segregations. The fracture planes provided channels for late, metasomatizing fluids from which only microcline and hornblende crystallized. Late microcline and hornblende were not introduced into the mafic segregations which retain a much higher proportion of plagioclase. A noticeable concentration of microcline is present, however, around the margins of these segregations.

The tonalite described by Hoffman (1932) from Bald Butte is similar in composition and structural history to the adamellite of Granite Point, except that it has not been affected by metasomatism. The original intrusive foliation of both exposures of pre-basalt basement appears to have had a controlling effect on pre-basalt topography.

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The Glacial Geomorphology of the Puget Lowland, Washington and British Columbia: Comments and Selected References

The glacial geomorphology of the Puget Lowland has escaped detailed consideration in the literature of general Pleistocene events. Sufficient research in the area is now available in published form to provide a sound bibliographic resource. With the hope of increasing interest in this regional topic and with the aim of facilitating that additional activity, this list of selected references is offered.

The bibliographic listing is limited to those works dealing with Pleistocene glacial events and processes, while items concerning Holocene or more strictly glaciological topics have been excluded. William H. Reichert of the Washington Department of National Resources Library offered valuable criticism and additions to the reference list. Comments, additions or suggested deletions are solicited.

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Gravimetric Ice Thickness Determination, South Cascade Glacier, Washington

It is often important to know the thickness of a glacier in order to relate theory and observations of glacier behavior. The vertical dimension of a glacier is the most difficult to measure directly, requiring a large number of expensive bore holes. Of the indirect methods, gravimetric seems most practical because of the large density contrast between ice and rock, known upper surface, and simple field procedure. Of course, the interpretation of gravity data gives non-unique results. Nevertheless, if combined with other bits of information, limits can be applied so that the final results of the analysis should be fairly dependable. Gravimetric studies on other glaciers have shown that good results can be obtained (*e.g.,* Corbato, 1965).

A gravimetric analysis was carried out on the South Cascade Glacier. This is a small valley glacier (approximately 1 km wide and 3 km long) in the North Cascades of Washington, on which the Water Resources Division of the U.S.G.S. has been carrying out many aspects of glacier study for over 10 years. Earlier estimations of bedrock topography had been made by considering surface velocities, crevasse patterns, and surface topography (Meier, oral communication). The thickness had been determined by a hot point bore at two points (Tangborn, oral communication) and cross-sectional areas had been calculated from surface velocities and ice discharge (Meier and Tangborn, 1965).

Data Collection and Reduction

Field work was completed in two weeks of moderate weather in early July of 1968. Twenty-two transverse profiles were spaced approximately 150 m apart. A station spacing of approximately 100 m along each profile resulted in the establishment of about 200 stations. Stations were lined up by eye and marked with a survey flag. Each station was surveyed from two triangulation points with a Wild T2 theodolite. The triangulation network had been previously established. Station elevations were calculated by triangulation from the two points, and in most cases the elevations agreed to within 20 cm. The positions were plotted on a 1:6000 map. In all cases the gravity reading at a station was taken within 24 hours of the position survey to minimize errors due to the vertical and horizontal surface movements.

A Worden model #358 gravimeter was used. A bedrock base station was established, and all readings were tied to it in loops not exceeding three hours. Instrument drift was corrected by using this base as a standard and assuming a linear time relationship.

The standard Bouguer, free air, and latitude corrections were added to the station gravity readings. Eleven rock samples from localities around the glacier were collected