

ALEXANDER RIVER.

In the south-east corner of the Reefton Subdivision a narrow zone of auriferous greywackes lies between the main eastern granite mass and another belt of granite extending from the Big Grey River northwards to the Waitahu. Although the present boundaries between this greywacke strip and the granites are faults, visible in several localities, nevertheless there are indications, from a tendency in places to recrystallization, that the greywacke may originally have taken the form of an elongated roof pendant projecting down into the batholith. It is surprising, then, that no true dykes of pegmatite were encountered, and, further, that the lodes are of the mesothermal type characterizing the Reefton field. The granite encountered near the contact in the upper reaches of the Alexander River was of a type that suggests a magma of high viscosity and comparatively low temperature at the time of its uprise. From such a magma extensive apophyses might be expected to be absent. Modification will be necessary of the granite - Greenland Series boundaries as shown in the maps with *N.Z. Geol. Sur. Bull. No. 18* (Reefton Subdivision).

In addition to widespread normal faulting, westward-directed thrusting was again evident in the eastern area. An excellent example of a low-angle reverse fault, by which granite has been thrust over greywacke, was seen in the Alexander River Gorge. Massive complexly-jointed, quartzose greywacke is the prevalent type, and elucidation of fold structures was not accomplished; but where reliable dip and strike observations could be made the strata were everywhere steeply dipping and in many places approached verticality. It seems best to regard the field data as indicating a series of close folds aligned from 10° to 20° east of the meridian, dislocated and largely destroyed by numerous normal faults and compressional shear-zones. The more important faults typically are guided by the direction of strike of the rocks. They are well seen in the cross-sections provided by Mullocky Creek, Bull Creek, on the power-house race in the Alexander River, and in the mine. Faulting transverse to the structure may also be seen in the mine workings.

A strip of Tertiary rocks hitherto unrecorded was discovered in the upper Alexander River. It is about 10 chains wide, is bounded on both east and west by faults, and lies between granite and Greenland rocks. The occurrence is known to extend southwards to the head of the basin of Mullocky Creek, but the streams entering the Alexander River from the east below Mullocky Creek bring down no Tertiary detritus. Similarly, the creeks flowing into Absalom Creek from the east carry no Tertiary waste, so that the limit of these rocks in this direction cannot be far north of the Alexander River. These rocks, consisting of coarse breccia similar to the Hawk's Crag breccia, feldspathic grit and sandstone, are probably a fragment of a Tertiary cover elsewhere stripped off by erosion, but here entangled in what appears to be one of the major faults of the region. Another infaulted fragment of Tertiary rock occurs a short distance below the junction of the Alexander River with the Big Grey; here an arenaceous limestone passes upwards into soft dark sandstone.

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These consist of a fairly regular line of short ore bodies, evidently occupying a shear-zone or series of close-spaced vein fissures within the one fault-zone, conforming in trend with the general strike of the rocks. The several blocks probably represent local expansions of lode material at various points along the one main mineralized fault-zone. At present only the so-called Bull Block may be studied within the workings. This block, the most southerly worked, is pitching northwards, the usual condition in the Reefton field, and is dipping steeply east.

The quartz which first attracted attention to the Alexander area appears to have been loose blocks of shoad-stone that had been shed by reefs of which the situation at depth could not reliably be forecast from surface observations, trenching, &c. This was due partly to the effect of faults which are not readily detected by surface prospecting, and also to a large extent to the very steep topography, which, aided again by the fault-induced shattered condition of much of the rock, causes surface creep to a marked extent. The flattening of the Bull reef near the surface, which led to misconceptions and difficulties in the early development of the mine, is, it is believed, due to this combination of factors. The creep effect is strikingly evident in cuttings on the incline leading to the Mullocky Creek section of the mine.

The effects of faulting on the reef itself are important. The earliest faulting would appear to be that resulting from the breakdown and shearing-out of the close folds, providing means of escape to the surface of contemporaneously active magmatic solutions. Longitudinal constrictions in the ore bodies and their pinching out and dislocation vertically seems to be due to another system of faults, also more or less parallel with the strike, but of tensional origin. Small cross-faults which displace the reef laterally may be due to a later phase of thrusting, and perhaps represent the boundaries between a number of small blocks differentially thrust westwards.

Although it is the rule in the Reefton goldfields for values to be maintained at depth, the future development at deeper levels of the Bull block may be affected by faulting, which may prove to have dislocated the reef to a serious extent. Further prospecting south from the present workings should be carried out, driving south from the south end of the reef, and cross-cutting in both directions. Shoad-stone of interesting value has been reported on the surface to the south of the present workings, but surface prospecting is regarded by the writer as unreliable in the circumstances, and the possibility of other blocks existing in this direction should be tested from within the mine. Further, now that pneumatic rock-drills are in use and facilities improved for the transport of heavy machinery to the mine, it should be possible economically to extract the hard stone in the Mullocky and other northern sections, which defied hand-steel mining methods and was abandoned.