly subsidised only after the private companies who formed them, petitioned the Otago Provincial Council, although the maintenance of the main roads was later accepted by the Council as its responsibility. (373) The characteristic government policy throughout the 1870s regarding roading to quartz reef areas, was to leave the development to private enterprise until


(371) O.W. January 30, 1875, p.17.

(372) C.A. August 18, 1875, p.7.

(373) Votes and Proceedings, Otago Provincial Council, Session XXX, May 23, 1872, pp.94-5.
such time as the field or reef proved itself payably auriferous. (374)

Roads to Carricktown, the Nevis, and to Thomsons Saddle were left for development in this way. The policy retrograded company success, tending to drain mining companies of their financial resources, through the necessity of providing services such as road access and regular water supplies, before they could expend capital on the primary task of mine prospecting and development.

Water supply was largely undertaken in both the Cromwell quartz fields on the strength of private enterprise. The Carrick Range Water Supply Company expended all their available capital in constructing part of their seventeen mile race from Coal Creek (Figure II) to the northeastern face of the Carrick Range. The Central Government limited the application of water supply companies for financial subsidies, in that it required all such companies to be registered under a limited liability act. (375)

Central Government aid was slow, although the Carrick Water Supply Company, which was to supply all of the Carrick quartz reefs with water for crushing purposes, received a £5,000 subsidy in 1873, (376) under the Public Works and Immigration Act 1871. (377) The Company attempted to maintain its race for most of the 1870s - the first water on

(377) Part III, Subsidies for works for supplying water.
the Carrick Range flowing into the Young Australian battery-wheel in January 1875, (378) but after exhausting all its capital in heavy maintenance costs, the Provincial Government agreed to manage the race. Once again, the aid was too late to be of any value to the majority of quartz mining concerns on the Carrick.

Certain factions of the mining fraternity considered the government had failed in their duty, which was seen as solely to supply services. Of quartz mining, a correspondent to the Otago Witness observed in 1875:—

Success undoubtedly depends upon 3 circumstances - means, motive power and material. Give the miners reasonable facilities to prosecute their employment, and we shall soon hear less of importuning the Government for assistance. (379)

Repeatedly stifled by internal disputes, government aid and subsidising sources all failed to anticipate areas of potential quartz mining wealth in time to provide services. Aid always appeared reluctant, frugal and late. For the majority of quartz mines and their investors, government interest was too late, and money withheld for fear of wastage was, indeed, ironically wasted through the time expended in government dispute over this very question.

Political constraints exhibited themselves throughout the quartz mining phase of the study period, in the form of official and legislative frustrations. Ill-timed decisions, inadequate legislation through an equally ill-informed

(378) O.W. January 23, 1875, p.16.
(379) O.W. February 20, 1875, p.8.
legislative attitude concerning the local quartz reef area characteristics, and government lethargy, all combined to engender a feeling among the mining community that government was interested only in the gold duty tax. It is clear that such opinion was indisputably valid.

Limitations effected by social environment classes, and the problem of labour unrest

Central to all the attitudes and perceptions of the quartz mining industry and the mining environment, have been those of the actors - those people who, through various direct or indirect means, affected and in turn, were affected by, the vacillating prosperity of the industry.

It must be recognised that the entire fate of the industry was essentially guided by the perceptions and prejudices of this broad social sphere. All of the limitations and constraints discussed, have, in some fashion, become manifest within the attitudes to the reefing industry of the contemporary actors. This intrinsic focussing, however superficial, permitted the mining and non-mining communities to effect various pressures on the development of the industry. These pressures are visible in the varying fortunes of the Cromwell quartz mining industry. The most fundamental pressures from within the social structure and classes of the period, such as the role of the business community, the existing alluvial mining community, the shareholder and investment classes, and the miner/shareholder groups, have all been discussed at length.

Of central significance in the fluctuating fortunes of the reefing industry was the role played by the mining
labourer, being the catalytic means through which the industry operated. Consequently, the control over the industry's progress was determined to some extent by the willingness and competence of labour, and the wages paid and demanded.

The first years of quartz mining on the Cromwell reefs witnessed a great dearth of labour. The mining (especially quartz mining) interest had, by 1870, attained such a pitch that non-mining pursuits such as pastoralism and agriculture, were suffering badly for want of labour. Experienced quartz miners could command a wage of 13/- per day, working for any of the larger companies on the Bendigo reefs in 1870:

Great difficulty is experienced in obtaining men capable of performing the work required ... The wages offered are high, and the shifts are 8 hours.' (380)

Corresponding pay rates for contemporary quartz miners at the Thames goldfield barely averaged 6/- per day. (381)

An indication of the average labour costs to a larger company attempting to successfully open out a mine, erect machinery and satisfy shareholders, is afforded by the Colclough Company at Bendigo. Employing twenty regular and experienced quartz miners in 1871, (383) the company was presented with a weekly wage account of £72. In addition to this burden, machinery had to be paid for and erected,

(380) O.W. February 5, 1870, p.9.
(381) O.W. December 24, 1870, p.15.
(382) O.W. April 15, 1871, p.11.
(383) O.W. August 12, 1871, p.17.
working materials provided, a competent mine manager employed, and the routine expenses of mining company operation attended to.

The first outward signs of company dissent over the high labour costs were visible in 1871, when Bendigo reef area companies successfully co-operated in lowering the weekly wage for experienced quartz miners from £4 to £3.10 per week of six ten-hour shifts. Press reaction clearly illustrated the prejudice held by that medium:–

>This [reduction] we cannot but consider a move in the right direction, as by the exorbitant rate of wages hitherto paid, the quartz required to be very rich before those who sent capital in developing the reefs could hope to secure a fair return for their outlay. (384)

The ease with which wages employment could be obtained on the reefs during this early phase contributed directly to the rapid establishment of a few very heavily financed companies, to the detriment of the prospecting of smaller claims. The Dunstan Times complained in 1871, of payable ground lying idle and the wanting of:–

>... men with a little energy to develop it. The few men that are idle in the neighbourhood prefer to knock about listlessly waiting for a chance for wages instead of setting to work in a manly way on their own responsibility. (385)

In partial contrast, was the attitude that an increase in the number of co-operative quartz mining lease areas should be established. Disappointment over the poor results

(384) D.T. March 10, 1871, p.2.

(385) D.T. April 14, 1871, p.3.
of most of the Cromwell area quartz mining companies, and the inefficiency with which they were managed, prompted a local correspondent to remark:-

... we must adopt a better system of combined labour ... It is harder to manage a party of four to six Europeans than one of 50 Chinese. The days of everyone being his own master are over, and more complete schemes for co-operation and combined labour are indispensably necessary. (386)

The demands made on capital and the mining company from labour, in the form of high wages and unsystematic work methods, were clearly being heavily felt by the quartz mining companies.

The problem was compounded by stringent retrenchment measures by companies, in dispensing with any surplus labour. (387) Ill feeling between mining company and labour intensified, as labour was dismissed and rehired according to the economic position of the company. The famed 'permanence' of quartz mining employment became a myth which continued to delude the ever-sanguine press.

The Carrick Range mines collectively succeeded in reducing mining wages during 1874, in spite of a threatened strike by quartz miners, illustrating that the former command of employment and high wages by working miners, had vanished. The Dunstan District Warden noted that the attempt by miners to show mine proprietors that they (the latter) were dependent solely on the wages-men in the

(386) D.T. June 9, 1871, p.2.

locality, served only to show how dictatorial either party could be, if possessing the upper hand. (388)

The Cromwell Company, by far the largest employer in the Cromwell reefs region, successfully reduced wages again in 1876, to £3 per week. This was at a time when the bulk of the estimated 600 persons (389) residing in the Bendigo reefs area, was directly or indirectly dependent on the workings of that large company. Strike action was thwarted through the lack of mining labour class solidarity - striking miners' jobs were quickly filled by eager fellow labourers. (390)

As the quartz mining share of the gold escort fell, both from the Cromwell and entire Otago reefs, during the 1870s, companies continued to fail. Mining unemployment became the rule; the few companies remaining in an employing capacity unwittingly creating a lifeline for settled quartz miners, many of whom were supporting wives and families in the reef townships. (391)

Fluctuations in the Cromwell Company labour force were regarded with alarm during the late 1870s and 1880s. Following an unexpected flood in the mine in 1878, over fifty men were dismissed for an indefinite period. The

(388) ibid.
(389) C.A. July 18, 1876, p.6.
(390) O.W. November 4, 1876, p.7.
(391) In 1881, 32 females were resident in the Bendigo reefs townships of Logantown and Welshtown. During the years 1874-81 the number of females resident on the Carrick Range reefs declined from 48 to 12, as a direct result of the decline in quartz reef gold yields. Census of New Zealand, 1874; 1881.
Bendigo correspondent to the *Cromwell Argus* lamented:-

This state of things has been altogether unlooked for by the men employed, who have hitherto looked upon the company's employ in the same light as they would view a Government billet - a sure and certain thing, regardless of wind or weather. It is hard to be reconciled to our disappointment. (392)

but characteristically, assuming the attitude of optimism over the future employment opportunities, he foresaw Bendigo soon regaining its 'pristine briskness.' (393)

Vacillations in the profitability of auriferous quartz mining continued to become manifested in the fortunes of quartz mining labour. Press reports displayed a confident attitude over quartz mining throughout this uncertain period, (394) although the large quartz mining strike at Bendigo in 1881, finally quashed all local trust in the remaining quartz mine employer, the Cromwell Company.

Continuing its farcical advertisement in the local newspapers hailing 'steady employment' for quartz miners, (395) the Cromwell Company determined to lower wages. The ensuing strike was inevitable, as the Company could not offer a declining gold output as a reason (Refer Table XIV), and more vexing to the fifty miners involved, the Company had chosen the most insalubrious time of year, the threshold of winter, to reduce wages. The altitude of the Bendigo

(392) C.A. June 4, 1878, p.6.
(393) C.A. June 4, 1878, p.6.
(395) C.A. June 14, 1881, p.4.
### TABLE XIV

**Cromwell Quartz Mining Company**

**Monthly Gold Yields from Quartz, 1879-81**

<table>
<thead>
<tr>
<th>Year</th>
<th>Gold (oz)</th>
<th>Quartz (tons)</th>
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<tbody>
<tr>
<td>1879</td>
<td>733</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td>524</td>
<td>470</td>
</tr>
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<td></td>
<td>484</td>
<td>372</td>
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<tr>
<td></td>
<td>735</td>
<td>407</td>
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<td></td>
<td>641</td>
<td>464</td>
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<td>969</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>625</td>
<td>480</td>
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<td></td>
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<td>232</td>
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<td></td>
<td>368</td>
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</tr>
<tr>
<td>1881</td>
<td>370</td>
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<td>455</td>
</tr>
<tr>
<td></td>
<td>317</td>
<td>290</td>
</tr>
</tbody>
</table>

*(miner strike at this point)*

**Source:** *Otago Witness* 1879-81
reefs dictated the necessity of fuel for heating and cooking, costs of which were greater than in other centres around Cromwell.

The Cromwell Company resorted to harsh and punitive methods in attempting to create submission on the part of the miners, in demanding that all houses, stone or otherwise, standing upon Company lease ground, must be removed. (396) This action, involving the wholesale movement of families and households, evoked the wrath of the district - mining and non-mining fraternities alike. (Refer Appendix B).

The long strike affected not only the miner, but his family, the Company shareholders and the district at large. (Refer Appendix C). A public meeting convened in Cromwell, was unanimous in condemning the actions of the Cromwell Company as 'dishonourable', especially considering the fact that at times of poor gold return, the same miners had worked for the Company on as much as twenty weeks credit, without pay. (397)

The strike collapsed after two months, to the Company's advantage, but mining labour had become disillusioned with the primary employing company. It is not surprising that the Cromwell Company, hitherto making good dividends, struggled in the ensuing years, eventually being sold in 1884. (398) The worth of the quartz mining class interest in the industry had been irrefutably underestimated by the industry's employers and capital investors. The

(396) C.A. July 12, 1881, p.5.
(397) C.A. July 26, 1881, p.5.
destruction of that interest preceded total company collapse by a very short period indeed. Henceforth, not even the press could engender a public spirit of faith in the future of quartz mining.

The Cromwell quartz mining industry traced its genesis to the working miner. The necessary and subsequent capital constituted the means with which the industry could be pursued. As was soundly acknowledged by the contemporary Cromwell reef mining communities, both capital and labour inputs were essentially interdependent. Each faction possessed the ability to wield a constraint upon the well-being and prosperity of the reefing industry.

The role of the press; its attitudes and public consciousness

Throughout the body of this work, the persuasive powers of the communicated medium of the contemporary newspaper have been prominently evident. As an attitude-moulding and synthesizing force it had no parallel.

A correspondent in 1883, concerned with maintaining a mutual trust between the quartz mining industry and the news medium over the question of conveying genuine information, reiterated the strong dependence of the public on the press for reliable information regarding the fortunes of the industry. Although the press had been known to distort the truth, the correspondent also pointed out that newspaper reporters were often misled by 'unprincipled mine managers' as to the true prosperity of a particular mine. (399)

(399) O.W. October 13, 1883, p.12.
While the Cromwell reef region was overwhelmingly supported by glowing press accounts of the workings, throughout most of the quartz exploitation phase, few criticised press optimism. (400) There is little doubt that the local news medium, engendering and prolonging an expectancy of good fortune from the Cromwell reefs, unwittingly or otherwise, misled the public capitalist and mining classes as to the true worth of the local reefs.

One paper, through the Dunstan Times Carrick reefs' correspondent, acknowledged this shortcoming as early as 1871:

> When fresh and startling discoveries are weekly made in any locality, however remote and difficult, 'a correspondent' to a newspaper requires to have cautiousness pretty largely developed to avoid 'losing his head'; more especially, should he be interested in the prosperity of the district, and state as facts what he wishes to transpire. We are all indulging in 'great expectations' ...(401)

In spite of such moralistic reflections, however laudable, the press continued to influence public opinion over the varying fortunes of reef investment. Modes of reporting, selective reporting, editorial comment, the abundance of 'special reporter' comment and public correspondence with the editor all contributed to the formation of a newspaper perception of the quartz industry. The public, in consuming and evaluating such resultant information, were free to translate such material as they so desired, but were inherently limited by the factual inform-

(400) C.A. September 17, 1878, p.6.
(401) D.T. November 24, 1871, p.2.
ation at their disposal - usually encapsulated within the format of a newspaper.

In tracing the direct and indirect effects on the Cromwell quartz mining industry of the numerous environmental constraints, it has been of particular concern to explore the actual and possible constraints upon the industry of contemporary attitudes to these various environments. Relative to the Cromwell quartz reef area, both the primary environmental factors affecting the industry, and the responses to these environments (and to the industry itself), have been recognised as contributing to the successive moulding and retardation of the industry's development.
No blazing fire nor boiling pot,  
No smiling wife, nor supper hot.  

Why Mining Centres Decay, 1879 (402)

By 1885, the Cromwell quartz mining industry was in a moribund state. The hitherto prosperous Cromwell Company was struggling under a new and inexperienced management. The large Carrick mining companies had all collapsed except the Star of the East claim, the workings of which were, during the early 1880s, of a desultory manner. (403) Small and isolated groups of miners picked away at abandoned reefs, but the zenith of the Cromwell quartz reef industry had long since passed, with the peak gold yield of 14,000 ounces in 1875 (Table XIII).

The original expectations of the reefs, held by the contemporary population, have been discussed at length in Chapters 2 and 3. However, it will be of use in further aiding the analysis of the industry's decline, to briefly examine the contemporary view of the collapse of quartz mining in the area. The latter views are most vociferous in the light of comment concerning the failure of any large scale settlement in the Upper Clutha region, as it was envisaged that quartz mining would supplement, encourage, and perhaps eventually relinquish its primary economic role within the local community to the large scale settlement of small family farms.

(402) C.A. August 12, 1879, p.5.  
(403) Parcell, J.C. Heart of the Desert, p.95.
Of the future of quartz mining and the settlement of an industrial mining and agricultural society, a correspondent to the Otago Witness in 1871 remarked:-

If the Government wish to benefit the miners, ... let them give easy access to the land; let each miner have his 40 or 50 acres near his works, as a home-stead for his family, free of rent and taxes ... Let them establish schools, give the miners' children a mining education ... Foster a mining, agricultural and horticultural industry and a settled, happy and thriving community will be the result. (404)

In this advocacy of a joint development of agricultural land and quartz mining in order to ensure prosperity and permanence of settlement in the area, the principal advantage recognised was the establishment of diversity of employment.

This concept, one of creating a wide base of alternative occupations, underlay contemporary Cromwell area attitude to the expected large scale settlement of the region - encompassing both the reefs and the Upper Clutha valley. (405) The central notion that auriferous quartz would remain the permanent source of income for the region, affording the means of transition through which settlement would take place, remained epitomised in the words of a Dunstan Times correspondent: - 'It matters little to the masses who actually gets the gold; they have only to deal with the fact that it is got.' (406)

(404) O.W. February 11, 1871, p.16.
(405) D.T. August 12, 1870, p.2.
(406) D.T. August 19, 1870, p.2.
Five, and even ten years after the initial Cromwell quartz rushes, neither the quartz mining townships nor the settlement in the Upper Clutha valley, had attained the expected degree of permanence and prosperity. Sales of failing business premises on the reefs (Refer Tables VI, VII, VIII), intermittent and unprofitable quartz mining,(407) and a general lethargy within the industry and its community, were all blamed on the 'inertness of residents.'(408) Other contemporary opinion on the failure of quartz companies blamed miner/shareholders for running companies and handling capital, 'the particulars of which they possess a very imperfect knowledge, leading to the ruination of the company ...'(409)

Reflection on the failure of settlement and industry in the quartz reef region became, in the latter 1870s and early 1880s, a major topic of public controversy. The issue was frequently clouded by the conflicting views of intensely parochial quartz reef township residents, especially at Wakefield and Bendigo, and the jealousy over township supremacy. This retarding attitude intensified with the decline in economic viability of the quartz industry. Of the Bendigo reef area townships, a correspondent observed in 1878:

It is an unfortunate circumstance of this place that its population is so much scattered. Although scarcely numbering 500 souls, yet they own no

(407) C.A. September 12, 1876, p.6.
(408) C.A. July 25, 1876, p.6.
less than 3 townships... each of these striving for predominance over the other. This bickering or petty jealousy does not fail to produce very injurious effects upon the district at large... You will see that it is seldom that we are unanimous in any one thing. (410)

Friction between quartz townships revealed the fact that the contemporary community was significantly apprehensive over the future of livelihood. Conflicting newspaper reports also conveyed an impression of unease and insecurity. The Cromwell Argus in early 1876, remarked favourably on the permanent nature of mining operations on the Carrick Range, with 'comfortable dwellings being put up throughout the district, ... denoting that the owners have established their home, and passed out of the ranks of the nomadic digger.' (411)

Within the following six months, the hitherto-prosperous Elizabeth mine had been sold for only £14.10, (412) five Carrick Range miners became bankrupt, one large Carrick Range registered quartz mining company, the Crown and Cross, fell into liquidation, and in Carricktown and Quartzville, a hotel, bakery, general store, butchery, piggery and patent sausage machine were all advertised for sale. (413)

Bankruptcy, liquidation and quartz reef property sale notices flourished, side by side in local papers with encouraging edicts on the 'certain' permanence of quartz

(410) C.A. August 27, 1878, p.6.
(411) C.A. February 1, 1876, p.5.
(412) C.A. April 4, 1876, p.5.
(413) C.A. February-August, 1876.
mining and settled quartz mining communities. Characteristic poetical euphory abounded within local literature. Of the Bendigo townships in 1879:-

A few years more will suffice to see many families settled on their own land, henceforward ceasing to rove to and fro, and they will then find rest for the soles of their feet. May their barns be filled with plenty, and their presses burst forth with new wine. (414)

Misleading comment continued to issue from the contemporary press. A long article in the Cromwell Argus in 1879, published lengthy tables to prove the longevity of quartz (over alluvial) mining. (415) A glance at local quartz production figures would have drawn attention to a definite decline in the quartz mining complement to the gold escort. (Refer Table XIII). The local community, especially the mining and agricultural sectors of the population, tended to exhibit a more realistic attitude toward the decline in auriferous quartz production, and the failure of permanent settlement in the reef areas.

Self criticism of petty jealousy has been discussed and documented. Concern over the lethargy of the quartz mining population was also expressed by the quartz township correspondents. For example, of the forty men discharged by the Cromwell Company in 1880, most left the Bendigo area altogether. A local resident wrote:-

And speaking of the want of pluck and enterprise in the Cromwell Company, reminds me very forcibly that many of

(415) C.A. March 25, 1879, p.7.
the men discharged are devoid of the same sterling qualities, for no sooner were they not wanted, than they started off in search of more wages work; ... most men nowadays calling themselves miners prefer £3 a week wages and run-no risk, ... (416)

Certain factions within the quartz mining society which bemoaned the tardy attitude to quartz prospecting and enterprise, blamed the demoralising state of the industry for this attitude. Of the prospecting in the Carrick Ranges in 1881, a resident remarked:-

As workmen generally, they may be steady and industrious, but no sooner do they take to the ranges in search of payable quartz reefs than they become demoralised ... preferring their bunks and the London Journal to the cold morning air and the searching mists of the mountains. (417)

With the dearth of rich new discoveries, and the abandonment of claims, the vigour of miner enthusiasm had vanished. The same Carrick resident further indicated the lack of youthful energy and 'love for enterprise'. (418)

This attitude was almost certainly, in part, a reflection of public reaction against the operation of the company system of mining. Most of the large companies in the Carrick Range area had collapsed by 1883. Furthermore, the early 1880s witnessed a series of dishonest quartz company dealings. One Carrick Range company, the Last Shot Company, through fictitious rumours concerning its quartz quality, endeavoured and succeeded in gaining the

(416) C.A. March 23, 1880, p.5.
(417) C.A. August 30, 1881, p.6.
(418) ibid.
199.

confidence of several local shareholders. The Company failed after receiving calls of local capital, but finance returned to the shareholders from this company's liquidation proceedings, was minimal. (419)

Other small companies, with neither reef nor gold, were reported in 1883 as attempting to attract capital. An abortive attempt had also been made to rig the local share-market. (420) This, the final blow to any future large scale investment in the Cromwell quartz reefs, was compounded by the large losses sustained at the time by speculators in West Coast mines. Quartz mining interest and speculation became paralysed throughout Otago. (421)

Contemporary examination of the lack of cohesiveness within quartz reef settlement societies also analysed the community structure. Because the quartz mining industry was a labour-intensive occupation, large numbers of males were attached to the area. Life in the elevated areas was considered harsh during the first years, but as the population in these areas stabilised, wives and families began to appear, living in the reef regions. The family population at Bendigo was still increasing in 1879, (422) in spite of the falling gold output of the primary employer, the Cromwell Company. The turnover rate of mining labour was high, through the impermanence of employment. (423)

(419) O.W. October 13, 1883, p.12.
(420) O.W. November 10, 1883, p.12.
(421) C.A. October 27, 1885, p.2.
(422) C.A. December 23, 1879, p.5.
(423) C.A. December 3, 1878, p.5.
Early in the development of the quartz reefs and their associated townships, the local population recognised that the settlement component of wives and families was absent. To ensure the permanence of miner settlement, the steadying influence of family life was considered to be of paramount importance. At the opening of the Bendigo reefs' Meeting House at Welshtown, in 1876, a local minister, the Rev. B. Drake, addressed the large assembly of miners and residents:

He spoke earnestly and seriously to the young men and bachelors present on the necessity of taking wives. Much of the low tone of society, as exhibited in drinking, billiard and card playing etc. was caused by the absence of home ties. The rev. speaker then offered to introduce any that wished wives to some amiable spinsters of his acquaintance, and assured them that he would be most happy to do his part of the business. (424)

Public dances, generally lasting all night, were frequent occurrences in the reef townships, both at Carrick and Bendigo, and always designed on the pretext of some celebration. Quartz miners attended in force at these social events, especially when young ladies of the district were present. Singing interludes were especially popular, as exemplified by the men from the Young Australian mine at a dance in 1877, who set the tone of the evening with their objective versions of 'Hark the Lark', and 'Now is the Month of Maying'. (425)

Unattached female society from throughout the district

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(424) C.A. March 7, 1876, p.4.
(425) C.A. March 13, 1877, p.4.
was always invited, although the object of such gatherings was sometimes embarrassingly indicated by over-enthusiastic paternal residents. An amusing example is afforded in the report of a large public ball at Bendigo in 1879, when, in the midst of the evening's proceedings an announcement was declared, 'recommending all bachelors present to each take unto himself a mate, if he could at all secure one'.

Family life in the reef areas was also considered as being proportionately retarded through the lack of available farmland. Attitude reflected the consideration that until an alternative employment existed for the quartz miner, supplementing its proven irregular nature, family life would remain the exception. In consequence, interest in the quartz reefs would only be of a transitory nature:--

Every man at a marriageable age who is unmarried may safely be said to be in the country but not of it. A single man has no home, no matter how much gold he may have ... Many a digger would marry if he could get a little bit of land to help him along, and have some place he could call his own ...

The quartz settlement community laid blame at their own feet in not rousing themselves to private schooling and associated services for the education of mining family children. A school was eventually opened at Bendigo in March 1879, but the long argument and debate over its siting had prolonged its eventual establishment.

(426) C.A. April 15, 1879, p.6.
(428) C.A. March 11, 1879, p.5.
Many families had left the region before it opened, the petty bickering over its siting having had 'a very baneful effect upon the prosperity of this place; for men with families will not settle down permanently here, or ... spend any time or money ... in developing this famous gold field'. (429)

A further criticism of the quartz reef community in constituting a limiting factor upon the quartz industry, was the type of miner who took up residence. In a very long article published in 1879, local residents expressed a strong dissatisfaction with those miners who did not intend to settle in the quartz region townships. These miners intended only to work for wages, and accumulate capital without attempting to re-invest in the local quartz reefs, or in the local community services. Of Bendigo, the report commented:—

... the money that has been earned here has been sent to N.S.W. and England, as well as Arrarat and Ballarat ... This class of men has been the plague-spot of Bendigo since the first of the diggings here. They never take any interest in local matters. (430)

The business community had a strong dislike for this class of men as well, for the latter were reported as existing on bare subsistence supplies, never purchasing anything more than was absolutely necessary. This export of capital from the reef goldfields area caused widespread dissatisfaction, especially when the expected permanent

(429) C.A. December 3, 1878, p.6.
(430) C.A. August 12, 1879, p.5.
settlement, both agricultural and mining, failed to materialise. (431) The depression attending the 1880s, compounded the complaint, leaving bitterness and a lack of cohesiveness within quartz reef communities, at the time when it was most required - during the period of diminishing quartz mine yields.

By the turn of the decade it was abundantly clear, through the lack of quartz mining enterprise, that, as a Bendigo reef resident wrote to the Otago Witness, 'few are interested in the success of quartz mines, beyond the hope of getting a job on wages, without spending any money or labour on them.' (432)

Of the quartz mining companies themselves, the contemporary population recognised, besides the many limitations and constraints outlined in Chapter 7, that by far the greatest fault was mismanagement. Reflecting in 1886 upon the failure of the Cromwell reef industry to maintain permanent output and employment, a correspondent to the Cromwell Argus criticised the

... big and expensive staffs, who must be paid, against problematical returns, What with mine managers, battery managers, legal managers, underground and overhead managers, it is little wonder that many otherwise promising speculations have been 'mismanaged' out of existence ... (433)

Resentment of the foolhardy management of mines, and the interference with mining operations by eager shareholders ran high, especially as company after company was forced out

(431) ibid.
(432) O.W. April 20, 1878, p.4.
(433) C.A. February 2, 1886, p.2.
of existence, taking with them the much-coveted employment of the miner. This concern over the class and competence of the men who controlled the mining operations, and as a consequence, the ultimate existence of regular miner employment, was considerable.

An intricate web of interdependence constituted the backbone of quartz mining settlement and industry. The contemporary quartz mining population recognised that to maintain a prosperous quartz mining settlement and society, family men were required, to settle with their families, and educate their children within the immediate vicinity. Family men would only be attracted to the area if a permanent industry, with regular employment, could be assured. The transitory and uncertain nature of quartz reef prospecting or small scale worker/shareholder mining, could not afford such a certainty of permanence. Even in the larger companies, men were periodically dismissed, wages cut, and labour unrest intensified. Complaint over lack of enterprise and the prospecting spirit was heard from the contemporary press, and non-quartz mining sectors of the population. The family-supporting miner could hardly afford to support a family on the pursuits of speculation and reef prospecting, consequently electing to move from the locality to take up more permanent forms of employment.

The quartz mining settlement once again suffered through its inhabitation by transitory, single men, and by those who came only to extract wages, before leaving the district with accumulated capital. The lack of associated agricultural land availability, through both the physically
unsuitable reef area terrain, and the all-encompassing nature of the pastoral leases, compounded the frustrations in attempting to provide an alternative employment within the reef areas.

The contemporary quartz mining population, in endeavouring to prolong and protect the struggling quartz township, declined to acknowledge the impending economic extinction of the industry. It must be recognised however, that the lack of available alternative land for settlement in the district encouraged this attitude. A public meeting in Cromwell in 1881 over the dearth of such land was reported in the Cromwell Argus:

Scores of men who had saved good round sums in mining pursuits, and who were anxious to invest it in land in the neighbourhood, had been compelled to leave the district, and spend their money elsewhere, owing to the land being held by the squatters. This was manifestly unjust. (434)

The pioneer capitalist in the Cromwell quartz reefs area, G.W. Goodger, publicly claimed that the present Cromwell quartz reef area and associated Cromwell district, could not always live through the efforts of a mining population. (435)

The vision of the permanent reef industry, of Cromwell becoming 'a vast manufacturing town such as Birmingham, or Sheffield, in England', (436) had irretrievably misted. Clouded by disillusionment, both with the quartz industry

(434) C.A. March 1, 1881, p.4.
(435) ibid.
(436) Barry, W.J. Up and Down, 1879, p.304.
and with the alternative life of small scale farm settlement in the Upper Clutha valley area, the population perspective had turned inwardly critical.

The search for scapegoat served no practical purpose but to justify the depressed situation, in 1885, of the quartz industry and the quartz area settlement. It was merely a reflection of the disappointment of an age, and more especially, of a community. For the purposes of analysing the decline of the quartz mining industry and the abandonment of established townships, it affords a valuable and personal assessment of contemporary causes. The value in the results of such contemporary analyses lies in their very nature - contemporary documents imparting a series of microcosmic glimpses of past attitude.
CONCLUSION

It is an accepted mining maxim that, 'if you cannot get any gold yourself, it is satisfactory to be in the neighbourhood of where it is.'

Cromwell reefs' correspondent, Otago Witness, 1875 (437)

During the series of rush phases which initiated the occupation of the Cromwell quartz reef areas, there is little doubt but that association with these reefs was a much-coveted aspiration. By 1880 and the years following, any close association with, or dependence on the Cromwell reef mines, was a mild embarrassment as well as unsettling and unprofitable.

An examination of the activity on the Cromwell quartz reef area during the period 1868-84, exhibits a view encompassing not only the physical establishment of extractive industrial enterprise and associated service settlement, but also a significant transformation in public perception of, and resultant attitude to, the Cromwell area rangeland. Both facets of such a view are inextricably interdependent.

The quartz mining industry had blossomed in the years 1869-71, as a direct consequence of the decline in yield from alluvial gold deposits, and diminution in the available area of easily accessible alluvial deposits. The fluctuating fortunes of the alluvial gold workings were tiring and unsettling - their transience forestalled the large scale settlement, and the permanence and stability
of economic base so earnestly desired by the contemporary Cromwell area communities. The resulting zeal with which the quartz mining industry was begun, inflated its prospects in waves of share speculation and expectation of industrial permanence.

The inevitable over-reaction to the scattered indications of payable quartz adversely affected the careful planning which should have attended the industry's development, through opposing public pressure sources. On the one hand lay the investment infusions of the capitalists, bloating the value of the industry's prospects to unattainable proportions, while on the other hand, faithful attempts to attract interest in genuine reefing enterprises failed due to the suspicion which later surrounded this 'unreliable' industry.

The ultimate reaction to the quartz mining industry's development reflected this latter trend. Even contemporary class attitude recognised that the seed of the industry's decline had been sown in the first rush mania which seized the Bendigo reef area in 1869. Expectation of prosperity and permanence became too deeply entrenched within the minds of the initial quartz miners and reef area communities. The eventual failure of the industry dispelled these expectations, but in consequence, the distrust of quartz mining enterprise became as proportionately distorted as the initial and inflated expectations.

Expectations of prosperity and permanence were gradually dissipated with the declining gold yields from quartz of the 1870s and 1880s, and with them, faded the quartz
reef settlements, and the reef area communities. The debates over freeing land for settlement in the Upper Clutha valley area raged, as the reefing communities melted away to Dunedin, and to the more prosperous reef areas of Macetown and the Arrow River.

The industry had succeeded in partially transforming the geographical character of the reef areas. Reefing operations seldom altered the physical landscape beyond the ragged lines of surface quartz extraction, and where conical piles of mullock and waste rock betrayed the entrance to a mine shaft or adit. These remnants of extraction fail to reflect the high financial investment in the industry, and are unable to discriminate between the mines of former wealth, and the failures. The massivity of the rangeland constituted the great leveller - the few remnants of former activity and enterprise appeared unobtrusive after the industry's decline.

Quartz reef settlement in the study area followed a distinct morphological trend. Wilson has recognised a common pattern relating coal mining activity and associated settlement which is readily translated into the Cromwell quartz reef situation. The establishment of townships with a single function - to house and service mine workers and their dependents (438) - is clearly evident in the Cromwell quartz industry pattern of settlement. These townships, expected to become self sustaining centres of growth supporting a settled residential function focussed

on the central service centre of Cromwell and on the mines themselves, adopted without exception, the veil of ghost towns within fifteen to twenty years of their beginning.

It is certain that their singular function, as residential service centres, served as the catalyst for their own failure. Their total dependence on the continuing prosperity of the quartz reefs and of the mining companies thereon, led to an assurance that they would eventually decline in business and service scope and in population size, in direct proportion to the decline of the quartz industry itself. Everything within these townships of less bulk and greater value than stone buildings, migrated with the exodus of resident populations during the 1880s.

Although the contemporary quartz reef settlement communities bemoaned the 'desideratum of domestic hearth' on the quartz reefs, and searched for many reasons for the decline in the industry's prosperity, many other contemporary environmental effects and population attitude influences have emerged as contributing to the ultimate failure of the industry. Of primary significance among these effects was the fact that the Cromwell quartz reefs failed in auriferous content at depth, and that there existed a paucity of highly payable reefs, in very localised areas.

Many environmental influences, and the complex interplay of contemporary population influence directly and indirectly affecting the ultimate prosperity of the quartz mining industry, have been recognised as contributing to the decline of the industry. The basic auriferous quartz
availability of the Cromwell reefs dictated the longevity of the industry; but the secondary effects born of population attitude and environmental constraints, aided in frustrating and negating that prosperous end which was so widely attributed as the outcome of the Cromwell quartz mining industry.

The rapid decline in quartz mining activity, especially during the years 1880-84, reflect the lack of available capital (in contrast to the plethora of investment finance following the lucrative alluvial rushes of the 1860s), and a distinct ebb in quartz mining enthusiasm. Quartz mining failures on the West Coast, and the national economic depression of the 1880s contributed to a disillusionment with investment and mining enterprise. In Otago, the successes of the gold dredging industry had eclipsed quartz mining returns manyfold. Capital investment and speculation was focussed on gold dredging during the ensuing years, to the great detriment of the quartz reefing industry in both the Cromwell area and in Otago province.

By these later years, most of the hundreds of mining, business and service class residents in the reef areas had illustrated their declining interest in quartz reefing by wholesale desertion of the reef regions. Few remained, attended by the perpetual silence of the rangeland, their illusions of wealth and permanence, and their sanguine expectations.

In this analysis of the diverse factors adversely affecting a past activity, the value of examining contemporary perceptions, ideas and subsequent actions, in relation
to the primary focus of the study, has emerged. The value of pursuing a general evaluation of past class, and individual attitudes to the study focus, lies in its role as an auxiliary probe into some of the more human-oriented contemporary influences. The method of taking into account the analysis of past comment and action, is successful in highlighting the diverse environmental constraints within the contemporary situation. In the Cromwell quartz mining study period, the results of human misunderstanding, ignorance and prejudice have emerged as definite and significant contemporary influences on the fortune of the quartz reefing industry, and consequently, upon associated settlement.

The explanatory model may be reviewed in the light in which it was envisaged - as a medium for relating and clarifying the various contemporary interflows of influence, both human and environmental, affecting the quartz reef industry. Relationships outlined within the model have been referred to during the study, but seldom in detail, in order to avoid placing undue emphasis on the model structure as being the study-aim. As a means in aiding the explanation of the subject matter, both the acknowledgement of the perception approach, and the use of the explanatory model, have emerged as justifiable assistance, in the greater depth of clarification and explanation they afford.

As a means of displaying relationships of the past, the explanatory model may be of use as an auxiliary aid in the explanation and analysis of further studies, in
differing areas and periods, and involving differing past activity - of extractive industry or otherwise. Within its present perspective, the model has revealed a significant degree of success in simplifying the process of explanation within this study. To this end, it has accomplished its stated purpose.

Through the analysis of past action, and the attempt to faithfully approximate the past, the historical geographer may synthesize his findings with those of associated disciplines, to help attain a greater understanding of some of the inherent human influences which, unwittingly or otherwise, affect present action. The human perceptual element is recognised as a primary motivating force in all human action. Since the activities of the present are always motivated by past attitudes, the discipline of historical geography attains a special prominence as aiding the translation and evaluation of such action. The accomplishment of this task calls for the co-operation of specialised analytical disciplines and methods, with the collective ability to transcend the ordinary limitations and distortions of time.
APPENDIX A

GEOLOGICAL NOTE ON THE CROMWELL REEF AREA QUARTZ LODGES, AND METHOD OF GOLD EXTRACTION FROM AURIFEROUS QUARTZ

Both the Bendigo and Carrick systems of quartz veins occur in the hard, quartzose mica-schists of the Dunstan and Carrick Ranges. Two systems of lodes were distinguished in the Bendigo area, 1,500 to 2,500 feet above sea level. In the more auriferously-productive and permanent system, which runs east-west, eight distinct lodes have been distinguished. All were found to be productive, some even continuing their high auriferous character into the blue, unoxidised ground. The other system runs northeast-southwest, containing two cross-lodes, two to four feet in width, and very indistinct.

The chief quartz deposit on the Bendigo field is contained within the Cromwell Reef, which varies between one and six feet in width (of grey and faintly banded quartz), and traceable on the surface for over a mile. Beneath the surface, workings were pursued along the reef for 1,000 feet, and as deep as 320 feet, when the first registered Cromwell Company sold out in 1884. The lodes in the Bendigo reef area are not widely dispersed, and are geologically regular, which tended to concentrate the siting of quartz mining claims.

Ulrich[1] reported these Bendigo reefs as being very well-defined, with uniform strike, and traceable for long distances, traversing flat-bedded mica-schist at very steep or almost vertical angles. Difficulties in working were recognised in the narrowness of the reefs, and the hard nature of the surrounding schist country - the horizontal inclination of these beds rendering shaft work difficult. Against these geological limitations lay the presence of the high dip of the reefs, which facilitated the stoping out of quartz, and the supporting of the underground workings.

The Carrick reefs are widely dispersed between 2,000 and 3,500 feet above sea level, and the lode lines diverge in no common pattern of strike or dip. These narrow quartz reefs are of a loose, broken nature, mixed with a red clayey mullock, and are easily removed. Surface working down to a few score feet below ground, generally proved very profitable, although the ore rapidly became impoverished with greater depths. Owing to its softness, the Carrick reef quartz could be crushed with comparative ease, but as the gold was very fine, a great deal was lost due to inefficient goldsaving apparatus.

The irregularity of course in these reefs was considered by Ulrich (2) to be their chief limitation, as they were peculiarly curved in both strike and dip, besides being frequently faulted by slides and cross-leaders. The soft nature of the quartz reefs, while aiding the stopping out operations, adversely affected the ease (as at Bendigo) with which the mine workings could be supported.

GOLD EXTRACTION FROM AURIFEROUS QUARTZ

The stamp mill or battery, pioneered in California and Australia, was the method of reducing auriferous quartz to a very fine powder before further processing. The stamps were cylindrical and of cast iron, attached to round rods or lifters, the single stamp and rod weighing 600 to 900 pounds. The lift of each of these stamps was effected by cams alternately raising and letting fall the stamps. The height of lift was generally eight or ten inches, while each stamper rose and fell up to ninety times each minute, depending on the machine gearing and the available motive power.

The powdered quartz, after passing through a fine wire mesh, was discharged through water action onto twelve foot long ripple tables in front of the battery. These tables, besides being covered with rough matting to trap gold particles, were often lined with copper plates filled with mercury. The gold was caught in the matting, as well as amalgamating with the mercury, to be separated in a later process.

The batteries employed in the Cromwell reef area during the 1870s and 1880s consisted principally of four and five stamp batteries, with stamps working in cast iron box bases, fed with quartz by hand. Weight of stamps ranged from four to seven hundredweight, the lift from five to eight inches, and the number of blows from 50 to 85 per minute. A supply of five to eight gallons of water per minute per stamp head was required to force the powdered quartz through the wire mesh onto the blanket tables. The blankets were regularly cleaned of their accumulations of gold, in revolving cast iron barrels, which effectively shook free the fine gold particles.

Ulrich (3) considered that both gold and mercury were being lost in the Cromwell reef area machines, through the common practice of putting mercury with the powdered quartz in the stamper boxes. The high pyrites content of the Cromwell reef quartz frequently caused the mercury to 'sicken', lose its affinity with the gold, and be lost.

(2) ibid., p.61.

Gold was separated from the mercury amalgam on the Cromwell reefs, through the process of placing measured proportions of damp sand and mercury inside a revolving iron barrel, and allowing the barrel to revolve for eight hours. Hot water was then introduced, and the apparatus continued to revolve for a further four hours, at five revolutions per minute. The mercury was then drawn off, and the freed gold washed from the sand.

Special problems associated with the gold saving apparatus used in the Cromwell reef areas involved the mercury, the amalgamating properties of which were adversely affected by low water temperatures and frosts. Hot water was always introduced to the stamper boxes where possible, during colder months.
...Although we have been dogged by the manager, who threatened to give one of our number in charge for trespassing on the Golden Link [lease], yet we did not retaliate. And when he (the manager) served us with notices to pull down our houses, which were erected on the Company's leases, or pay 15/- per week in advance, we complied with the request, and some of the houses were very substantial structures, composed of stone and iron. In one case the sight was heart-rending when a poor man with his wife and newly-born infant had to vacate and pull down a very neat cottage that would be no discredit to your own town, simply because the said cottage was standing on one of the Cromwell Company's leases. After such tyrannical conduct on the Otago goldfields, let us hear no more about Irish evictions and landlord terrorism. Not one of us wished to compel the Cromwell Company to give us employment, but as we had our winter supplies provided before the reduction of wages, we reasonably expected that we should be allowed to remain for the winter in the houses we had purchased from our predecessors - not knowing at the time that they were on the Company's leases. It is a painful feature of the times when such conduct on the part of a wealthy company is permitted to pass unobserved by the independent Press of the colony. Yet the Company with bare-faced impudence ask police protection while the work of spoilation goes on by themselves. How the manager can carry out the instructions or permit himself to crucify his fellow men, I cannot conceive. But I think when a man does so he allows himself to become an object of pity and derision.

Bendigo Miner.
THE WAIL OF THE STRIKER

Oh my heart is filled with woe—
Out of work and ne'er a show.
What the dickens made me go
On the strike?

'Tis enough to raise a tear
Or make one go on the beer,
For 'tis miserable here
On the strike.

What an ass to make a stand,
And with others, hand in hand,
Cease to work and join the band
On the strike.

Little did I think 'twould be
Such a prolonged agony,
Or this child you'd never see
On the strike.

I would take the 9 and 6
But for others in the fix
Who together stick like bricks
On the strike.

We have sympathising friends,
But that will not make amends
For the trouble that attends
On the strike.

Sympathy be blowed, I say;
'Taint substantial anyway—
'Twont give us ten bob a day
On the strike.

Times are changing now methinks;
He must work who eats and drinks,
And cease playing up high jinks
On the strike.
Everything does now foreshow
Labour cheap and wages low,
But we fail to own it so,
On the strike.

But from evil cometh good
Thus I wish it understood
That our heads are not all wood,
On the strike.

We've been stubborn, but we see
That a strike brings misery —
Upon this we all agree
On the strike.

If reduction I can't face,
I to others will give place
No 'request' should them outface
On the strike.

Anon.
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