(3.) *Miocene.*—(*a.*) Brown and grey soft sandstone associated with pebble-beds. (*b.*) Blue fossiliferous sands and sandy clays, at places marly, and downwards becoming glauconitic. (*c.*) Grey micaceous sands, sometimes a hard sandstone weathering brown, with pebble-beds, and at places containing bands of coal conglomerate and coal comminuted to a fine sand.

(4.) *Cretaceous.*—Coal-bearing series. This formation is present to the west and north-west, but there is no evidence that it directly underlies the surface-area over which the oil appears.

(5.) *Carboniferous.*—Maitai series. These rocks are largely developed on the Paparoa Range from the source of Moonlight Creek to Brunnerton, and south-west of the Brunner Gorge in Mount Buckley, and thence some distance along the range to the eastward. The eastern limit of this formation is a line drawn from the sources of Snowy River, a branch of the Little Grey, which, passing Bell Hill on its western side, is continued south-west to Kanieri Lake, Camel-back Hill on the Kokatahi Plain, Constitution Hill, and Mount Greenland. Between the Brown Grey and Lake Brunner these rocks are not seen at the surface, but there can be no doubt that they underlie the Recent and Tertiary strata, and form the fundamental rocks of the district over which indications of petroleum have been traced.

(6.) *Crystalline Schists, Gneiss, and Granite.*—These lie to the eastward of the oil-bearing area, and need scarcely be considered in this connection.

Probable Source of the Oil.

Formations 6 and 5 may be disregarded as being a probable source of the oil appearing at the surface, for, though the Carboniferous rocks might be considered capable of affording such, a careful examination of these rocks on the Paparoa Range throughout the Reefton district and along the east side of Little Grey Valley* showed no indications of either oil or gas springs.

The coal-bearing formation does not show north of Stillwater or east of the Grey River over any part of the district south of the Brown Grey, and, from the presence of much broken coal in the next overlying formation, it may be presumed that, even though once present, the coal rocks have been denuded over the area within which evidences of oil are present.

The Recent gravels, gravels of the "Old-man bottom," the brown and grey soft sandstones of formation 3 (Miocene), and the blue fossiliferous sands and sandy clays of the same formation, though capable of holding and storing oil, can hardly be considered as a likely source of the same; consequently there but remains the lower division of the Tertiary rocks, 3 (*c*), to which the source of the oil can reasonably be referred. This, it has been shown, contains considerable quantities of carbonaceous matter, the result of the breaking-up of coal-seams that formed part of the next older formation—the Cretaceous, or coal formation of the west coast of the South Island—and to this source the oil may reasonably be referred.

Rocks in which the Oil is found.

The gravels of recent date may be considered as merely admitting of the passage of oil, and as in no sense constituting storage-beds. With respect to the next underlying beds, which are more or less saturated with oil, there is some difficulty in determining their position and age. They present the normal appearance of the "Old-man" gravels as seen at the Sawpit in Deep Creek, and the soft sandstone and pebble-beds associated therewith as immediately overlying strata are not inconsistent with the assumption that the coarser material should be referred to the "Old-man" gravels, but the hard bluish-grey micaceous sandstone associated has not elsewhere been observed in connection with such rocks. This sandstone, however, appears in connection with the lower division of the Miocene group as above classified, and is in the range of hills between the Lower Grey and New River seen to overlie the bands of broken coal which have already been referred to.

The section from the Grey River across the front hills by way of Nelson Creek to Bell Hill supports the assumption that the rocks storing the oil lie at the base of the Miocene group, and do not represent the gravels of the "Old-man bottom" of Pliocene age. Along this line the gravels of the "Old-man bottom" form the lower slopes of the front hills and cap the hills to the eastward, the lower slopes of which and the valley-bottoms show the underlying brown sandstones and fossiliferous sands and clays. On the eastern boundary of these hills a steep scarp is formed, and the lower grounds to the eastward admit of the underlying beds, 3 (*c*), making their appearance. It has been stated there is some doubt as to the position of the gravels at the Sawpit, as to whether they should be referred to the "Old-man" gravels of Pliocene age or to the base of the Miocene sequence. Further examinations must determine this point, but in the meantime the evidence favours the conclusion that it is the coarser gravels associated with the lower Miocene beds, 3 (*c*) of the classification given above, that constitute the storage from which oil is escaping at the present time, and the only reasonable conclusion as to the source of the oil is that it is the product of the beds of coaly matter that lie at a greater depth in the same beds.

Prospecting.

Practically no prospecting has been done, and no prospecting-holes have been sunk to a greater depth than 2 ft., and these are all in the recent shingle or alluvial banks of Deep Creek. A series of holes should be sunk in the gravels at the Sawpit above the level to which the ordinary flood-mark reaches. If oil collects in such holes, then it may be fairly assumed that the oil has penetrated to near the surface from below. It will then be for those concerned to determine whether the oil should be collected in seepage-wells, or whether an attempt should be made by boring to reach oil under pressure at greater depth.

6th December, 1900. ALEX. MCKAY.

* Various geological explorations between 1874 and 1895 have been carried on over the districts mentioned by the Geological Survey and Mines Departments.