

The first six weeks were spent in the Mairoa district west of Te Fauti, where work was suspended last year and where geological maps were urgently required for detailed soil and pasture investigations in connection with the mineral content of pastures research (see pp. 3 and 23 in the 1929 Annual Report of the Department of Scientific and Industrial Research). During the month of May two small separated areas east of the Main Trunk Railway were surveyed, the one in the Kopaki district, where experiments with unhealthy sheep are being carried out by the Department of Agriculture, and the other in the Tiroa-Maraeroa district, where top-dressing experiments are being made by the Department of Native Affairs for the purpose of determining the suitability of the land for settlement under the Consolidation of Native Lands branch of that Department. In all, an area of about 80 square miles was surveyed in detail, and reconnaissances were made farther afield. Of this area, 60 square miles lie in Maungamangero and Pakaumanu survey districts that form part of Te Kuiti Subdivision, and 20 square miles lie in Hurakia Survey District.

AIR SURVEY.

In addition to the reconnaissances on foot that will accelerate future work, the Air Survey and Transport Co., of Auckland, has photographed from a height of 10,000 ft. a large area of partially explored territory east of the railway in Pakaumanu, Pahī, and Hurakia survey districts. The series of overlapping photographs are "tied" to points on the railway between Puketutu and Mangapehi railway-stations, and the "mosaic" forms a pictorial map of districts that will be examined shortly. The photographs are of great value for present and future use. They will save much of the time now used by the field geologist in making topographical maps upon which to place the geology, and they show in great detail the configuration of the land and its present condition as regards forest cover and developed pastoral areas. The photographs are of permanent value in that they can be used time and again to provide accurate and minute detail for topographic maps on almost any scale. The value of aerial surveys both from an administrative and an economic point of view is so well recognized in several countries that an air-survey unit forms part of their establishment. In those parts of New Zealand where ground surveying is difficult, photographic mapping will expedite the work of the geological survey, and a desired increased rate of mapping will be thereby attained.

GENERAL GEOLOGY.

Mairoa District.—On the east side of the Mairoa district disordered Triassic rocks containing casts of *Pseudomonotis richmondiana* are succeeded westward by Jurassic strata containing casts of *Pseudauella* sp. and *Inoceramus haasti*. These Mesozoic rocks form a broad plateau-like ridge, 1,200 ft. to 1,500 ft. high, flanked by Tertiary deposits which overlap upon them with marked unconformity, the Mesozoic rocks striking nearly north and having a nearly vertical dip, whereas the Tertiary deposits are almost horizontal. Inliers of Jurassic rocks also occur in the area covered with Tertiary beds. To the west of this area Jurassic rocks are again exposed in the valley of the Mangaohae Stream, and thence extending westward gradually gain height and form the Herangi Range. This range is a serrate ridge culminating in Maungamangero Trig. Station, 2,656 ft. above sea-level. In the strata on its flanks *Inoceramus* casts are abundant, and high on the range are lenses of green glauconitic sandstone containing the phragmacones of *Belemnopsis* sp. and other fossils. Since the Herangi Range is an escarpment facing west, a fairly complete sequence of these Mesozoic beds will be obtained when the survey is extended.

The Tertiary deposits that occupy the middle part of the district consist of mudstones, sandstones, and massive limestones. The mudstones are correlated with the Whaingaroa beds of Kawhia (see Henderson and Grange, 1926), and the sandstones and limestones are an extension of the Te Kuiti beds, and in their upper parts contain bands made up almost entirely of shells of the large oyster *Ostrea wollastoni*. Overlying these older sedimentary rocks are Pleistocene deposits of sand and gravel in patches, and over all is a tattered shroud of recent volcanic ash. These ash-beds cover great areas and, where not removed by erosion, are the parent material of the soil.

Kopaki District.—In the Kopaki district fault-blocks of greywacke and argillite, of supposed Triassic age, form hills that rise 1,800 ft. to 2,000 ft. above sea-level. An almost continuous sheet, 200 ft. to 500 ft. thick, of consolidated "Mamaku" rhyolitic tuff (see Grange, 1928), of late Pliocene age, surrounds these greywacke fault-blocks. Where this sheet is cut through by streams, underlying Mahoenui and Mokau beds (Cf. Henderson and Ongley, 1923) appear. Overlying the greywacke and rhyolitic tuff are Pleistocene deposits of sand and gravel in patches, and a sheet of recent volcanic material almost covers the whole countryside. This recent volcanic material resembles that at Mairoa, in that bands of brown andesitic (?) and of yellow rhyolitic earth underlies soils containing pumice-fragments, but differs from it in that at Mairoa the latest or "Taupo" pumice shower (Cf. Grange, 1929) is thin or absent, whereas in the Kopaki district this volcanic shower forms high terraces, is more than a foot thick on the low country, and is 2½ ft. thick on hill-tops.

Tiroa-Maraeroa District.—In the Tiroa-Maraeroa district Triassic rocks crop out only on the eastern and western margins, and Tertiary deposits are absent or concealed. The area examined is a not-deeply-dissected plain consisting of Mamaku rhyolitic tuff. As in the Kopaki district, this consolidated tuff is overlain by sands and gravels in patches, and by extensive, though comparatively thin, beds of brown andesitic (?) and yellow rhyolitic earth, over which is a thinner subaerial deposit of "Taupo" pumice. This pumice deposit is about 18 in. thick on the average, but where it has drifted or been blown into hollows it may be as much as 20 ft. to 30 ft.

THE SOILS.

In the past the geological survey has usually focused its attention upon the rocks *in situ* that build up the land, or upon the possibility of the presence of mineral wealth concealed at depth beneath; but latterly more attention than heretofore has been given to pedology—that is, to the shallower