

boundary of the slates curves to the south-east, and crosses the ridge into the Tiki Creek. Proceeding up the Tiki Creek the dip of the slaty shales is south-east, and the strike north-east and south-west; and a short distance further up, at the junction of the Tiki and Pukewhau Creeks, the soda-felsite or ceratophyre of the Tokatea is found to be interbedded with the slates, standing out above them as a huge dyke-like mass, much as it does in the Tokatea area. The Tiki Creek runs across the strike of the slaty shales for a distance of a mile and a half with the usual scenery of these rocks—deep gorges and numerous rock-pools. For the first 10 chains above the junction with the Pukewhau the Tiki Stream runs along a slickensided fault wall, striking north to south, and dipping west 55° to 60° . The felsite here weathers into a fine grit without clay or mud. Crushed and recemented breccias 2 ft. wide are met with along the course of the creek. The strike of the slates in the upper portion of the Tiki is east-north-east and west-south-west, with a dip to the east-south-east at high angles, giving a thickness in this section of not less than 5,000 ft.

On the Pukewhau track to Opitonui the slaty shales rise from the alluvial flat, and at a height of 770 ft. above sea-level are traversed by the Castle Rock dyke. At 950 ft. they culminate on the Pukewhau saddle. From the Pukewhau they may be traced to the Matawai, where they have much the same breadth of outcrop as in the Pukewhau area. At the Matawai Falls, however, the Palæozoic rocks are composed of false-bedded sandstones overlying a softer band of slate.

In the Awakanae Creek, a short distance from the mouth, an outcrop of the slaty shales occurs, which persists nearly to the source. The shales are here regularly bedded, and strike north-north-east and west-south-west, and dip north-north-west at steep angles, thus apparently forming a syncline with those of the Pukewhau and Matawai districts. The beds are composed of alternate coarse- and fine-grained sheets, varying from 2 in. to 6 in. in width. From the Awakanae the shales extend south to the Mill Creek. In this Palæozoic area the soil is devoid of bush and scrub, and the shales may be traced by the yellowish-white soil, poor herbage, and generally barren appearance. The overlying volcanic rocks, on the other hand, weather to a deep brownish-red ochreous soil, carrying a rich, green sward.

The junction between the shales and volcanic rocks may be easily distinguished along the course of the Mill Creek. In the andesites the valley is broad, shallow, and straight, but on passing into the slates it abruptly becomes narrow, deep, and sinuous, as shown in Fig. 2.

In the Mill Creek the slates strike north to south and dip west, but are evidently much disturbed.

On the Thames Road, a few chains to the north of the Mill Creek Bridge, they consist of fine-grained slates and overlying coarse sandstones. The underlying slates are considerably contorted. From this point the slate outcrop runs south out of the area under discussion.

A microscopic section of the above sandstone throws some interesting light on its origin. It is a dark-coloured even-grained rock, which under the microscope is seen to be composed of rounded and subangular fragments, cemented by a dark siliceous base. Quartz in rounded grains is fairly abundant, showing no crystallographic contours. Orthoclase is present, showing Carlsbad twins. A single fragment shows polysynthetic twinning, and is an albite felspar. Chlorite, resulting probably from the decomposition of hornblende, is present in long green lath-shaped crystals, exhibiting feeble dichroism from pale-green to dark-green. The most interesting fragments, however, are the inclusions of an ancient rhyolitic flow. These are from 1 to 2 mm. in diameter. In them the lath-shaped felspars are set with their longer axes approximately parallel, indicating the direction of flow of the ancient lava. When the lath felspars encounter a porphyritic crystal they curve round it and resume their parallelism on the farther side of the crystal, as exemplified in many modern rhyolites. The section, therefore, indicates that the slates and sandstones derived part of their materials from the denudation of an ancient acidic volcanic district.

Further evidences of the existence of contemporaneous volcanic outbursts are supplied by the interbedded ancient lava-flows of the Tiki Creek, the Tokatea Hill, and Koputauaiki Creek. In the Tiki Creek they are seen to be both underlain and overlain by black slaty shales, and to have a dip corresponding with that of the shales. The ceratophyres weather to a homogeneous rock by the elimination of the porphyritic felspars, and of the ferro-magnesian silicates, revealing then but little evidence of their igneous origin. The freshest specimen of this rock collected was from the No. 7 level of the Royal Oak Mine, Tokatea. It is a compact, whitish rock, translucent on thin edges, and breaking with a subconchoidal fracture. In thin sections under the microscope the base is felsitic, consisting of a cryptocrystalline aggregate of quartz and felspar, the result of devitrification. The felspars are large, varying in length and breadth from 2 to 4 mm. Polysynthetic twinning is abundant, and the extinction angle, 14° , indicates an acid type of felspar. The larger phenocrysts show zonal banding; some, however, are so much decomposed that they can be traced only by the outlines of their decomposition products. The ferro-magnesian silicate originally present has weathered, or rather decomposed, to chlorite, magnetite, and iron-pyrites, the magnetite occurring mainly along the crystal edges. On analysis, the rock gave the following percentages:—

Silica (SiO_2)	...	...	...	...	59.35	per cent.
Alumina (Al_2O_3)	...	...	...	...	21.30	"
Iron-protioxide (FeO)	...	...	...	...	10.06	"
Lime (CaO)	...	...	...	...	1.58	"
Magnesia (MgO)	...	...	...	...	0.48	"
Potash (K_2O)	...	...	...	...	0.34	"
Soda (Na_2O)	..	...	...	...	7.68	"

100.79