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Structural Style of Volcanic and Plutonic Rocks at Barton Peninsula, King George Island (South Shetland Islands)

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King George Island is a magmatic pile composed largely of volcanic rocks. The backbone of this pile (Fig. 1) is the Barton Horst. Inside the horst, the volcanic rocks are commonly altered, whereas outside the horst they are more fresh. The horst is pierced by numerous calc-alkaline intrusions ranging in composition from quartz-gabbro to granodiorite. Barton Peninsula (Figs 1, 2) is localized at the south-western termination of the Barton Horst. The peninsula is largely ice-free and presents the most extensive area of outcrops of the altered volcanics of the King George Island.

STRATIFIED SEQUENCE

A sequence of stratified volcanics crops out on the Barton Peninsula. The lavas in this sequence are andesites and basaltic andeites. Three tectonic unis have been distinguished within the sequence.

The lower unit (I) crops out only in a restricted area immediately west from the basaltic plug at Narebski Point (Figs 2, 4). The unit comprises flat lying, well stratified lapillistone and agglomerate. The observable thickness of the unit is about 10 m.

An angular unconformity (Fig. 5) separates unit I from the overlying unit II. The latter crops out on the southern shore of the peninsula. Unit II comprises steeply dipping, poory stratified lapillistones and agglomerates with subordinate lava flows. The apparent thickness of unit II exeeds 800 m.

Another angular unconformity separates unit II from the overlying unit III (Figs 3, 5) The latter, which occupies gently dipping lava flows, lapillistones and agglomerates. The thickness of the unit III is ca. 500 m.

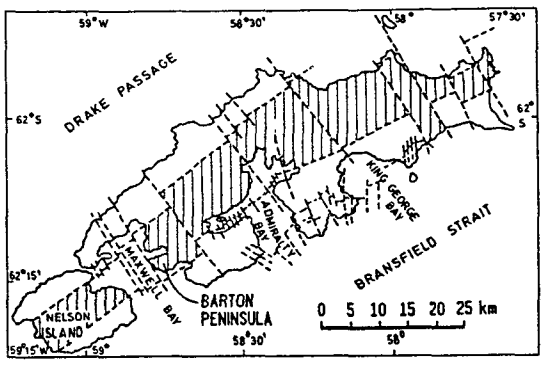

Fig. 1. Structural scheme of King George Island (after Birkenmajer, 1983; simplified). Barton Horst vertically shaded.

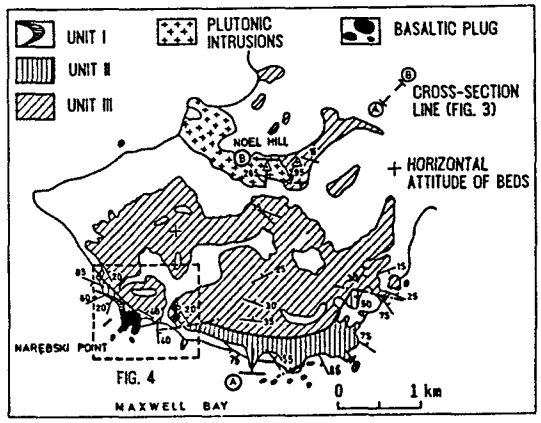

Fig. 2. Structural sketch of Barton Peninsula (after Tokarski, 1988; simplified)

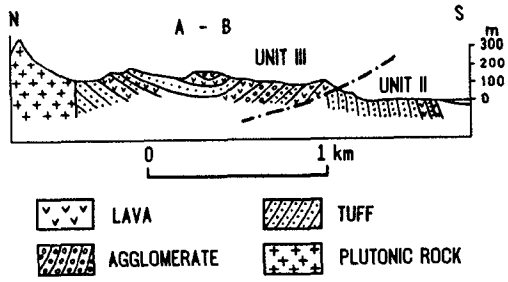

Fig. 3. Cross-section of Barton Peninsula

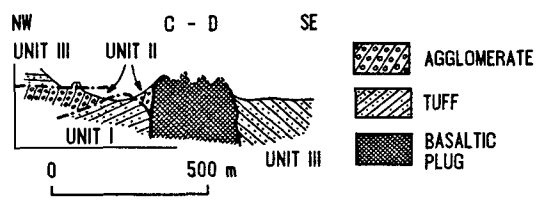

Fig. 5. Cross-section of the area close to Narebski Point

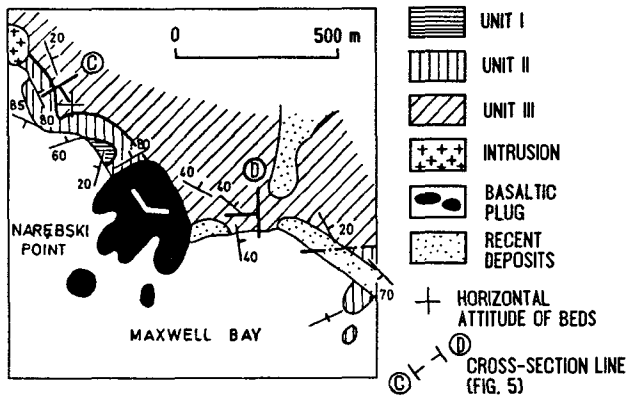

Fig. 4. Geological scheme of the coast close to Narebski Point

INTRUSIONS

The stratified succession is pierced by two plutonic intrusions and a volcanic plug. The Noel Hill intrusion have yielded a range of K-Ar ages down to about 60 Ma.

This date provides the minimum age for the stratified sequence.

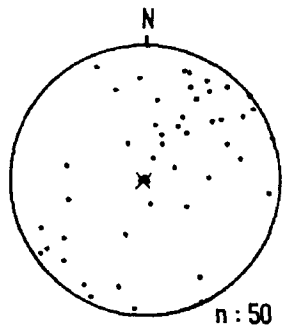

Fig. 6. Orientation of strata in stratified sequence. Upper hemisphere plot.

FOLDING

The rocks of the stratified sequence strike mostly NW to WNW (Fig. 6). The dips are differentiated depending on the unit. In unit III, which contains thick lava flows, the dips are relatively flat (<45°), whereas in unit II, which consists mostly of detrital rocks, all observed dips are steep (>50°). This indicates lithological control on the intensity of folding.

The orientation of constructed fold axes in units II and III forms an anomaly in the Antarctic Peninsula sector. There, the structural development had been controlled by a ESE directed subduction since at least Cretaceous up to Neogene. The NW-SE oriented reconstructed fold axes in units II and III do not fit in the structural pattern of this period. On the contrary, this orientation of fold axes is parallel to the strike of the Noel Hill intrusion. Moreover, in the vicinity of the Narebski Point volcanic plug, the strikes in all units clearly conform with the shape of the plug. It follows, that the orientation of the folds could had been

imposed by the shape of the intrusions.

The subhorizontal unconformities between units I and II and units II and III are tectonic in origin. The complete lack of any systematic vergency in the stratified sequence, and lack of flat dipping structures close to the unconformities indicate that the unconformities could hardly be interpreted as thrusts.

The plutonic intrusions and the volcanic plug are affected exclusively by brittle deformations.

CONCLUSIONS

Structural style of the rock deformation of the Barton Peninsula sequence is controlled by lithology. The deformation changes from pure brittle in intrusive bodies (least ductile) through open fold in the sequence containing thick lava flow (more ductile) to intensively folded detrital sequence (most ductile). The orientation of folds in folded (more ductile) bodies conforms with shapes of unfolded (less ductile) bodies.

REFERENCES

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