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Geologic studies in the northern Antarctic Peninsula, R/V *Hero* cruise 78-1B, February 1978

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Geologic investigations were carried out between 2 and 18 February on eastern Joinville Island and surrounding offshore islands and at Hope Bay (figure 1). Studies

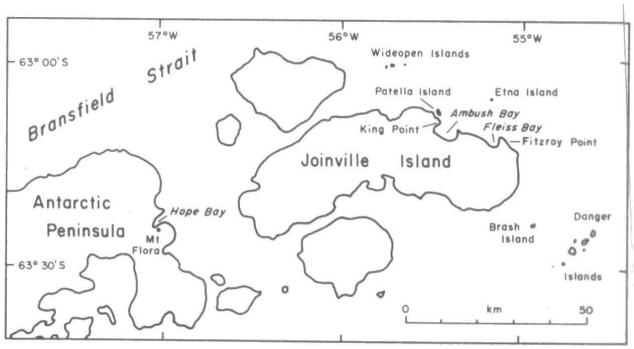

Figure 1. Location map of northern Antarctic Peninsula.

originally planned for the South Shetland Islands were not carried out because the cruise was terminated early.

The objectives of the studies were:

1. To investigate the Mesozoic conglomerates and associated rocks cropping out on Joinville Island and at Hope Bay, as part of the program initiated in 1974-75 to study the late Mesozoic and Cenozoic evolution of the Antarctic Cordillera through the sedimentary rocks of that age (Dalziel *et al.*, 1977; Elliot *et al.*, 1975; Elliot and Trautman, in press; Elliot and Wells, in press); and

2. To collect samples for paleomagnetic study to establish the position of the northern Antarctic Peninsula relative to South America and the east antarctic craton during the late Mesozoic and early Cenozoic (see Watts, in press).

Mesozoic sedimentary and volcanic rocks. The principal objective of this part of the program was to establish the relationship between the Mesozoic sedimentary and volcanic rocks (see Bibby, 1966; Elliot, 1967) that crop out on Joinville Island and at Hope Bay and the evolution of the Antarctic Cordillera. The sedimentology of the conglomerates suggests that all are alluvial fan deposits. Four sedimentary facies have been recognized, and at Hope Bay an evolution in the depositional environment is suggested by the vertical change from debris flows, through sheetwash conglomerate, to fluvial or lacustrine plant-bearing beds at the top of the section. All the conglomerates reflect erosion of the late Paleozoic-early Mesozoic Trinity Peninsula Formation. The alluvial fan deposits are probably related to fault block tectonism. The finer grained, plant-bearing sandstones at Hope Bay represent a sedimentary facies not preserved elsewhere, except possibly at inaccessible outcrops west of Fleiss Bay (see Bibby in Elliot, 1967); the plant beds are known to be either fluvial or lacustrine deltaic deposits, but a precise distinction must await further detailed fieldwork. Siliceous volcanic rocks occur at intervals through the sedimentary sequence at Hope Bay and form a thick pile of rocks conformably overlying the plant beds.

The unconformity between the conglomerate beds and the Trinity Peninsula Formation was observed at three places around Ambush Bay, and what appear to be Trinity Peninsula Formation outcrops were located very close to the conglomerates at Hope Bay.

Dating of these rocks has regional significance and, therefore, samples were collected for palynological study. It is hoped that such studies will help define the age of the conglomerates and refine the age of the plant beds.

Hope Bay is particularly important in the Mesozoic history of the northern Antarctic Peninsula (figure 2). Here the Trinity Peninsula Formation, which was deformed during

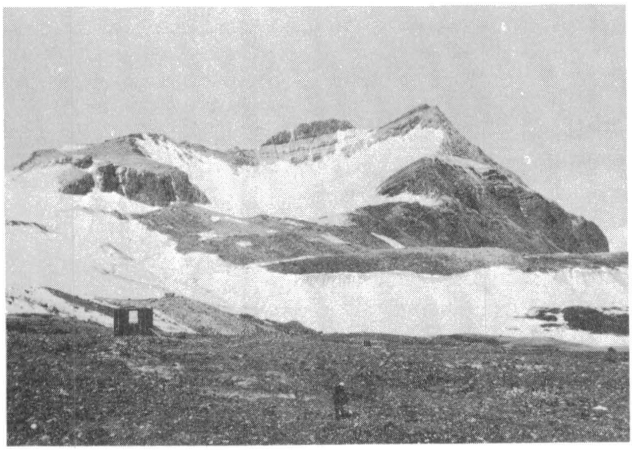

Figure 2. Mount Flora, Hope Bay. (The Trinity Peninsula Formation crops out on the low ground at the base of Mount Flora. The conglomeratic rocks form the lower north-facing cliffs (right-hand side of the photo) of Mount Flora below the prominent pale band located in the middle part of that face. The volcanic rocks form the upper part of that face and the rest of the mountain.)

the early Mesozoic Gondwanian Orogeny, is seen to be unconformably overlain by what probably are Jurassic sedimentary rocks. The conglomerates probably resulted from the erosion of the uplifted Gondwanian Orogen; however, these rocks, together with the overlying plant-bearing beds, have intercalated volcanic rocks representing the initiation of the Andean cycle. Nowhere else in the northern Antarctic Peninsula is this transition from Gondwanian to Andean events so well displayed.

Paleomagnetic studies. An extensive paleomagnetic investigation of Mesozoic rocks in the northern Antarctic Peninsula was initiated with the collection of 234 oriented samples from the vicinity of Joinville Island and Hope Bay. Wherever possible, oriented cores were collected using a commercially available, portable drilling apparatus; otherwise, oriented block samples were taken. The samples were oriented by clinometer and magnetic compass. Magnetic bearings were checked by a direct-reading solar compass (Stone, 1967) when possible.

Samples were collected from intrusive rocks at King Point, Fitzroy Point, and the offshore islands to the north and east of Joinville Island. Most of the units sampled in the area consist of gabbro, though a few have intermediate compositions. Intrusive rocks of granitic and intermediate composition were sampled at Hope Bay.

The Antarctic Peninsula Volcanic Group was sampled in detail at Hope Bay. Volcanic rocks above and below the plant-bearing horizons were collected. Because normal faulting has tilted some of the volcanic rocks up to 50°, the fold test of Graham (1949) may be applied to establish the stability of the magnetization of these rocks.

It is hoped that laboratory analysis of the samples collected will yield a well-dated Mesozoic pole position for the northern Antarctic Peninsula.

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Geological studies in southern Victoria Land, on Black Island, and on the McMurdo Ice Shelf

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Earlier dry valley glaciations (H.T. Brady and B. McKelvey, Armidale University, N.S.W.). Brady and McKelvey (in preparation) describe an ancient tillite at 2,750 meters on Mt. Feather overlooking the Skelton Névé, the Ferrar Glacier, and Beacon Valley. The deposit has many features in common with the Sirius tillites described by Mercer (1972), Mayewski (1972, 1975) and Barrett (in press). Brady and McKelvey mapped 57 directions on striated clasts and exposed two sections of striated pavement showing a glacial direction to the south-southeast towards and parallel to the Skelton Glacier. Brady and McKelvey's paleocurrent readings do not agree with those of Mayewski's thesis diagram, which shows a direction at Mt. Feather parallel to the Ferrar Glacier. No descriptions of the site are given in his text. Brady and McKelvey consider the tillite to be a remnant of an uplifted