

A soil survey is, therefore, not a final investigation, but rather a means of determining the position and extent of soil-types. When these are delineated their cultural value is soon found, and measures can then be taken to increase their productivity in the most economical way.

3. ST. BATHAN'S SUBDIVISION.

(By H. T. FERRAR.)

In conjunction with the soil survey a geological survey of the flat country covered by the Public Works Department's irrigation projects in Central Otago and of adjoining hilly districts was undertaken. The area being geologically examined has not yet been definitely demarcated, but has provisionally been called the St. Bathan's Subdivision. The Alexandra Subdivision (N.Z. Geol. Surv. Bulletin No. 2) adjoins it to the south and west.

Mr. N. H. Taylor, of Auckland University College, who assisted in carrying out the geological mapping of the country adjoining the irrigation areas, covered an area of 306 square miles. In the course of soil-survey work I was able to map the geology of an additional area of 554 square miles, making a total area of 860 square miles. Field-maps of the following survey districts have been completed: St. Bathan's, Lauder, Blackstone, Idaburn, Naseby, Gimmerburn, Maniototo, Upper Taieri-side, and Upper Taieri.

PHYSIOGRAPHY.

The country examined includes parts of the following fault-block mountains—namely, Hawkdun Range, Mount St. Bathan's, Dunstan Range, Blackstone Hill, Rough Ridge, and Rock and Pillar Range, described in some detail by C. A. Cotton ten years ago ("Block Mountains in New Zealand," Amer. Jour. Sci., vol. 44, pp. 249-93; 1917); and three intermontane depressions—the Manuherikia Valley (upper part), Ida Valley (upper part), and Maniototo Plain. The depressions lie at an altitude of 1,000 ft. to 1,500 ft. above sea-level, and the even crests of the block mountains are 4,000 ft. to 5,000 ft. higher.

The chief streams of the district are the Manuherikia and the Taieri. The former drains Manuherikia Valley, Ida Valley, and a small part of Maniototo Plain; the latter drains the remainder of the plain. The numerous consequent streams draining the block mountains flow in narrow but not very deep valleys. Many of these on reaching the intermontane depressions lose themselves in detritus fans of their own making. The larger of them, however, coalesce, meander down broad flood-plains between terraces, and unite with the main streams in the lower parts of the depressions. At Linnburn Bridge the Taieri River emerges from a gorge, meanders first northward, then eastward over a swampy flood-plain to the now insilted Taieri Lake, then makes its way southward into another gorge, and so out of the subdivision. That part which flows through the south-east portion of the subdivision receives a great number of tributaries from all points of the compass.

GENERAL GEOLOGY.

Previous geological work in this part of the Dominion has been carried out mainly by J. Hector, F. W. Hutton, A. McKay, and J. Park. The district included in the St. Bathan's Subdivision is wholly within the area described in McKay's "Report on the Older Auriferous Drifts of Central Otago," published in 1894 (2nd edition, 1897). This report, with its small-scale map, has been of great assistance. The following tentative table shows the geological column as developed within the area under consideration:—

Approximate Age.	Composition and estimated Thickness.	Name.
Quaternary	Swamp, alluvial and æolian deposits; gravel, detritus fans, moraines; basalt flows and dykes. (<i>Erosion interval.</i>)	
Lower Pliocene or Upper Miocene	Greywacke conglomerates ("Maori bottom" or "sandstone gravels"), 1,000 ft. Soft sandstones and quartz-grits, 500 ft. Green shaly clays ("paper shales"), fossiliferous, 250 ft. Local lignite deposits (up to 30 ft.) Quartz-grits and fine quartz conglomerates, silicified in places, 500 ft. (<i>Unconformity.</i>)	St. Bathan's beds.
Lower Miocene (Awamoan)	Fossiliferous glauconitic greensands, 100 ft. (<i>Unconformity.</i>)	
Oligocene (?)	Green and red schist conglomerates, white-quartz conglomerates, 900 ft. (<i>Great Unconformity.</i>)	Kyeburn conglomerate.
Middle or Lower Palæozoic	Greywackes, grits, sandstones, argillites, phyllites, 5,000 ft. or more Foliated mica, quartz and chlorite schists, 10,000 ft. or more	Kakanui Formation. Maniototo Formation.

The Maniototo and Kakanui schists, phyllites, and greywackes form the fault-block mountains. The schists, a series of highly metamorphosed sediments, have been described in detail by J. Park in N.Z. Geol. Surv. Bulletin No. 2, and need no further mention here. The phyllites mark an intermediate stage of metamorphism between the unaltered greywackes and the schists. The detailed mapping shows that a mile-wide belt of phyllites separates the schists proper from definite greywackes, and that the greywackes and underlying sediments have been progressively metamorphosed as stated by P. Marshall in N.Z. Geol. Surv. Bulletin No. 19. Apart from this metamorphosis, no other evidence as to the age of these rocks has been found in the subdivision.