

Whatever may be the epoch of the formation of the glaciers he describes, Oldham regards it as,

geologically speaking, extremely recent, and the facts and considerations detailed above show that within the time which has elapsed since that epoch, the Sind river has lengthened its course by 20 miles and added 150 square miles to its drainage area, while the range to the north of it has undergone an elevation of at least 2,500 feet as compared with the valley of Sonamarg, whose drainage formerly flowed through the valley now forming the Zoji-la.

In different summaries CHARLES RABOT, at the same time, discussed the results obtained so far; so for instance in *Exploration des Glaciers du Karakorum*.<sup>1</sup> In his *Glacial Reservoirs and their outbursts* he deals with some special kinds of phenomena. He describes the torrents of mud, in Baltistan called »shwa», which occur in the high valleys of the Western Himalaya and Kara-korum. In many cases the »shwas» are due to the dilution of glacial mud, encumbering the high valleys with the melting from snow and ice, but they are also often produced by glacier outbreaks. Inundations caused by the outflow of glacier lakes are very frequent. Some of the Kara-korum glaciers, as Baltoro, Biafo, Hispar, are the greatest on the earth. The average slope, RABOT gives as 3.5°. The lower limit of the *névés* is accordingly very high, 5,700—5,800 m. (18,696—19,024 feet), according to GUILLARMOD, 1902, on the Baltoro. A vast surface of ice is therefore exposed to fusion and the melting is very rapid; innumerable torrents are formed giving rise to border and surface lakes.<sup>2</sup>

In 1905 systematical observations on the secular movements of the principal Himalayan glaciers were begun under the control of the Geological Survey Department. Already in August and September, Officers belonging to the Geological Survey were sent to the glacial regions of Kumaon, Lahaul, and Kashmir. H. H. HAYDEN surveyed the Barche, Hinarche, Minapin, Hispar, Yengusta, and the Hasanabad Glaciers, all in the Kashmir region. H. WALKER and E. H. PASCOE examined the Bara Shigri and Sonapani in Lahaul, and P. COTTER and J. C. BROWN surveyed the Pindari Milam, Shan Kulpa, and Poting Glaciers in Kumaon. By plane-table sketches, cairns, photographs, *etc.* the state of the glaciers and moraines was fixed for the time of the visit. In this way starting points were made for comparative studies in the future. The chief object so far was the secular advance or retreat of the glaciers.<sup>3</sup>

Examining the reports HOLLAND found that the glaciers of the Hunza valley and the Kara-korum Range generally descend to lower altitudes than those in Lahaul and Kumaon. The former go down to 7,000 or 8,000 feet, the snouts of the latter

<sup>1</sup> *La Géographie*. Tome IX. Paris 1904, p. 374 *et seq.*

<sup>2</sup> *Geographical Journal*. Vol. XXV, 1905, p. 545.

<sup>3</sup> T. H. HOLLAND: *A Preliminary Survey of certain Glaciers in the North-West Himalaya*. By Officers of the Geological Survey of India. *Records of the Geological Survey of India*. Vol. XXXV. Calcutta 1907, p. 123 *et seq.*