N86-23099

EXTENSIONAL TECTONICS DURING THE IGNEOUS EMPLACEMENT OF THE MAFIC-ULTRAMAFIC ROCKS OF THE BARBERTON GREENSTONE BELT.

M.J. de Wit, Lunar and Planetary Institute, 3303 NASA Road One, Houston, TX 77058 and BPI Geophysics, University of the Witwatersrand, Johannesburg, South Africa.

The simatic rocks (Onverwacht Group) of the Barberton greenstone belt, which occur in at least 3 regional thrust nappes, are part of the Jamestown ophiolite complex[1]. This ophiolite, together with it's thick sedimentary cover (Fig Tree and Moodies Groups) occupies a complex thrust belt. Field studies have identified two types of early faults which are entirely confined to the simatic rocks and are deformed by the later thrusts and associated folds. The first type of fault (F1a) is regional and always occurs in the simatic rocks along and parallel to the lower contacts of the ophiolite-related cherts (Middle Marker and equivalent layers; for their distribution see Fig. 1, de Wit et al., this volume). These faults zones have previously been referred to both as flaser-banded gneisses[2] and as weathering horizons[3]. (F1a) zones consist of anastomosing, cross-cutting and folded extension veins which have internal cross-fibrous growth textures. Vein filling minerals are predominantly calcite, less often quartz. The veins are separated by schistose to proto-mylonitic folia of fuchsite, chlorite, sericite and serpentines (Fig. 1). In general the zones range between 1-30m in thickness. The veins formed by a succession of dilation-diffusion increments[4,5] and subsequently deformed during simple shear to form banded gneisses (Fig. 1; in this poster presentation, polished slabs of these rocks will be displayed). The simatic host rocks close to (F1a) zones, are ubiquitously brecciated and extensively altered (carbonatized and/or silicified) as documented by the major elements, stable and radiogenic isotope compositions (REE are relatively stable). This alteration is related to a extensive hydrothermal-fluid/rock interaction. It has been postulated that the dilatancy-anisotropy of the fault zones was related to a hydraulic fracturing-gliding mechanism in a geothermal environment[6]. Episodic decrease of fluid overpressure due to movement in these zones would cause boiling, calcite precipitation and crack-sealing with a concomittant resistance to movement of the cherty cap-rock[6]. Displacements along these zones are difficult to estimate, but may be in the order of 1-10^2 km. The structures indicate that the faults formed close to horizontal, during extensional shear and were therefore low angle normal faults. In many areas, both the faults and their overlying cherts, are cut by subvertical simatic intrusions of the Onverwacht Group (Fig. 2). Thus (F1a) zones overlap in age with the formation of the ophiolite complex. The second type of faults (F1b) are vertical brittle-ductile shear zones, which crosscut the complex at variable angles and cannot always be traced from plutonic to overlying extrusive (pillowed) simatic rocks. (F1b) zones are therefore also apparently of penecontemporaneous origin with the intrusive-extrusive igneous processes (Fig. 2). Thus (F1b) zones may either represent transform fault-type activity or represent root zones (steepened extensions) of (F1a) zones. Both fault types indicate extensive deformation in the rocks of the greenstone belt prior to compressional overthrust tectonics, and at least (F1a) implies regional extensional tectonics and probably block rotation during the formation of the ophiolites.

References

(1) de Wit et al. this volume. (2) de Wit (1982) Journal of Structural Geology, 4, p. 117-136. (3) Lowe et al. (1985) Precambrian Research, 27, p. 165-186. (4) Ramsay, J.G. (1980) The crack-seal mechanism of rock deformation. Nature, 284, p. 135-139. (5) Ramsay, J.G. and Huber, M.I. (1983) Strain analysis. Academic Press. (6) de Wit et al., Economic Geol., 77, p. 1783-1802.

de Wit, M. J.

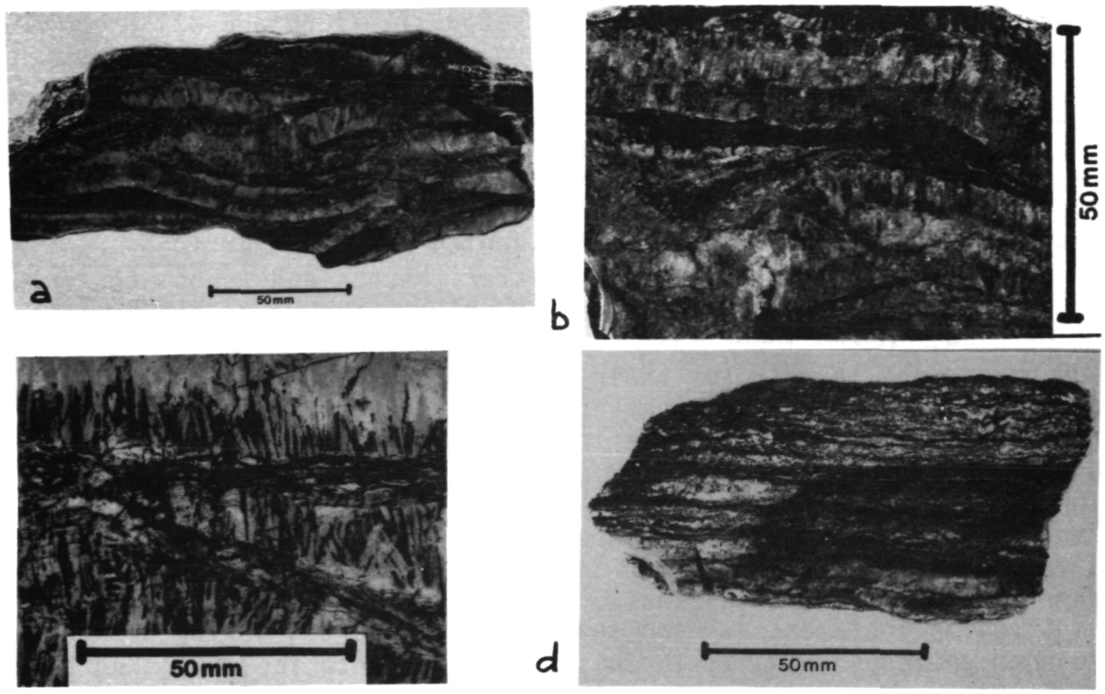

FIG1

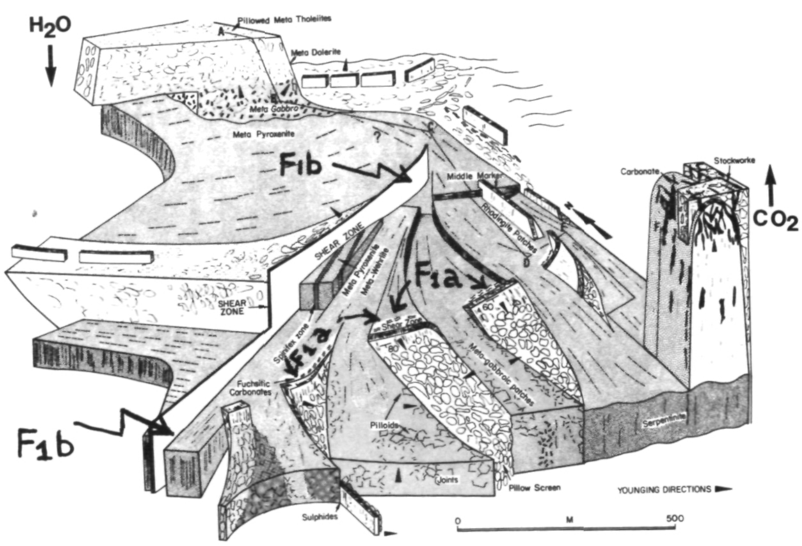

FIG.2

Figure Captions: Fig. 1 (a) Anastomosing/crosscutting carbonate extension veins (pale-grey) with thin schistose folia (dark grey). Sections up to 30 meters thick entirely composed of this rock-type constitute flaser-banded tectonites[2]. (b) as in (a), showing the cross-fibrous carbonate growth textures in the veins. Different shades of grey are due to variations in concentration of inclusion bands and trails[4]. (c) Internal brecciation and shearing of cross-fibres (vertical) yielding (subhorizontal) protomylonites. (d) gneissose-mylonitic fabric following shearing and flattening of extension veins. (2) Block diagram of area near the Onverwacht bend (see Fig. 1, de Wit this volume for location - as outlined by the box marked Fig. 2) showing the disposition of both (F1a and F1b) fault zones. Note how vertical metawehrlite intrusions (grey) have cross-cut and incorporated screens of middle marker-like cherts underlain by (F1a) gneissose tectonites (shear zones).