GRANITIC AND DIORITIC MAGMATISM DURING COMPRESSIONAL DEFORMATION WITHIN THE ANTARCTIC PENINSULA MAGMATIC ARC

Alan Vaughan[1] and Ian Millar[2].

(1) British Antarctic Survey, Madingley Rd. Cambridge CB3 0ET.
(2) NIGL, Keyworth, Nottingham, NG12 5GG.

RESUMEN: Granodioritas y dioritas del Peninsulo Antarctico de edad Jurásico Superior, emplazado en una sequencia de neises Triásico Superiores y gabbro posiblemente de edad Jurásico Superior, muestran estructuras de deformación que sugieran emplazamiento de rocas granodioriticas/dioriticas y movemiento syn-magmatico en zonas de cizalla. Estes zonas de cizalla se inclinan al norte-este con angulos a eso de 40° y marcadores cinemáticos indican una sensa de cizalla reverso-sinistral hacia el óceano.

KEY WORDS: Magmatism, shear zones, thrusting, Antarctic Peninsula

INTRODUCTION

Magmatism which is synchronous with thrust deformation has only recently been described, mainly from the north western Pacific margin of North America (Davidson *et al.* 1992, Ingram 1991, Karlstrom *et al.* 1993) and the Variscan of France (Blumenfeld and Bouchez 1988). New combined structural and magmatic studies of the Mesozoic magmatic arc in the Antarctic Peninsula, a former continuation of the southern Andes, have identified granitic magmatism during a period of thrusting within the arc.

GEOLOGICAL SETTING

Granodiorites dated as Upper Jurassic (141±3 Ma U-Pb zircon age) and co-eval diorites, emplaced in both gneissic basement of at least Upper Triassic age (227±1 Ma U-Pb zircon age) and gabbro of Upper Jurassic age or older from Palmer Land in the Antarctic Peninsula, record possible syn-emplacement ductile deformation with a reverse sense of shear. Gneiss, gabbro, and cross-cutting aplites (140±5 Ma Rb-Sr whole rock age, Harrison 1989) are also ductilely deformed in these reverse shear zones which are up to 150m wide. On a mesoscopic scale granodioritic and dioritic sheets parallel shear zone margins and exhibit a strong ductile foliation which dips shallowly eastward. Amphibole crystals within diorite sheets have a well developed preferred orientation and these, and the hinges of ductile folds developed within granodiorite sheets, plunge steeply ENE. S-C fabrics, also

within granodiorite sheets, indicate reverse shear with oceanward overthrusting to the WSW. Deformed granodiorite and diorite sheets are cut by steep thin granite dykes which are themselves sheared, suggesting that shear zone activity was episodic. The timing of magmatic and solid state deformation overlaps within the shear zone and structural evidence indicates lithological, spatial and temporal partitioning of deformation. Away from the shear zone intermixed gabbro, diorite and granodiorite suggest simultaneous emplacement of basic and felsic magmas and this is reflected in the presence of a high proportion of net-veined diorite within the shear zone. Also, ductile extensional syn-magmatic shear zones are evident in granodiorite and gabbro bodies away from the compressional shear zones.

CONCLUSIONS

The structural and igneous evidence suggests heterogeneous evolution of a zone of simple shear within the Antarctic Peninsula magmatic arc. The present zone of deformed rocks represents the end product of multiple pulses of reverse movement, with possible synchronous intrusion of granodiorite and diorite and further magmatic emplacement in tensional lulls, during overall compressional deformation. Comparison with areas of late Triassic to Middle Jurassic granitic magmatism synchronous with ductile shear within the southern Andes (Rapela et al. 1991) is currently being undertaken.

REFERENCES

Blumenfeld, P. and Bouchez, J.-L. 1988. Shear criteria in granite and migmatite deformed in the magmatic and solid states. *Journal of Structural Geology,* **10,** 361-372.

Davidson, C., Hollister, L.S. and Schmid, S.M. 1992. Rôle of melt in the formation of a deep-crustal compressive shear zone: the Maclaren Glacier metamorphic belt, south central Alaska. *Tectonics,* **11,** 348-359.

Harrison, S.M. 1989. Aspects of magmatism and metamorphism within a magmatic arc: evidence from north-western Palmer Land. *Unpublished PhD. Thesis,* NERC.

Ingram, G.M. 1991. The Great Tonalite Sill, S.E. Alaska: a record of late Cretaceous to early Tertiary orthogonal convergence and terrane accretion. Abstract, Tectonic Studies Group Conference 1991.

Karlstrom, K.E., Miller, C.F., Kingsbury, J.A. and Wooden, J.L. 1993. Pluton emplacement along an active ductile thrust zone, Piute Mountains, southeastern California: interaction between deformational and solidification processes. *Geological Society of America Bulletin,* **105,** 213-230.

Rapela, C.W., Dias, G.F., Franzese, J.R., Alonso, G. and Benvenuto, A.R. 1991. El Batolito de la Patagonia Central: evidencias de un magmatismo Triásico-Jurásico asociado a fallas transcurrentes. *Revista Geológica de Chile,* **18,** 121-138.