Polarforschung 60 (2): 96–98, 1990 (erschienen 1992)

7. Young Tectonic Activities in the Coastal Ranges of Central Victoria Land

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INTRODUCTION

The character of parts of the Ross Sea area as a meridionally orientated rift system has been recognized in recent years (Ross Sea Rift System, TESSENSOHN & WÖRNER 1991). At the same time, the morphogenesis of the Transantarctic Mountains was estimated by fission track data and other methods to be younger than 50 my (FITZGERALD & GLEADOW 1990). The subsidence of rift related grabens as well as the uplift of the mountain ranges adjacent to the west seem to have a uniform genetical source. In addition, the morphogenesis of the North Victoria Land coastal ranges was explained to be the result of shoulder uplift in relation to the second phase of the Ross Sea rifting (ROLAND & TESSENSOHN 1987) which started in the Upper Paleogene (COOPER et al. 1987, HINZ & KRISTOFFERSEN 1987). Up to now, this interpretation is based mainly on geophysical data from the Ross Sea. Therefore, the study of the younger tectonic development in central North Victoria Land was one of the topics of the GANOVEX team in 1990/91.

In this paper, we present preliminary results of these studies in the coastal region from Terra Nova Bay to Lady Newnes Bay as well as between the Priestley and Larsen Glaciers (Fig. 1). Methodically, we focus on field measurements of fault and dike orientations, age relations of different dike generations, as well as the character and sense of motion on fault planes. Prior to the field studies, LANDSAT images and aerial photographs had been analyzed. Since younger syngenetic sediments in the coastal ranges are missing, it is difficult to determine the exact ages of the observed post-Ross tectonic events.

FAULT ZONES

The frequency and intensity of post-Ross faulting varies in the investigated area. Submeridionally oriented faults exist both in the Terra Nova Bay and in the Lady Newnes Bay. The intensity of NNE-SSW to NE-SW oriented faults increases to the north. In general, the faults represent brittle deformation in a high crustal level in an extensional environment. The outcrops of the „Berliner Mauer" (proposed new name) at the northern flank of the Aviator Glacier (THIEDIG & STACKEBRANDT this vol.) show this character very clearly. NW and SE dipping faults creating horst- and graben-structures or en echelon systems cut submeridionally oriented basaltic dike swarms. If we assume a late Mesozoic to early Tertiary age of the basaltic dikes, then the faults should be of Cenozoic age. Another argument for a young age of these faults is their strong influence on the morphology of the whole territory. This relation will be worked out in more detail. To the south, the exposures of rocks are poorer. Many faults can be localized on aerial photos, but their age relations are unclear.

Important fault zones seem to be rare in the investigated area. Possibly they were exposed to strong glacial erosion and are now covered by glaciers. On the southern flank of the Priestley Glacier the accompanying inventory of a NW-SE trending regional fault was mapped. To the SE, this fault crosses Black Ridge and re-emerges again in the southern part of Gerlache Inlet. The same fault zone has been used by intrusions of younger basaltic veins. In the west, this normal fault displaces the Beacon peneplain by some hundreds of meters, whereas to the SE the intensity decreases rapidly. The relations to the Rennick graben (ROLAND & TESSENSOHN 1987, SKINNER 1987) are currently under discussion.

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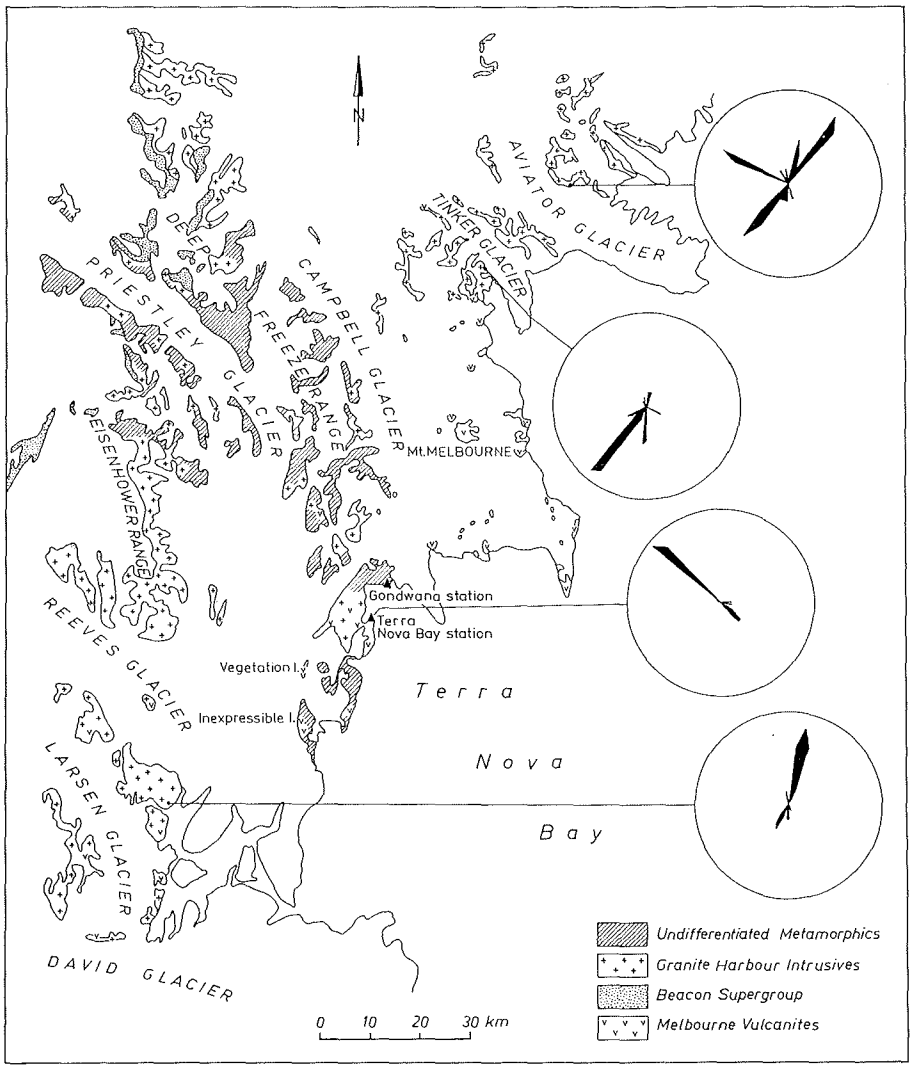

Fig. 1: Orientation of basaltic dikes in the coastal ranges of central North Victoria Land. Geology simplified after CARMIGNANI et al. (1988) and GANOVEX Team (1987). For direction of dip reduce given maximum by 90° anticlockwise.

Abb. 1: Orientierung basaltischer Gänge im zentralen Victorialand. Das Einfallen der Gänge erhält man, wenn vom dargestellten Streich-Maximum 90° gegen den Uhrzeiger-Sinn abgezogen werden

In the same area satellite images show numerous NE-SW trending normal faults. According to field observations in the central part of the Priestly Glacier, these faults are often accompanied by intensively jointed zones reaching several tens of meters in width. Slickenslide striations impley a dominant sinistral sense of motion. The transformation of joints and faults to open cracks points toward a young morphogenesis of the mountains along a NE-SW oriented axis. Typical examples for open cracks were found likewise in the southern part of the Eisenhower Range and in the vicinity of the Tinker Glacier to the north.

DIKES

The coastal region of the investigated area is characterized by frequent dike intrusions. To the south of Terra Nova Bay, acidic dikes frequently occur (Tarn Flat, Mt. Crummer, south of Drygalski Ice Tongue (KLEINSCHMIDT & MATZER this vol.). However, in the northern part near Lady Newnes Bay basaltic dikes are dominant. By observing the crosscutting relations of the different dike types the following time sequence of intrusive activity has been derived: (i) dikes of the late Ross cycle (lamprophyres, pegmatites and aplites; these were not further considered) and (ii) dikes of the post Ross cycle, i.e. from old to young: altered basalts - rhyolites -dacites - fresh basalts.

The strike direction of the dikes varies (Fig. 1). Both types of basaltic dikes follow mainly submeridional to NE-SW oriented zones, whereas the acidic dikes, which reach often more than 10 m in width, are aligned predominantly along E-W directions. The intrusion of dacites is often connected with a dextral sense of shearing. Dextral shear movements south of the Drygalski Ice Tongue (KLEINSCHMIDT & MATZER THIs vol.) were obviously created by the same regional stress field. On the other hand, the intrusion of the younger basaltic dikes is predominantly connected to a sinistral sense of shearing. Later on, normal faulting dominates. The increase of basaltic sills and dikes from the inland towards the Ross Sea points to a close connection between the generation of graben structures within the Ross Sea and the crustal widening in the coastal ranges of North Victoria Land. Good examples for this relationship exist especially in the northern part of the investigated area (Tinker, Aviator and Parker glaciers).

A more detailed interpretation of the field data, including an evaluation of satellite images and aerial photos, will be given later. Another study, which includes new radiometric data as well as the petrography of the dikes is planned.

ACKNOWLEDGMENTS

We are greatly indebted to F. Tessensohn and G. Kleinschmidt for making available our Antarctic studies in a very historic time in Germany. The project was financially supported by the Deutsche Forschungsgemeinschaft (DFG).

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