

The highlands east of the Nelson depression, north of Tophouse, consist of strongly folded and well-consolidated conglomerates, grits, green greywackes, and well-bedded green and purple argillites. Thin lenses of limestone are present in places. These rocks form the Maitai Series, of supposed late Palæozoic age. Conglomerates and greywackes associated with igneous rocks occur in the basin of Rainy River as inconsiderable inliers, surrounded by Moutere Gravels and still later deposits. These are probably Maitai rocks. Possibly also the greywackes and argillites of a small area on the west side of the D'Urville Valley, a mile from the mouth of that stream, are of the same age.

The sediments forming the eastern highlands south of Tophouse are quite distinct from those of the Maitai Series. They consist of conglomerates, grits, greywackes, quartzites, and minor bands of dark argillites. The greywackes, which are the dominant rocks, are fine- or coarse-grained and dark- or light-coloured. The light-coloured and usually coarser-grained rocks are closely related to the quartzites. Many bands of greywacke contain angular and subangular fragments of dark argillite, and where these are numerous the rock becomes a breccia or breccia-conglomerate. Conglomerates consisting of smoothly rounded pebbles of igneous and hard sedimentary rocks also occur. The beds of this series closely resemble those of the Southern Alps in the Otira district. They are provisionally regarded as of Triassic age.

The older Tertiary rocks of the subdivision cover large areas in the Murchison depression, which is as yet almost unexplored. The basal beds, as exposed in the headwater branches of Owen River, consist of arkositic grits and sandstones, with bands of conglomerate, carbonaceous shale, and coal. These beds grade upward into sandstones and argillaceous sandstones, followed by more or less calcareous mudstones. The sections exposed along Sandstone Creek and the lower Owen valley show that the calcareous mudstones are succeeded by alternating bands of sandstone and mudstone, and these by massive sandstones containing plant-fragments. Massive mudstones next appear, and these are overlain by sandstones and conglomerates. Not enough work has yet been done to determine the position in the sequence of the conglomerates, sandstones, shales, carbonaceous shales, and coal-seams exposed between the Owen and Matiri rivers.

Crushed and steeply dipping Tertiary rocks outcrop in a narrow strip along the eastern base of the Hope Range from Glenhope to Mount Murchison. These strata, consisting of sandstone, shales, and carbonaceous shales, are probably of about the same age as those of the Murchison depression.

The younger Tertiary beds of the subdivision occur only in the Nelson depression. Compacted but not strongly cemented conglomerates, grits, sandstones, and shales with lignitic bands outcrop along one or both sides of the Hope Valley from Tadmor Saddle to the Buller River. The conglomerates consist of well-rounded pebbles of igneous rocks derived from the granites of the Hope Range and from the more basic rocks that form the floor of the Nelson depression in this locality. For the most part these strata lie flat, but in places they are steeply tilted. They were not observed in contact with the other Tertiary strata in the Murchison Subdivision, but a few miles north of Tadmor Saddle they overlie them unconformably.

Steeply dipping conglomerates and sandstones in every way similar to those near Glenhope outcrop over a small area on the ridge between the north end of Lake Rotoroa and the Howard River.

Between four and five miles north of Tophouse, conglomerates, sandstones, and shales, in places containing leaves of dicotyledonous plants, are exposed along the bed of Motupiko River for half a mile. The pebbles of the conglomerates are of rocks different from those of the beds near Glenhope, but they are for the most part igneous and derived from near-by sources.

The Moutere Gravels, the youngest Tertiary beds in the subdivision, cover a large area in the northern portion of the Nelson depression. In places they are more than 1,200 ft. thick. They consist of flat-lying, thick-bedded gravels, the pebbles of which are almost entirely siliceous greywacke derived from the eastern highlands south of Tophouse. The matrix is a sandy clay, which also forms inconstant lenses in the lower part of the gravels. The strata are usually weathered yellow, but in a few localities are outcrops showing the original blue-grey colour of the gravels.

All the upland valleys of the south-eastern highlands and many of those of the central highlands are strongly glaciated. The chief glacial deposits, however, are those of the Nelson depression. These had their source in the south-eastern highlands, from the base of which they extend irregularly for ten miles, and were probably laid down by a piedmont glacier. They are now greatly denuded, the main drainage-channels being in places 2,000 ft. below their surface. These deep-cut valleys, though almost certainly excavated by running water, were later occupied by valley glaciers belonging to a period of ice-advance younger than that of the piedmont glaciers. These deposited moraines at many points. Varved clays, in places contorted and overlain by boulder-clay, occur in the Howard basin. Similar clays outcrop in the Matiri Valley near the junction of that stream with the Buller. These are lake deposits, probably nearly contemporaneous with the deltaic fore-set beds exposed in the Matiri a mile from its mouth and the sands forming part of the south bank of the Buller west of Longford.

The chief Recent deposits are the fluvial gravels of the flood-plains and terraces and the mountain-screens.

Plutonic rocks, ranging from granite through diorite to gabbro, seem to form most of the floor of the southern part of the Nelson depression. This complex is best exposed about Lake Rotoroa and along the Gowan Valley, but even here it is in great part concealed by glacial deposits. In the lower valley of the Hope and at many points in the valleys of the upper Buller and Howard rivers it outcrops beneath younger Tertiary deposits. A small area occurs in the basin of Rainy River. Apparently an irregular land-surface, carved from the plutonic complex, and relatively depressed between the crustal blocks now forming the eastern and central highlands, was later smothered with young Tertiary and Pleistocene deposits.