

north and south. These ranges are in groups, divided from one another by trough-like valleys traversing the length of the chain. The two eastern ranges from the Bow Fort to the Sawback range are mainly composed of a blue limestone, sometimes cherty, sometimes compact, and sometimes crystalline, with fossils which belong either to the carboniferous or devonian epoch. As a rule, these strata dip to the west, the same beds are, however, exhibited again and again, being thrown up in plications of great magnitude. Behind the Bow Fort, the mountains rise as huge cliffs made up of the cut-edges of these strata, elevated to the height of 3,000 feet. Borne up on these limestones is a mass of strata composed of micaceous sandstone, with particles of carbon disseminated. This group also appears along Bow River and Deadman's River, after they leave the mountains. Along with these sandstones are intercalated carbonaceous shales, among which are to be found traces of coal and carboniferous plants, of which latter one was a calamite, somewhat like calamites *cannæ formis* of the coal measures at home.

Resting on the flanks of the limestone ranges are patches of the septaria clays and grits which are recognised at a distance by their earthy appearance. Such patches are found throughout the mountains at different points. Thus at the Vermillion River, the beds which, by their decomposition, give rise to enormous quantities of ochre along the courses of the smaller stream, seem to belong to this group. At the angle which this river makes, about fourteen miles from its source, there is a small patch of about one square mile in extent which presents an unmixed soil of ochre of a light reddish yellow colour, without a trace of vegetation on its surface.

To the west of the Sawback range the limestone was not observed, that range being composed of its bed cropping out vertically along the east side of a valley, in which stands Castle Mount composed of horizontal beds of a hard quartzose sandstone, passing into a conglomerate, and capped by brown slaty shale. At the Kootanie plain, on the north branch of the Saskatchewan this shale is seen to underlie the limestone.

The mountains which compose the height of land of the Vermillion pass consist of the same rocks as the Castle Mount, but in descending Vermillion River a white slate is met with, which again is succeeded by a deep blue compact limestone, associated with a clay schist, curiously banded with red layers. On the north branch of the Saskatchewan, the mountains at its source are composed of this blue limestone and banded schist.

The very complicated relations of these strata renders it impossible to form any sound view regarding their thickness or relative positions from data collected during one rapid survey, especially when it is remembered that they compose one of the most massive mountain chains in the world, the topography of which had to be learned step by step as the survey was made.

The most singular fact is, that no trace of the eruptive rocks which have caused the great convulsive movements of this portion of the earth's crust should be found in connexion with the dividing line of the mountains, from which the waters are thrown into the Gulf of Mexico, Hudson's Bay, the Arctic and Pacific Oceans. The direction of these waters seems altogether to be determined by the arrangement of the superficial deposit filling up the valleys.

Towards the lower part of the Vermillion River, the schists are fractured by slaty cleavage, but which is not very perfect. More to the south, however, from Mr. Sullivan's notes, I find that the mountains along the east side of the Kootanie river valley are composed of true clay slate, which also forms those at both heights of land crossed by Captain Palliser's party.

I have, &c.

John Palliser, Esq.
&c. &c.

(Signed) JAMES HECTOR, M.D.
