BRITISH ANTARCTIC SURVEY SCIENTIFIC REPORTS

No. 44. C. M. BARTON. The Geology of the South Shetland Islands: III. The Stratigraphy of King George Island. 1965. 33 pp. 18*s*. 0*d*.

THIS is the third in a series of reports on the South Shetland Islands, the previous work having been described by D. D. Hawkes in *Falkland Islands Dependencies Survey Scientific Reports* Nos. 26 and 27.

The dominant trend of King George Island appears to be governed by lines of tectonic weakness parallel to the general line of the South Shetland Islands. The Jurassic volcanic rocks, together with the plutonic rocks of the Andean Intrusive Suite, form a central axial core stretching from the south-west coast to the north coast east of False Round Point. Down-faulted lavas (and occasional intercalated sediments) of Upper Cretaceous–Tertiary age are present to the north and south of this belt, but farther south Pliocene–Recent rocks are exposed. Throughout the Upper Cretaceous–Miocene, volcanic eruptions seem to have been associated with the lines of faulting which bound the central area of older rocks. It is suggested that the Pliocene–Recent volcanic rocks to the south are also connected with this fault zone.

A comparison between stratigraphic successions proposed by Ferguson (1921), Hawkes (1961) and the present author is given. The author has found no evidence for the existence of the Basement Complex *in situ* and he suggests the oldest rocks of King George Island are Upper Jurassic in age.

The great thickness of Jurassic volcanic rocks is dominated by pyroxene-andesites. All these rocks are altered to some extent, silicification, pyritization and epidotization being widespread. The metasomatism is mainly associated with the later Andean plutonic intrusions. Intense shattering and jointing are present in these Jurassic rocks, whereas the post-Jurassic rocks are relatively undisturbed. Individual exposures of the Jurassic rocks are described, but the author has found it impossible to make an accurate correlation between them. Detailed stratigraphical successions are compiled for north-west Potter Cove and Keller Peninsula.

The Jurassic volcanic rocks are intruded by plutonic and hypabyssal rocks of the Andean Intrusive Suite, which is thought to be either late Cretaceous or early Tertiary in age. As yet, only granodiorites, quartz-diorites and quartz-gabbros have been recorded. Andean rocks are well exposed at Rose Peak, Crépin Point and Noel Hill, but the plutonic intrusion reported by Hawkes (1961) on the North Foreland peninsula was not recorded.

Quartz-pyrite lodes invading Jurassic lavas are described from Barton and Keller Peninsulas, the largest attaining a width of 170 yd. (156 m.).

In this report, the four mappable sub-divisions of the Upper Cretaceous–Miocene volcanic rocks contrast with the two groups described by Hawkes from petrological evidence. The Dufayel Island Group, thought to be the oldest sub-division, is situated within a major east–west trending fault zone. Pyritized and silicified sediments containing Cretaceous–Tertiary leaves and plant fragments are overlain by altered andesite lavas. The younger Ezcurra Inlet, Fildes Peninsula and Point Hennequin Groups are free from mineralization and clearly post-date the Andean intrusions. Both the Fildes Peninsula and Point Hennequin Groups contain rounded inclusions of granite and quartz-pyrite, indicating that they were preceded by a period of erosion.

Structural evidence shows that the Ezcurra Inlet Group pre-dates the remaining two groups, and an Oligocene–Miocene age is suggested. These rocks consist basically of hypersthene-augite-andesites, although basaltic andesites and augite-andesites are also present. This line of volcanic centres was initiated south of the outcrop of Jurassic rocks. A detailed succession of the rocks at south Ezcurra Inlet is given.

Dominantly basaltic andesite lavas, together with minor hypersthene-augite- and augite-andesites, constitute the Fildes Peninsula Group, which forms a line of volcanic centres north-west of the present outcrops of Jurassic rocks. This group is subdivided by minor unconformities into andesitic lavas (oldest), sedimentary rocks, agglomerates with subordinate lavas and tuffs, and lastly, andesites with interbedded tuffs. The field relationships between these sub-divisions are well illustrated in a large-scale geological map of Fildes Peninsula.

The youngest group of Upper Cretaceous–Miocene rocks, the Point Hennequin Group, comprises predominantly hypersthene-augite-andesites together with thick trachyandesite flows, which have a petrological affinity with succeeding Pliocene–Recent volcanic rocks. Plant-bearing sediments are also present.

The Lions Rump Group includes a marine conglomerate containing the fossil *Pecten*, suggesting a Pliocene age which is confirmed by preliminary work on the Foraminifera. The volcanic succession includes augite-andesites, hypersthene-augite-andesites and olivine-basalts. A very detailed map illustrates the geology of Lions Rump.

Resting unconformably on the Pliocene rocks is the Penguin Island Group consisting mainly of olivine-basalts. These volcanic centres can be traced in a line along the south coast of the island, but no accurate correlation could be made between the individual exposures.

Moraines and raised beaches are described and provide evidence for a reduction in the ice cover together with a drop in relative sea-level.

The detailed successions and maps given throughout this report should prove most valuable for any future geological work undertaken in the area.

No. 45. S. W. GREENE. The Vascular Flora of South Georgia. 1964. 58 pp. 32*s*. 0*d*.

THE last account of the flora of South Georgia was that of Skottsberg, published in 1912. Since that time further botanical information has resulted largely from the post-war activities of members of the Falkland Islands Dependencies (later British Antarctic) Survey, culminating in Dr. Greene's visit to the island in 1960–61. This publication, therefore, may be considered to bring up to date our knowledge of South Georgian plants and to provide a basis on which to plan future research.

During the past 50 years the number of native species known from the island has risen from 19 to 24, while the alien list has increased spectacularly from 1 to 27. In view of the prominence of introduced species in insular floras such as this, the author's discussion on their status in South Georgia is particularly important and his division into naturalized and transient aliens provides a useful yardstick for future observations. The nomenclature is based on published information, supplemented in some cases by personal advice from specialists on certain groups, and no taxonomic revisions were undertaken for the flora. A key is provided for identifying the native and naturalized alien species, for which descriptions and distributional data within and outside South Georgia are given. The descriptions are generally clear and to many are appended interesting observations made on the plants in cultivation. They should be useful both to botanists and to the many non-botanists who frequently spend some time on the island. In view of the latter, it is rather disappointing that the transient aliens were not described and included in the keys, instead of being merely listed. The person on the island wishing to identify a plant, probably with no other reference source available, seems to be unnecessarily penalized and future information on aliens, at present transient, may be less forthcoming from interested non-botanists. Furthermore, changes in status are to be expected; indeed three transient aliens are accorded naturalized status in footnotes. A notable feature of the work is the series of maps showing distribution within the island of all native and naturalized alien species, based on presence in the squares of a 5 km. grid. An excellent map, with the overlying grid, is provided in an end pocket so that this work can readily be extended by future visitors.

A short account is given of the major plant communities, illustrated by some good photographs. Although detailed ecological studies have yet to be undertaken in South Georgia, it is obvious from his account that the author's personal field observations have resulted in a clearer delimitation of the plant associations that was previously available. The historical résumé of botanical exploration usually given in accounts of this kind provided an unexpected and welcome bonus to the reader. The author has been at pains to provide information on the species recorded by previous collecting expeditions and, in tables, gives the location in the world's herbaria of what he considers to be a great part of the material from South Georgia.

The style is eminently readable, the photographs and other illustrations are well chosen and well reproduced, while the type and lay-out are extremely attractive. Altogether this work

should provide pleasant and profitable reading for those who either may find themselves on South Georgia or may wish to take a vicarious botanical trip to this part of the world. Both the author and editors are to be congratulated on a useful addition to the *British Antarctic Survey Scientific Reports*.

No. 51. N. AITKENHEAD. The Geology of the Duse Bay–Larsen Inlet Area, North-east Graham Land (with particular reference to the Trinity Peninsula Series). 1965. 62 pp. 40*s*. 0*d*.

IN this report the author describes the geology of a 2,000 sq. mile (5,175 km.^{2}) tract of territory extending south-westwards from the Hope Bay area, which was one of the first parts of the Antarctic continent to be geologically investigated.

Some aspects of the geology of the coastal periphery and of a few specific localities within this area have already been investigated by earlier workers and form the subjects of other reports in this series.

The rocks range in age from (?) Carboniferous to Tertiary and, apart from an additional formation of banded hornfelses of limited extent, the broad stratigraphical sub-divisions set up by Adie (1953) for the greater part of the Antarctic Peninsula are found to be generally applicable to this area.

The Trinity Peninsula Series sediments and their metamorphic equivalents are discussed in more detail than the other rock groups, because they are the commonest and most widespread rocks in this area. These sediments comprise mainly greywackes and siltstones intercalated with grey mudstones in a monotonous succession having an estimated total thickness of the order of 45,000 ft. (13,715 m.). Conglomerates, pebbly mudstones, red and green mudstones, cherts and greenschists occur locally. Though little evidence is presented concerning either the age of these rocks or the palaeogeography of their source areas, it is clearly shown that the rocks were derived from a terrain comprising mainly granite-gneisses, quartzites and sub-arkoses, and acid volcanic rocks. Petrographical descriptions, modal analyses and pebble counts of the arenaceous and rudaceous rocks provide the evidence for these conclusions and a basis for comparison with descriptions of other thick geosynclinal sequences in the Antarctic and Andean sectors of the circum-Pacific orogenic belt.

Careful consideration is also given to the regional and thermal metamorphism of the Trinity Peninsula Series. The evidence provided by the petrographic examination of many specimens is used to illustrate a gradual increase in low-grade metamorphism towards the south-west, accompanied by more intense and complex deformation. Metamorphic rocks above the chlorite grade occur only where plutonic intrusions have superimposed their effects on the pre-existing rocks, producing quartz-biotite-hornfelses and mica-cordierite-andalusite-schists.

Several photographs illustrate the style of the folding in the Trinity Peninsula Series, particularly the isolated disharmonic folds which occur in the north-east where there is a fairly uniform steep or inverted dip on the south-east limb of an anticlinorium.

The other groups of rocks are described in less detail within the context of the general stratigraphy of the area. They include a distinctive group of banded hornfelses (of uncertain age) with a minimum thickness of 2,000 ft. (610 m.). These rocks have been thermally metamorphosed by intrusions of the Andean Intrusive Suite but they show no evidence of deformation by the major pre-Jurassic orogeny which was responsible for folding the Trinity Peninsula Series.

New occurrences of sedimentary, volcanic and associated hypabyssal rocks belonging to the Middle Jurassic beds and the Upper Jurassic Volcanic Group have similar fossil flora and petrographic characteristics to those already described from adjacent areas. At one locality (Tower Peak) they are shown to rest with strong unconformity on Trinity Peninsula Series metasediments.

Major granodiorite-granite plutons are assigned on petrographic and structural evidence to the Andean Intrusive Suite. These plutons are shown to intrude relatively small intrusions of tonalite but there is little evidence in this area of associated metasomatism or pneumatolytic mineralization.

This report together with several other geological and geophysical reports in this series, which have either just been published or are in the press, provide both a detailed and comprehensive record of some of the most important work of the British Antarctic Survey in north-east Graham Land.

No. 52. A. G. FRASER. The Petrology of Stonington and Trepassey Islands, Marguerite Bay. 1965. 51 pp. 30*s*. 0*d*.

As a result of recent geological investigations, the stratigraphical relations and petrology of the Basement Complex rocks in the Marguerite Bay area of the Antarctic Peninsula are now fairly well known. This further report concerns a very limited outcrop of Basement Complex rocks in the Neny Fjord area of Marguerite Bay, and its main purpose is to examine the more detailed aspects of the geological processes involved in the evolution of the complex so that existing knowledge can be interpreted more precisely.

The rocks of Stonington and Trepassey Islands comprise a series of mainly dioritic gneisses, and their field relations, petrography and chemistry are described. A tentative time sequence for the various phases of the dioritic gneisses is given but no systematic mineralogical or chemical variation is apparent in the order of intrusion. The derivation of hornblende from pyroxene and the wide compositional range in the plagioclase leads to the conclusion that most, if not all, of the *ortho*gneisses are of hybrid origin resulting from the contamination of basic rocks by later material of acid or intermediate composition.

Although there are no reliable criteria for determining the temperature and pressure conditions which characterized the metamorphism of the dioritic gneisses, it is possible to deduce their metamorphic history indirectly from a study of the feldspars. For example, some of the plagioclases exhibit a complex patchwork which is interpreted as unmixing under conditions of very slow cooling, followed by replacement. Secondary glide twinning frequently originates either inside or in the immediate vicinity of the patches and the progressive elimination of the patchwork by this twinning is believed to represent structural re-organization in the plagioclase. Such extensive re-adjustments in the plagioclase structure are considered to have taken place when the structure was disordered, so that the elimination of the patchwork must have occurred under high-temperature conditions which persisted for a considerable time. Very slow cooling from high temperatures is also deduced from other properties of the plagioclases and the potash feldspars. However, the general absence of pronounced metamorphic textures and the partial preservation of igneous textures denote that the *ortho*gneisses were intruded at or soon after the peak of metamorphism and that during the cooling period shearing stress was minimal. The thermal history determined from a study of the feldspars is supported by a detailed examination of the minor intrusions inasmuch as the varying modes of emplacement of minor intrusions and the textural differences between dykes of similar compositions but of different ages indicate repeated intrusion of magmatic material into country rock which was undergoing a gradually decreasing metamorphism.

The report also deals with unusual geological phenomena on Stonington and Trepassey Islands, including xenolithic basic dykes, rheomorphism and basification of acid dykes. These are described in detail and their significance is discussed. Xenolithic basic dykes and the basification of acid dykes are closely related phenomena which resulted from the simultaneous or nearly simultaneous injection of basic and acid magma. Basification occurred where a basic dyke intersected a predominantly liquid acid dyke, whereas xenolithic basic dykes were formed when contrasting materials were emplaced along the same plane. In both cases, the basic and acid magmas in juxtaposition interacted and hybrid rocks with variable textures were produced locally. A significant coarsening of grain-size is apparent in many of the reactions and it is believed that this would not have taken place if the interacting rocks had not been maintained at high temperatures for a long period. This conclusion is fully consistent with the earlier conclusions concerning the metamorphic history.

The report concludes with a description of late basaltic dykes which are tentatively correlated with the post-Andean dykes of the Argentine Islands, and this is followed by a brief account of the structures.