PLEISTOCENE DEPOSITS AT PARANGANA DAMSITE IN THE MERSEY VALLEY

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(With 3 text figures and two plates.)

ABSTRACT

Pleistocene glacial and periglacial deposits filling a channel 200′+ deep and 200′ wide at Parangana Damsite in the Mersey Valley are described. It is suggested that the site is the location of a terminal zone.

INTRODUCTION

The following information is the result of further investigation of Parangana Damsite (Figure 1) in the gorge tract of the Mersey River ½ mile below the Fisher River Junction. The results of a preliminary investigation were given in Volume 99 of this journal.

At the damsite (Figure 2, Plates I and II) the Mersey River is superimposed and flows from south to north transverse to the structural trend. The gorge has been cut in vertically to near vertically foliated Precambrian Fisher Group quartzite, schist, phyllite and slate. It has a broad upper profile and a narrow buried U-shaped central channel 200′+ deep and 200′ wide. The profile of the channel has been defined approximately by drilling and seismic survey. The average core recovery in the channel fill has ranged from 40% to 80% and these results have been achieved by using triple tube core barrels, bottom discharge bits and mud as the drilling fluid.

CHANNEL FILLING

Details of the channel filling are shown on Figure 3. The bottom of the channel has not been located, but the bulk of the channel from SL940′ to SL1125′ (185′) is filled with what is considered to be periglacial solifluction material. This is overlain by glacial drift, which has a maximum thickness of 50′.

The periglacial solifluction material is unstratified and consists of angular rock fragments in a yellowish to reddish-brown sandy clay to clayey sand matrix. Along the dam axis, where the valley walls are formed by quartzite, the angular rock fragments (Drill Holes 5773, 5774, 5781, 5782, 5783, 5784 and 5791) consists mostly of pebbles, cobbles and boulders (up to 18″ diameter) of quartzite, with pebbles 1″ and less predominating. A few angular pebbles of schist and rounded pebbles of weathered basalt and dolerite are also present. Downstream, where the valley sides are formed by repetitions of quartzite and schist, the proportion of schist pebbles (Drill Holes 5767 and 5771) is markedly higher. In both areas the ratio of fragments to matrix averages about 60:40. On the left abutment a pocket of periglacial solifluction material up to 90′ wide and 30′ deep occurs within the glacial drift (Drill Holes 5774, 5783 and 5791).

The position of this quartzite fragment and clay deposit below and within glacial drift suggests deposition close in time and place to a glacial environment, whereas the angular shape and the predominance of quartzite and schist fragments indicates local origin with little transport. Coupled with the similarity of the content of the deposit with the composition of the immediately adjacent valley wall this is indicative of a periglacial solifluction origin. The drill core has been examined by Stephens (Glacial Geomorphologist, Queens University, Belfast) who agrees with these conclusions. The mass movements are considered to have taken place when the glacier was in the near vicinity, as a result of thawing of the surface layer in the summer months while the ground below remained frozen. That the material accumulated and filled the channel suggests that it dammed it at a time when the flow of water was greatly reduced, when precipitation remained in the upper reaches of the valley in the form of snow and ice.

A distinctive reddish-brown clay occurs in the core from Drill Holes 5768 (82′-114′), 5772 (120′-125′) and 5784 (80′-97′). It is missing in Drill Hole 5782 which lies between Drill Holes 5768 and 5784. In this hole the clay is replaced by periglacial solifluction material containing a sand band (87′-91′), suggesting erosion of the clay. The clay may be the result of a solifluction slide of basaltic material from Emu Plains, or it may be a till, but most probably it was deposited in a lake dammed by a solifluction slide.

Bands of fine to coarse-grained quartz, quartzite and schist sand and gravel, ranging up to 11′ in thickness occur within the solifluction deposit, and the distribution suggests that some may extend laterally over about half the width of the channel. These are probably fluvial or fluvioglacial deposits laid down between slides. Drill Hole 5767 on the right bank encountered a 52′ channel cut into the upper surface of the solifluction deposit and this was also filled with quartz, quartzite and schist sand and gravel.

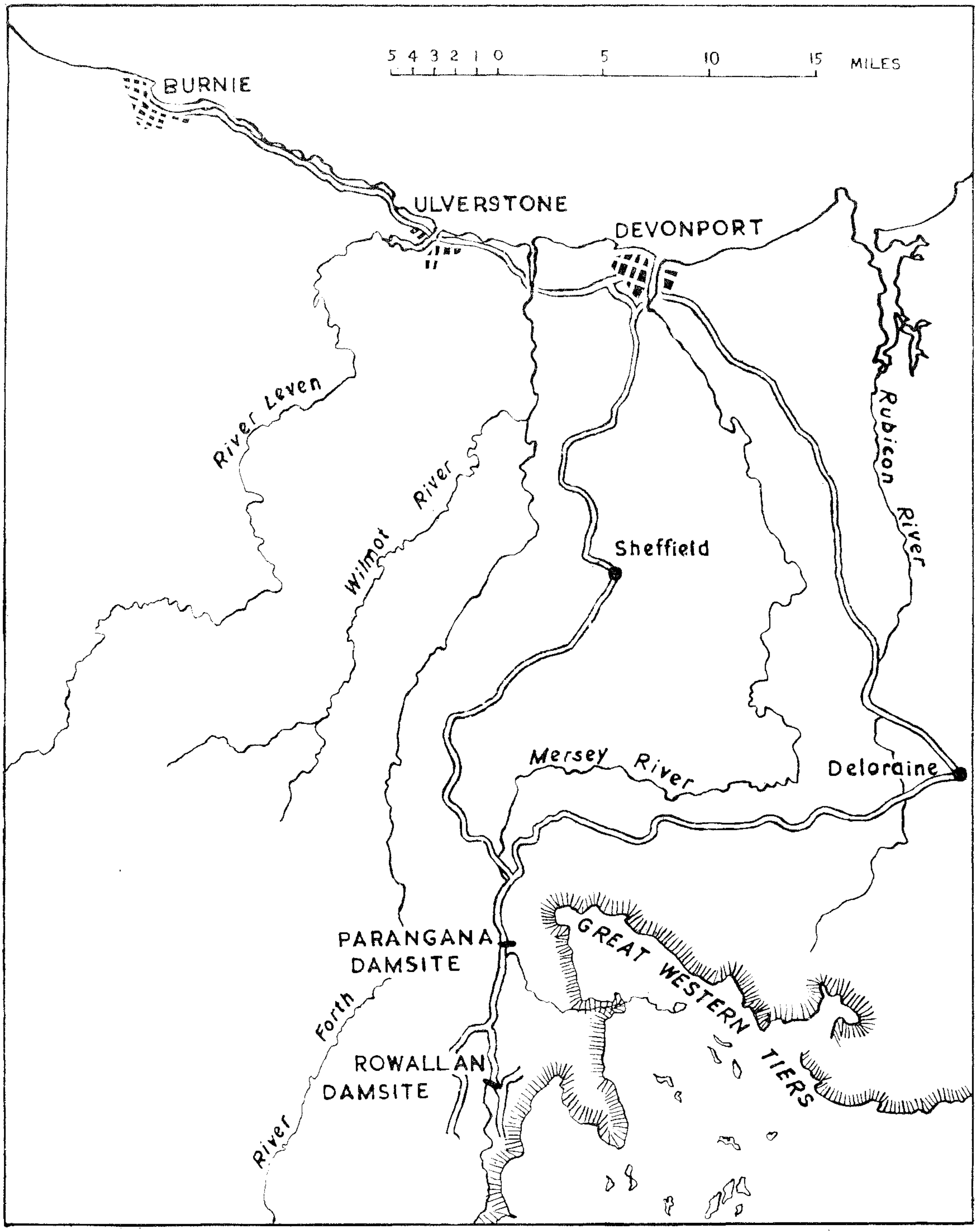

FIG. 1.—Locality Map.

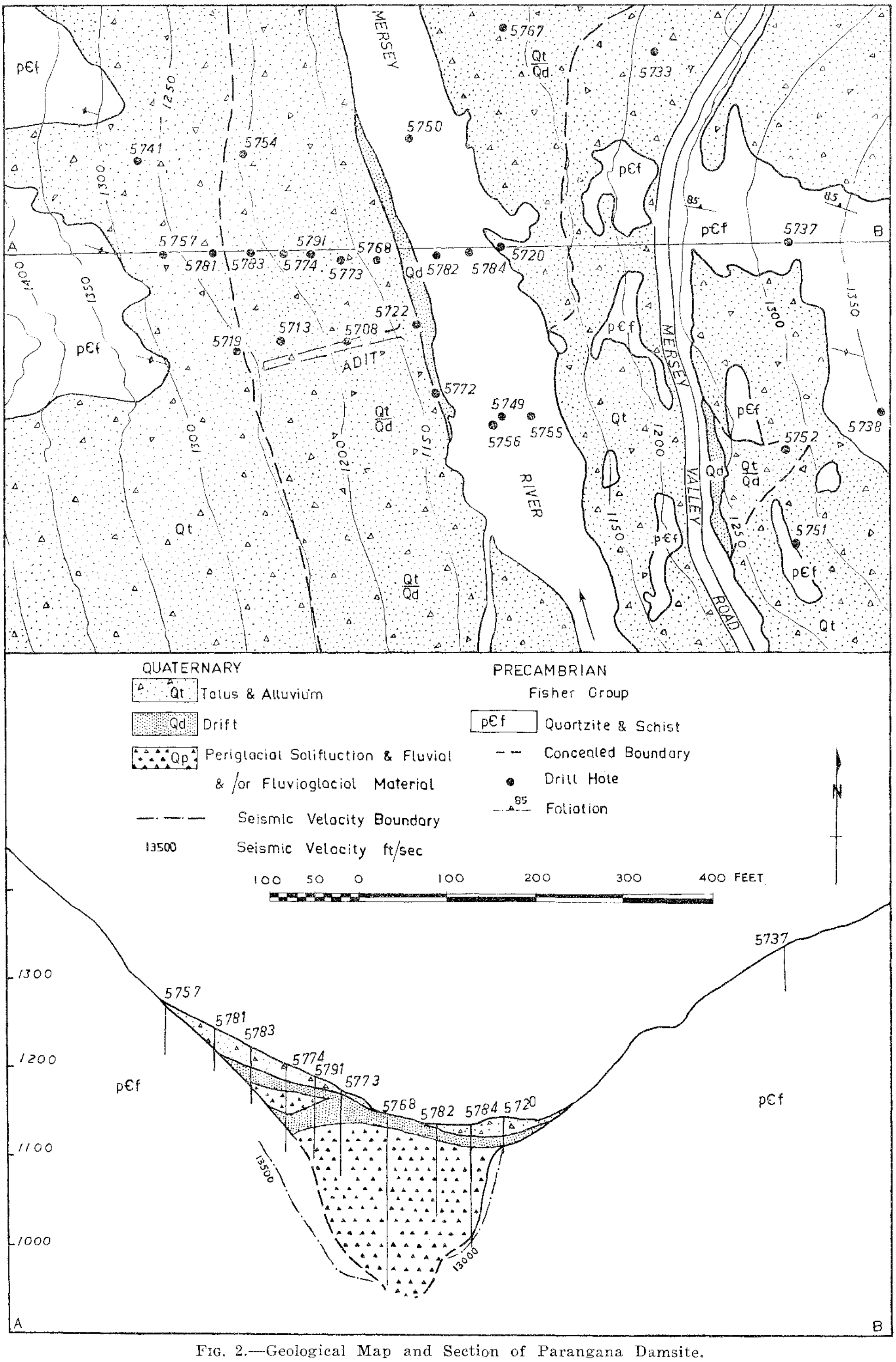

FIG. 2.—Geological Map and Section of Parangana Damsite.

GLACIAL DRIFT

The layer of glacial drift that covers the periglacial solifluction material extends onto both banks of the river, where it is in turn overlain by talus. The maximum thickness is about 50′ in the channel section, but a 20′ thick deposit occurs on the right bank 150′ above river level, and a 40′ thick deposit occurs on the left bank 130′ above river level.

An adit 110′ long was driven into the deposit on the left bank and in this up to 70% of the material consists of pebbles, cobbles and boulders, coated with clay, silt and sand. The material is toughly compacted, uncemented to weakly cemented, unstratified and heterogeneous, and the greater part has been derived from dolerite, with basalt, quartzite and schist contributing minor amounts. Boulders of dolerite and basalt up to 3′ in diameter occur and these are sub-rounded to rounded, whereas the boulders of quartzite and schist range up to 10′ diameter and are angular. The quartzite and schist boulders are locally derived, possibly superglacial till, but the dolerite boulders have been transported from the Central Plateau. The finer material is weathered yellowish-brown in the adit, but little matrix was recovered from the drill cores. Bands of medium grained quartz, schist and dolerite sand were located by Drill Hole 5772 (19′-19′6″ and 29′-34′) and the drilling mud was lost in Drill Hole 5773 at 29′-40′. It reappeared at the base of the slope 110′ downstream.

Subsequent river erosion has removed any topographic evidence of the nature of the deposit at Parangana Damsite. Nevertheless the drift appears to have been deposited near the limit of glaciation, for immediately downstream interlocking spurs replace the straight broad valley with truncated spurs that exists upstream of the damsite. The situation suggests terminal moraine conditions, such that both lodgment and ablation till might be expected. A degree of lithification corresponding to a weak tillite occurred in Drill Holes 5769 (47′-48′6″), 5770 (27′-31′) and 5771 (16′-20′) just off the northern edge of the Geological Plan (fig. 2) suggesting deposition as a lodgment till under a considerable weight of ice. By comparison the glacial drift in the adit is only a toughly compacted till, and the high proportion of coarse material suggests some washing by meltwaters and perhaps deposition as an ablation till. The presence of a pocket of periglacial solifluction material within the till suggests a retreat and readvance of the glacier. A high proportion of rounded pebbles and boulders occur in the till in the adit; this may be the result of weathering of the dolerite in the source area, the distance of transport (up to 20 miles), and reworking in part by water during transport.

The degree of weathering of the glacial drift at Parangana is unusually deep, for in the adit the matrix is weathered yellowish-brown at a depth of 85′ below the surface, which is 45′ below the base of the talus. Deep weathering also occurs at the Fisher River Junction where dolerite boulders are almost completely decomposed at a depth of 15′. By contrast the till in the Rowallan Damsite borrow area 7 miles upstream is fresh a few feet from the surface. Weathered material may have been transported by ice to the Parangana area from the upper valley, but the difference in degree of weathering may also be indicative of an age difference between the two deposits. The glacial drift at Parangana may be older than that at Rowallan Damsite.

TALUS

Talus obscures the greater part of the right abutment and all of the left abutment, and talus fans extend almost to plateau level on both sides of the prominent quartzite cliffs that lie above the left abutment.

The deposits have a maximum thickness of about 35′ (Drill Hole 5719) and slopes of up to 30°. Three test pits were dug on the left abutment and these indicate an upper few feet of loose rock fragments overlaying lightly compacted, tough, bony talus consisting of angular rock fragments set in a sandy clay matrix. The junction of the talus with the underlying drift is a free draining zone coated with black carbonaceous material.

The upper loose layer is moving under the existing environment but the thick compacted layer is considered to be the product of a periglacial environment and to have formed by solifluction (head) as the glacier retreated from the site. It is stable under the existing environment.

GEOMORPHIC HISTORY

The Mersey River took its present course (Spry, 1958) after extrusion of the Tertiary basalts, and at the beginning of the Pleistocene a valley about 1600′ deep was in existence. The nature of the basal deposits in the central channel is not known, but the profile indicated by drilling and seismic survey suggests some modification of the valley by glacial action. The central channel was filled by a series of solifluction slides, probably while a glacier remained in the near vicinity. During this period of reduced river flow the slides apparently effectively dammed the river permitting deposition of 32′ (Drill Hole 5768) of clay. The sand bands present are thought to be fluvial or fluvioglacial deposits laid down as the dams were overtopped. The presence of a pocket of solifluction material within the glacial drift suggests that at least two glacial advances occurred, at which time the solifluction deposits were protected from erosion by ground freezing. The location appears to have been near the site of a terminal zone.

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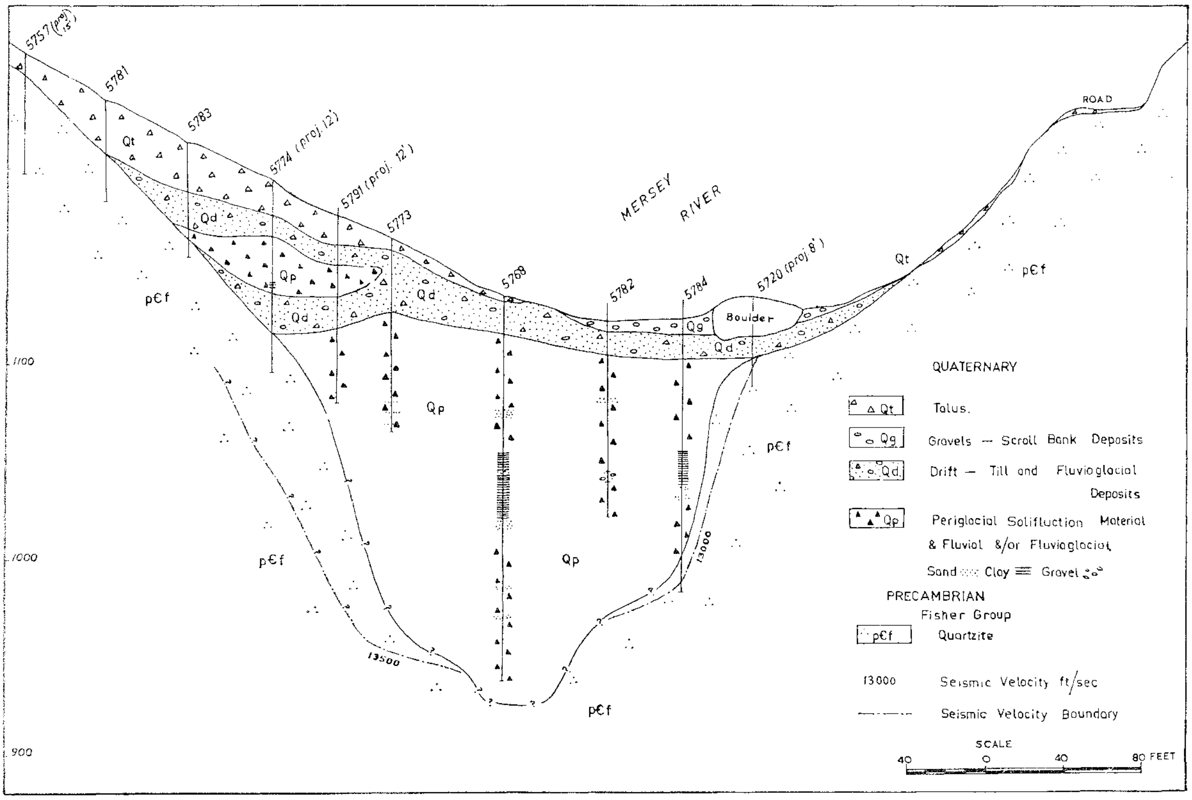

FIG. 3.—Details of the channel filling at Parangana Damsite.

PLATE I.—The left abutment of Parangana Damsite showing cliffs of vertically foliated Precambrian Fisher Group quartzite (Q) and the talus slopes (S). The lower part of the talus covers glacial drift.

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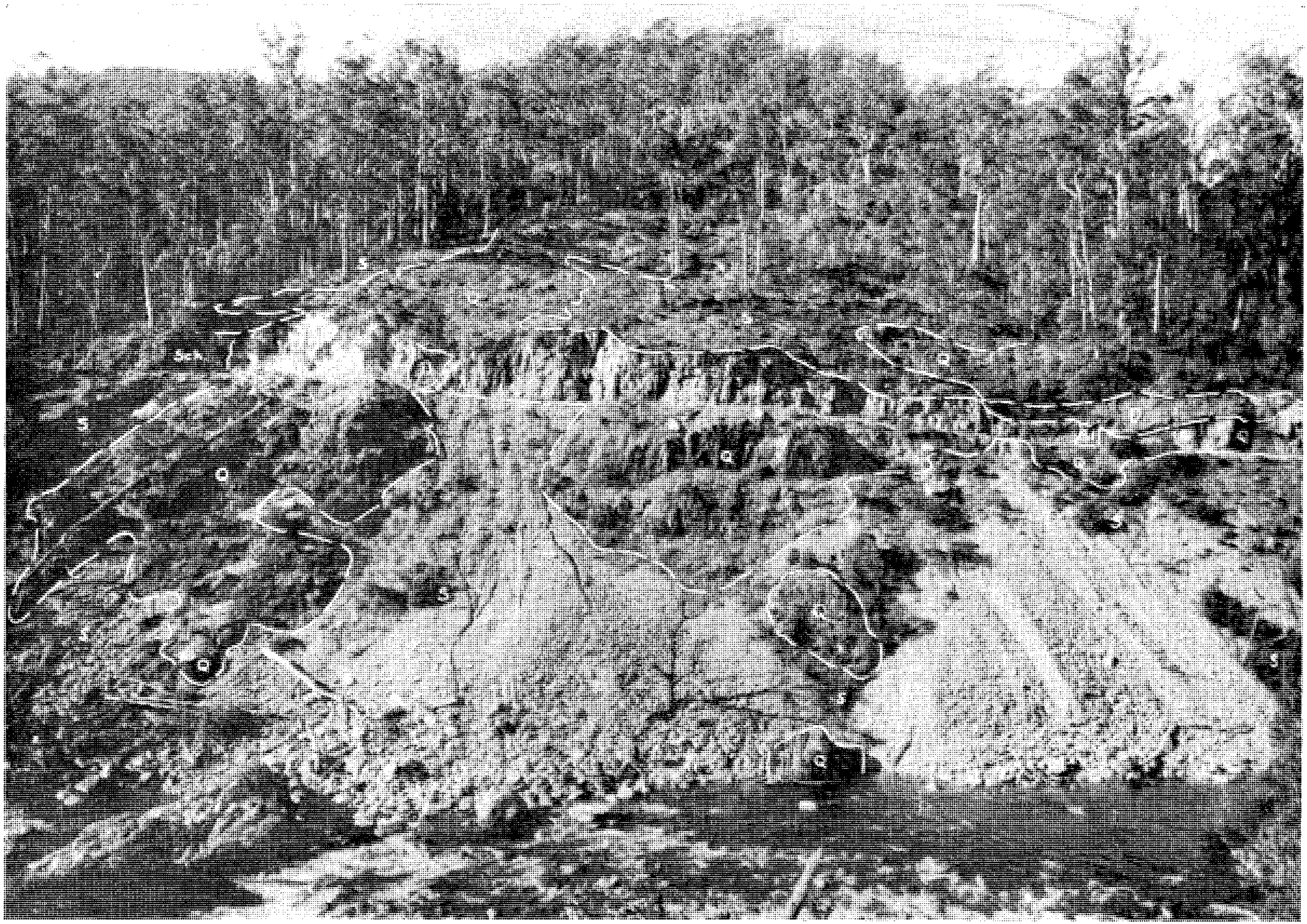

PLATE II.—The right abutment of Parangana Damsite showing cliffs of vertically foliated Precambrian Fisher Group Qutrazite (Q), schist (Sch) and slate (Sl). Glacial drift (F) and talus (S) cover much of the lower part of the abutment.