

THE GLACIATION OF NEW ZEALAND

PROFESSOR PARK'S THEORY OF A CONTINUOUS ICE-SHEET COMBATED BY DR MARSHALL.

One of the most interesting debates engaged in by the members of the Otago Institute was begun last night, when Professor Park and Dr Marshall joined issue on the question of the extent to which New Zealand was glaciated in ages past. Professor Park's theory, to which he was led principally by observations in the Wakatipu district, is that a continuous sheet of ice stretched practically over the whole of the South Island of New Zealand, and that the great Antarctic ice barrier in the glacial period extended over the sea that separates it from New Zealand.

The room at the Museum in which the members meet was crowded, and Dr Scott presided. It was intended that Dr Marshall should bring forward his arguments against Professor Park's theory, that Professor Park should reply, that Mr G. M. Thomson and Professor Benham should speak on the flora and fauna whose characteristics throw light upon the matter in debate, and then that the whole question should be open for discussion. But it was already so late when Dr Marshall had concluded his paper and Professor Park had made reply to one or two points that the meeting decided to conclude the debate next week.

The Facts in Brief

In summary a few of Dr Marshall's arguments against the assertion that an ice-sheet reached the east coast were: (1) The absence of moraines near the coast, except in the Taiieri Gorge, where there have been important earth movements; (2) the absence of till and boulder clay, the substances claimed to be such being loess, residual clays, moraines and valley trains, and old sea beaches; (3) the absence of roches motonnees, and striated glacial pavements, and erratics and striated boulders; (4) the absence of a glacial topography in coastal districts.

A summary of his comments on the conclusions drawn by Professor Park from the ice of the Wakatipu glacier would be: (1) The occurrence of ice in one valley does not justify the conclusion that the neighbouring valleys were ice-filled; (2) if the ice was 7,940ft thick at the Hector Mountains, and if it had the same surface slope as the Greenland ice-sheet, it must have extended far over the tops of all the western mountain peaks, which, however, are not glaciated.

Some of the arguments to be advanced against the suggested extension of the Antarctic ice-sheet were: (1) At the present time the ice nowhere extends into deep water; (2)

there is an absence of all effects of an ice-sheet at the Campbell and Auckland Islands; (3) no erratic blocks from South Victoria Land have yet been found in New Zealand.

Finally, Dr Marshall expressed himself as seeing no reason to depart from the view long held by New Zealand geologists that the amount of pleistocene glaciation in New Zealand did not reach the magnitude of an ice-sheet. On the western side the ancient glaciers reached the coast in many places in the south of the South Island, while on the eastern side they threaded far through the mountain valleys towards the coast.

Professor Park Begins his Reply

Professor Park, without touching upon his main argument, replied to a few points introduced by Dr Marshall. He said that, judged by some of the criteria which Dr Marshall had mentioned at the beginning of his paper, no ice-sheet ever crept over Scotland. The statement that almost the whole area of an ice-sheet was covered with till or boulder clay was quite true so far as the greater continental areas of Europe and America were concerned, but it was not true of an isolated case like that of Scotland, where the boulder clay was mainly distributed as a strip along the coastal plains. And in geographical position, topographical features, and size the South Island of New Zealand was more nearly related to Scotland than to the greater continental areas: and therefore in the matter of glaciation Scotland would seem to afford the better and fairer standard of comparison. Another of Dr Marshall's criteria was that the extreme limit of an ice-sheet was always marked by a terminal moraine. On the contrary, Geikie said that "no terminal moraine marks the southern limit of the ice sheet" that at one time covered Scotland and England. Again, Dr Marshall placed the maximum thickness of the ice-sheet in the Wakatipu basin at 5,240ft, as against the speaker's estimate of 7,490ft, because (as he put it) he had seen no glaciation on Ben Lomond (over 5,000ft) or Mount Dick (over 4,000ft). By carrying such a rule to its logical conclusion it would be easy to show that the thickness of the ice was even less than 2,000ft, for the speaker had seen many ridges and minor mountains in the Wakatipu region that showed no signs of glaciation whatever, and perhaps never did. But the height to which a stream rose during flood time was determined by the debris left at the highest point, and so it must be with ice-erosion. The summits of Mount Soho (5,723ft), of the Crown and Coronet Ranges (up to 6,000ft), still retained the impress of ice-erosion in many places, and the speaker considered his estimate of 7,490ft a conservative one.

At this stage the meeting adjourned. Next Wednesday night Professor Park will deal with Dr Marshall's remarks with respect to the extension of the Polar ice, and also with other criticisms.