

PHYSIOGRAPHY AND STRUCTURE.

As in the neighbouring Naseby Subdivision and, in fact, Central Otago as a whole, two major divisions of the rocks are apparent. First, the undermass of ancient sediments exhibiting various stages of metamorphism, and, second, the cover of younger unaltered material. Peneplanation of the older rocks was far advanced before the deposition of the overmass of Secondary and Tertiary sediments, and following this there occurred a period of extensive block-faulting resulting in the tectonic depressions and elevated block-mountains of to-day.

The Moeraki Subdivision is divided into two major structural units by the Shag Valley Fault, which runs north-west from Shag Point. The eastern upthrown block is tilted to the north-east and drained chiefly by the Kauru, Waianakarua, and Kurinui rivers. Its high south-west border is the Horse Range. The western block, forming the back-slope of the fault-angle, is tilted similarly and drained by the Shag River and its tributaries. On both blocks the stream-courses have little or no relation to the structure of the undermass—viz., the schists—and obviously have been superposed from the sediments of the overmass. This feature is particularly well shown west of Hampden and at Waihemo.

On the older rocks, which form the greater part of the district, the dissection is very sharp in contrast with that on the late Secondary and Tertiary formations which have gentle rolling topography.

Owing to the high competency of the basement rocks faulting rather than folding controls the structure. The most important fracture, the Shag Valley Fault, or Fault system, was described by S. H. Cox as early as 1882. From the base of Puke Hiwi Tahī, the peak at the east end of Horse Range, it runs up Woolshed Creek for three miles and ends abruptly in a cul-de-sac near the Horse Range Road. Here a transverse fault striking north-east causes a break in the major system. Beyond this point the dislocation in the crust is along two parallel north-west fractures, one passing west of Harry Peak, and the other, the major break, east of that peak and continuing almost unbroken beyond Waihemo and out of the subdivision. The elongated block between the faults forms the Blue Mountains.

Since the older beds (Wanaka Series) form the downthrown block, it is obvious that the Shag Valley Fault is of ancient origin and that the latest movement along the fracture was the reverse of that which originally took place. This was first pointed out by Cotton,* and the following cycle of events seems to represent the history of the terrain involved in the fault movements. After the deposition and metamorphism of the sediments which are represented by the Wanaka and Kakanui series of schists, a fracture with downthrow to the east occurred along the line of the present Shag Valley. Extensive erosion and even peneplanation followed, causing the removal of the younger (Kakanui) series from the upthrown block. In Cretaceous times negative epeirogenic movements took place and the rivers deposited conglomerates and coarse sands under conditions similar to those obtaining during Pleistocene and Recent times on the Canterbury Plains. Marine deposition of various sediments continued with slight breaks till the Pliocene, when faulting movements caused the Shag Valley to assume its present shape.

As would be expected, transverse and oblique faults are numerous, and in one case, at the Blue Mountains, the fracture has proved advantageous in that it has faulted limestone down from an elevation of 1,200 ft. to a workable level of about 400 ft.

Away from the Shag Valley faults are common—for instance, west of Herbert the limonitic sandstones have been depressed nearly 600 ft. along a north-south fault; near the Waianakarua Estuary south of Trig. B a fine fault-section is exposed with horizontal Waiarekan tuffs lying on a 30° plane against Hampden Clays; at Kakaho Creek a sub-Recent fault trending eastwards is nicely exhibited; in the Shag Point coal-mines trouble is experienced owing to the presence of strong faults; and west of Dunback a fracture running west-south-west passes from Wayne's to a considerable distance beyond the geodetic station at Dunback Hill. Other minor breaks are too numerous to mention.

The succession of strata on the eastern structural block indicates that the latter has been intermittently rising since late Mesozoic times; the sediments become increasingly younger as one passes eastwards. It is possible that this uplift has produced the syncline in late Cretaceous beds at Shag Point.

STRATIGRAPHY.

A great succession of lithologically distinct strata occurs throughout the subdivision, but, unfortunately, fossils are extremely rare until the Tertiary formations are reached.

Wanaka Series.—Rocks of this series continue from the Naseby Subdivision and end abruptly at the Shag Valley Fault. They are foliated quartz-mica schists with schistosity planes dipping north-east about 20° or 25°. Quartz veins are common and are auriferous in many places.

Kakanui Series.—These rocks constitute the undermass of the eastern block and consist of argillaceous semi-schists and coarse sedimentaries affected relatively little by metamorphism and therefore best classed as greywackes. An interesting volcanic rock, probably an andesite, interbedded with vesicular material and displaying schistosity, was discovered west of the "Dasher" homestead in Waihemo Survey District, and belongs to this series.

Waihemo Series.—This term was introduced by Williamson† for a unit consisting of greywackes and argillites outcropping in the upper basin of Shag River on the east side of the main fault. They

* COTTON, C. A.: "Block Mountains in New Zealand," *Am. Jour. Sci.*, Vol. 44, 1917, pp. 249-93.

† WILLIAMSON, J. H.: *28th Ann. Rep. N.Z.G.S.*, 1934, p. 7.