

No. 18.

REPORT ON THE GOLD FIELDS OF OTAGO, BY G. H. F. ULRICH, Esq., F.G.S.

Presented to the Otago Provincial Council.

REPORT ON THE AURIFEROUS QUARTZ REEFS AND CRUSHING MACHINES OF THE PROVINCE OF OTAGO, with Remarks on Auriferous Drifts, and * Occurrences of Copper Ore, Cinnabar, Grey Antimony, and Brown Coal in Different Parts of the Province.

SIR,—

Technological Museum, Melbourne, April, 1875.

I have the honor to submit herewith for your consideration the observations I made during my recent journey of inspection through the quartz mining districts of Otago. The instructions contained in your letter of the 21st December, 1874, were, that I should devote myself principally to an examination of the quartz workings, with the view of reporting generally on their geological relations, and more particularly in regard to any improvement I might be able to recommend in the mode of mining, crushing, or amalgamating, as would come within the scope and means of private enterprise; and further that, if not unduly trenching upon the time required for such examinations, I should pay attention to and afford information on the known occurrences in different parts of the province of copper ore, cinnabar, antimony, and other minerals that came under my notice.

In obedience to these instructions, and mostly under the valuable guidance of Mr. D. MacKellar, the Secretary for the Gold Fields, I have visited all the principal quartz mining localities of the province, viz., Tokomairiro, Tuapeka, Waipori, Bendigo, and the Carrick Range, near Cromwell, Arrow, Skipper's Creek, the Rough Ridge, Macrae's Flat, Shag Valley, Green Island, and Portobello; and besides examining most of the quartz reefs in work or opened, and the crushing mills existing in each district, I also made observations in certain localities on the auriferous drift deposits, and on the occurrences of copper ore, cinnabar, grey antimony, and on some of those—for Otago most important ones—of brown coal. Finding that, in merely working out the copious notes taken during these inspections, very frequent repetitions would be unavoidable, more especially in my recommendations touching the working of the mines, crushing and amalgamating, prospecting, &c., I thought it best to embody the principal observations and recommendations in a general report, throwing into appendices the special description of the mines, and certain information I have to afford of a profitable mode of burning brown coal for boilers, in a fireplace of novel construction, invented in Germany. Having, in forming my opinion on the reefs of the province in their various stages of development, and more especially with regard to their chances of carrying payable gold in depth, taken those of Victoria as my principal standard of comparison, I think it but fair to state my reason for so doing. It will be remembered that a celebrated, perhaps the best, authority on the occurrences of gold in matrix in the older rocks—the late Sir Roderick Murchison—propounded in the third edition of "Siluria," when speaking of the Victorian gold fields, the hypothesis that the gold in quartz reefs would gradually decrease in quantity downward, and ultimately run out, or at least become unpayable to work at a limited depth. His reasons for this prognostication were solely based upon mining experience in other gold mining countries. Nevertheless, the miners of Victoria worked courageously and successfully deeper and deeper, and when thus in later years it was incontestably proved that gold occurred there in payable and even larger quantities at depths which certainly did not deserve to be called "limited," Sir Roderick, in his last edition of "Siluria," fairly withdrew from his original standpoint, acknowledging that the results of quartz mining in Victoria put former general experience at fault, and inferring that quartz reefs of similar character and geological relations might offer similar chances of success in depth.

In more recent years the results of deep mining in Victoria have still more fully established the downward extent of the gold, and several reefs are there at present being profitably worked at depths approaching 1,000 feet. Considering all former experience in gold mining in the matrix in other countries (California excepted), everything concerning mineral character, structure, and behaviour of the auriferous quartz reefs of Victoria in depth, is therefore new to mining science, presenting, as it were, a new experience, fairly applicable in judging of the chances of similar quartz-reef occurrences elsewhere. As I found the reefs of Otago to exhibit this resemblance—in many respects a very close one—to Victorian reefs, I shall, I think, be considered justified in basing my opinion of their prospects upon certain features exhibited by the latter in similar stages of development.

THE AURIFEROUS REEFS.

General Geological Observations.—As introductory to the description of the reefs, the following remarks on the nature of the country rocks in which the reefs occur, or gold has been found in matrix, will save frequent repetitions. With the exception of those of the auriferous locality near Portobello, specially considered further on, the rocks consist throughout, according to my observations, and which are confirmed by Captain Hutton the Provincial Geologist's more extensive and detailed geological survey—of metamorphic schist, *i.e.*, argillaceous mica schist or phyllite, changing from the east towards the west into real mica schist, with subordinate bands of chlorite schist, or chloritic mica schist. The line or boundary where this change takes place has with difficulty been traced by Captain Hutton, but it appears that within the large district on the west, occupied by mica schist, there exists at least one rather large area, viz., the Carrick Range, where the rock conforms in all lithological respects to true phyllite, and this range lies, according to Captain Hutton, within the line of a main anticlinal axis, the existence of which he first established. Whether this inlying patch of phyllite represents a remnant of denudation of a once superincumbent general formation on the mica schist, or whether it simply constitutes an area where the metamorphic action and change were of less intensity, remains a difficult problem, to solve by future investigation. Only at two places within the extensive metamorphic district I obtained evidence of the existence of an intrusive rock, viz., high up the Carrick Range, in small dyke-and-knoblike protrusions of a dark "hornstone-porphry," and at

* This portion of the Report is omitted, having nothing specially to do with the gold fields.