for the permanent Weather Station of Marion Island, is interested in the preservation of the wild life of the island and will see that the disturbance of the vulnerable flora and fauna will be as small as possible. So far eight different weeds have been found on Marion Island. The vegetation on Prince Edward is practically undisturbed.

The results of this expedition are being worked out in co-operation with colleagues working on similar islands and in contact with the U.K. Scientific Committee on Antarctic Research. It is intended to publish the records of the expedition in the form of a monograph.

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Geological Studies

A BRIEF note[1], emphasizing the lack of geological knowledge about Marion and Prince Edward Islands, appeared in *Nature* two days before we set foot on the larger island in order to commence its first systematic geological survey. The field work, which entailed topographic and geological mapping, volcanological observations and sampling for geochemical, petrographical, geochronological and palaeomagnetic purposes, was completed between January and March 1965. This included a 5 day visit to Prince Edward Island of which no reliable map or any scientific information has yet been published. The generalized geological maps presented here (Figs. 1 and 2) are based on triangulation, Royal Air Force air photographs corrected by radial line plotting, and field sketches. Petrographic and other investigations are still in progress and will eventually be published in the final report of the expedition.

Marion Island

Marion is a sub-antarctic island situated about 900 nautical miles south-east of Cape Town (lat. 46° 54′ S., long. 37° 45′ E.). It is near the junction between the Atlantic–Indian and Crozet Ridges, occupying a similar position with respect to sub-oceanic ridges as the Tristan da Cunha island group much farther west. The island represents the top of a volcanic cone rising steeply from the ocean floor at a depth of about 12,000 ft., but has a low dome-like profile above sea level. There is no central cone or crater, and no evidence of previously existing ones. The summit, Jan Smuts Peak (alt. 3,890 ft.), is one of numerous scoria cones dotted about the island.

The island is roughly oval in outline and is some 115 square miles. It measures 15 miles from east to west and 10·5 miles from north to south. The western half is exposed to strong westerly trade winds often reaching gale force. Above 1,000 ft., this area is shrouded in almost perpetual cloud while the summit area from Jan Smuts Peak westwards carries a permanent or semi-permanent snow cover.

Physiographically the island can be divided into (*a*) a coastal plain, (*b*) an inland slope, and (*c*) the summit plateau.

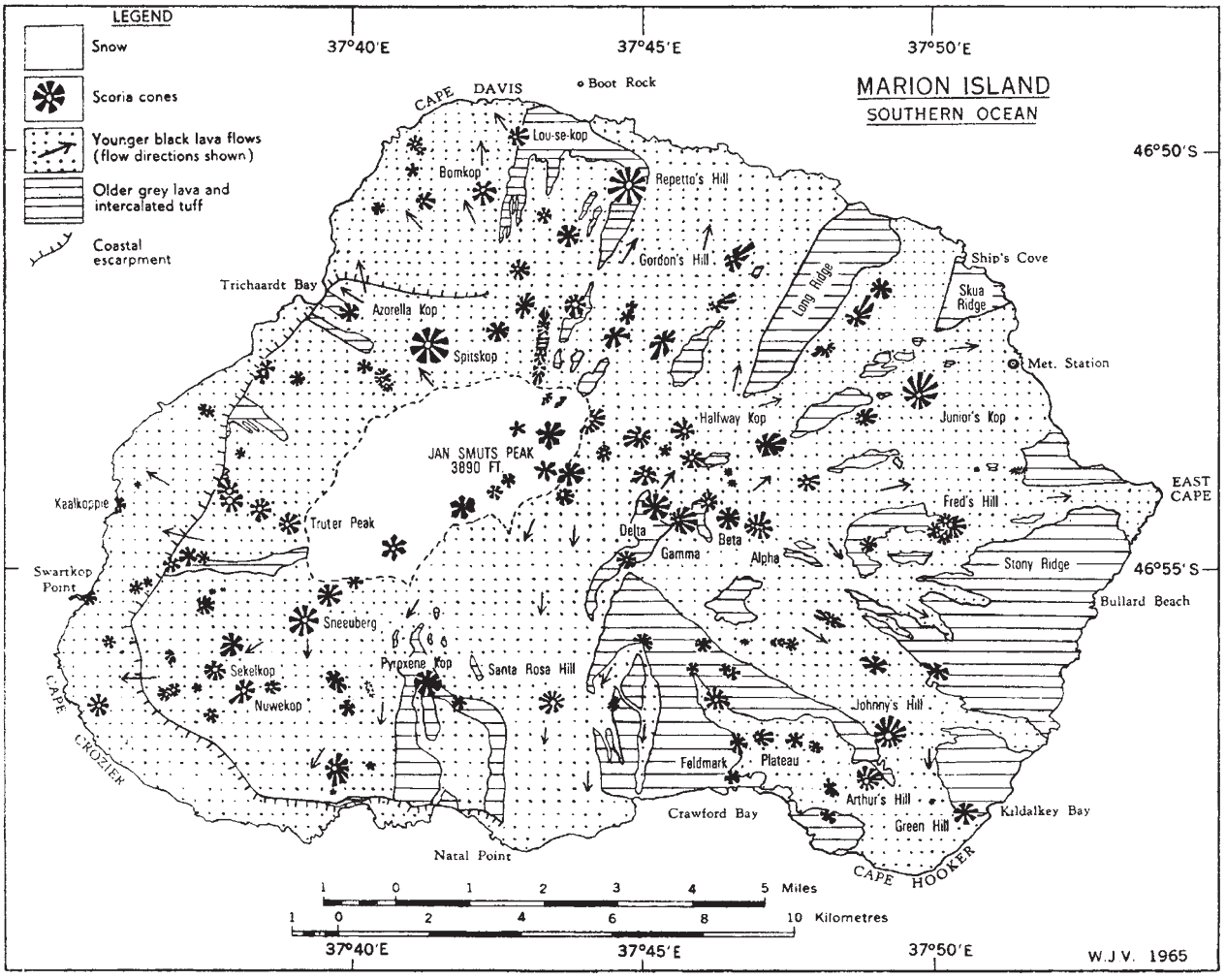

Fig. 1.

The coastal plain is only present along the western and south-western periphery of the island. It varies in width from 0·5 to 1·5 miles, and has an average altitude of 120 ft. above mean sea level. The generally flat, marshy surface is diversified by a few younger cones and lava flows. It is separated from the inland slope by an escarpment, 600–1,200 ft. high, trending parallel to the coast. Although the escarpment obviously represents a former coastline, the coastal plain is not considered to be a raised wave-cut terrace. It is built of lava that flowed over the escarpment on to an eroded shelf which is still submerged. The entire coastline of Marion combines the characteristics of retreat due to marine erosion and advance by seaward flow of lava. Low-lying areas which can perhaps be regarded as portions of a coastal plain are also found in the north-eastern half of the island, for example, between Repetto's Hill and Long Ridge and at East Cape. These areas, however, have tectonic boundaries and merge gradually with the inland slope; they are therefore different from the south-western coastal plain, both in shape and origin.

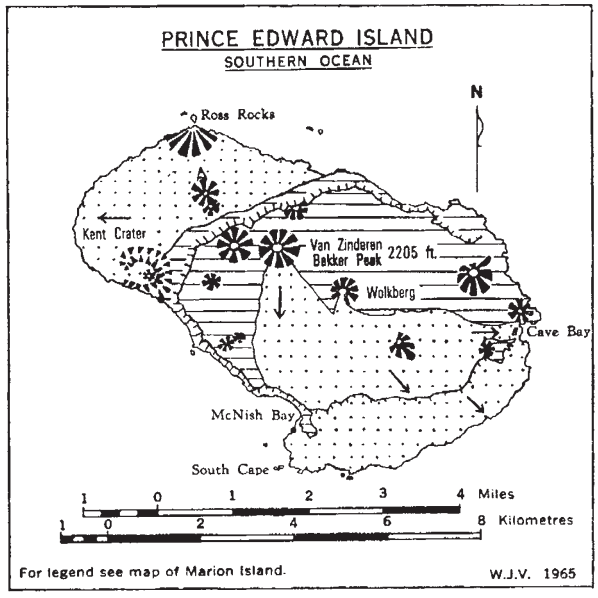

Fig. 2.

The inland slope comprises the greater part of the island. Despite a fairly smooth profile, the slope is by no means an even surface. Conical hills rise up to 750 ft. above it, and the eastern half of the island consists of roughly triangular plains and plateaux arranged around the central peaks in alternating fashion. Long Ridge and Feldmark Plateau are two of the most prominent highlands, adjoined on both sides by broad valleys that can be ascribed to relative depression. Stony Ridge is part of a segment with intermediate elevation.

The summit plateau is a narrow strip above 2,500 ft. extending for a distance of about 4 miles from Alpha Kop westwards. Two conspicuous cone lines, one from the south-west and the other from the south-east, meet here. Vast quantities of younger black lava were poured out from the summit plateau on to the lower slopes.

Geologically, two stages in the evolution of the island can be distinguished. The first stage is represented by a succession of grey lava flows (trachybasalt ?) with interbedded tuff and agglomerate. The lava flows dip at low angles seaward and vary in thickness from a few to about 100 ft. They are vesicular but very seldom scoriaceous. Most grey lava is massive and often it is columnar jointed. Megascopically, several petrographic types appear to be present, some of them porphyritic. Gabbroic or ultrabasic inclusions have not been encountered. The areas built of the grey lava succession strongly contrast with the younger black flows and protrude as isolated inliers through the latter. The grey succession is thought to be much older because its topography is smoothly rounded, well established water courses exist, minor irregularities of the coastline have been erased, and prolonged mechanical weathering has resulted in surfaces strewn with rock slabs.

The second stage again gave rise to effusive and pyroclastic products, the latter being restricted to the mostly unconsolidated cone-building scoriae already mentioned. The lava belonging to this stage is black basalt with olivine but individual flows contain different proportions of feldspar, olivine and pyroxene phenocrysts. The two analysed specimens described by Abbott[2] undoubtedly belong to the younger suite, even though he referred one of them to the older grey series. The numerous flows that must have succeeded each other over a long period of time can be distinguished. Some are covered with vegetation on the lower slopes of the island, while others are bare and appear to be no more than a few hundred years old. Some scoria cones are partially buried by the latest lava flows. The most striking difference between the black lavas of the second stage and the older grey succession is that the former still shows all the primary features of an uneroded volcanic landscape, for example, lava tunnels, lava channels, lava levees, tumuli, spatter cones, craters, aa and pahoehoe. The stream pattern is determined by the contacts between adjacent flows, while the previously established drainage has been disrupted at many places by black lava flows following pre-existing valleys. Where outbuilding flows of black lava form the coastline, initial irregularities have been accentuated by wave erosion.

There is considerable evidence in favour of tectonic movement between the two stages. The high plateaux are invariably built of older grey lava and intercalated tuff, to a greater or lesser extent concealed by younger lava flows. In the intervening plains and valleys, however, the grey succession is buried beneath great thicknesses of younger black lava. The plateaux are often bounded by straight lines of cliffs extending radially from the central highland. Moreover, some scoria mounds are also aligned along such radii. It is concluded that the major features of the inland slope are fault blocks; the valley containing Santa Rosa Hill, for example, is best described as a rift valley. Variable tilting of individual blocks during radial fracturing would also explain, in part, the asymmetric development of a coastal escarpment.

We found no fumaroles or other signs of recent volcanic activity.

Prince Edward Island

Prince Edward Island is 12 nautical miles north-north-east of Marion and represents a subsidiary peak of the same volcano. Two stages in the geological evolution corresponding to those on Marion have been recognized. The older group of grey lava and tuff builds mainly the central, high part of the island bounded on the north-west and south-west by steep coastal escarpments, up to 1,500 ft. high. During the second stage of volcanism, scoria cones were built up on the older succession and black basaltic flows extended the island both to the north-west and south-east. The black lava flows are all covered with vegetation, which seems to suggest that volcanic activity on Prince Edward came to an end earlier than on Marion.

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[1] Truswell, J. F., *Nature*, **205**, 64 (1965).
[2] Abbott, D., *Ann. Geol. Surv. S. Afr.*, **2**, 89 (1963).