Mr. DOWLING.—The shales which form such a great deposit over the plains of the west, are in the main, sediments from muddy sea water, and contain but a small percentage of the remains of animal or plant life. There is, however, about the centre of this shale series one thick bed or formation in which there is obtained more evidence of marine life. In places these shales are found to contain many remains of fishes and shells. Minute animals, such as forams, are very abundant and the hydro-carbon compounds, evidently derived from these animal forms, constitute nearly fifteen per cent of the mass, and the shales are considered oil-bearing. If this percentage could be extracted as oil it would amount to about 30 imperial gallons per ton. The richer parts might yield this amount but the average would be much lower.

Q. Would there be any ammonia sulphate there do you think?—A. Small amounts have been determined from specimens not specially selected and it is quite possible better returns could be obtained from the richer parts.

Q. What would the area be?—A. The area of this shale is very large but it is covered generally by thick beds and the points at which it could be mined would be along its outcrop in the eastern edge of the escarpment which forms the plateau in the western border of Manitoba; that is, along the edge of the Pembina, Riding, Duck, Porcupine and Pasquia hills. The outcrop of this bed then turns westward toward the Athabaska river. In places there are exposures of these shales showing a thickness of about two hundred feet and a large part of this seems to be bituminous. In the southern part of Manitoba, southeast of Larivière, on the Pembina river, borings have been made in these shales for oil, but none was obtained except by distillation. Samples were sent to the Survey four years ago from this locality which showed the rocks bored through as well as a sample of the oil which was distilled from the mud from the bore hole. In the northern part of the outcrop of these shales, Mr. McInnes of the Survey, examined outcrops on the north slope of Pasquia hills. His report on this portion contains the following statement:—

> *The only exposures of rock in place met with on the mountain were found in gullies eroded by streams flowing down the hill-slopes. They consist for the most part of soft, grey, fissile shales that contain a considerable amount of bituminous matter, enough to cause them to burn freely with the emission of a strong odour of petroleum when heated in the camp fire. The best exposures were found in the valley of the Nabi river where a section in ascending order, as nearly as it could be made out, gave:—
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> Thirty-five to forty feet of thick-bedded, soft, grey bituminous shale or thin-bedded sandstone, holding the remains of fishes which seem to be *Enchodus shumardi,* large bivalves probably *Inoceramous problematicus* and *Foraminifera.* Though the first named species range widely in the Cretaceous of northern Manitoba they occur most freely perhaps in the Niobrara.
>
> Six inches of harder, compact, impure limestone filled with fine shells that are probably *Ostrea congesta.*
>
> One hundred and twenty feet or more of soft, fissile, light-grey (almost black when wet) bituminous shales holding the comminuted remains of fishes and many species of *Foraminifera.* Dr. Whiteaves, after preliminary examination, states that these fossils are clearly Cretaceous and very probably Niobrara. Mr. Wait found that these shales on ignition leave 70·17 per cent ash. From this the hydro-carbon content can be approximately inferred, as one-half or more of the remaining percentage would consist of hygroscopic and combined water. When heated to redness in the camp fire the hydro-carbons were volatilized and burned with a bluish flame giving off a strong odour of petroleum.

Since the publication of the above, special examinations of oil-shales have been made and include a later sample from the same locality. This was not specially selected for its oil-bearing properties hence the results are low. The nitrogen content

* Sum. Rep. Geol. Survey, Can., 1907, p. 45.