Geophysical Research Abstracts
Vol. 14, EGU2012-2032, 2012
EGU General Assembly 2012

Petrofabrics in the Bushveld Complex demonstrate existence of turbidity currents in magma chambers

R. G. Cawthorn
Witwatersrand, Geosciences, Johannesburg, South Africa (grant.cawthorn@wits.ac.za, 27117176579)

Petrofabric studies in layered complexes can provide information on the accumulation processes in large magma chambers. A diagnostic succession of layered gabbronorites, up to 20 m thick, occurs toward the top of the Main Zone in the Bushveld Complex. There exists an alternation of thin ($\pm$ 10 cm) layers which are variably leucocratic and melanocratic with sharp contacts. The ratio of clinopyroxene to orthopyroxene is constant in all rocks regardless of the proportion of mafics. No layer contains the cotectic proportion of plagioclase to pyroxene. There is no relationship between the thickness of a leucocratic and either underlying or overlying melanocratic layer. A linear fabric for the plagioclase exists for all the layers. In the mafic layers the linear elongation is parallel to the margin of the intrusion. In the leucocratic layers it is perpendicular, and oriented toward the centre of the intrusion. This relationship is interpreted to have resulted from paired bed load – suspended load transport and deposition mechanism as a slurry of grains descended a very gently inclined surface toward the lowest central region of the chamber. During such transport, denser mafic minerals tended to sink through this crystal mush, but also entrained some plagioclase grains. The total density was such that they formed a bed-load where grains were rolled along the floor of the density current. Elongate grains of plagioclase involved in this basal flow would have become orientated with their long axes perpendicular to the direction of flow. Conversely, the upper part of the slurry would have been plagioclase enriched, and would have remained suspended because of their lower bulk density. The plagioclase grains in this suspension would have been aligned parallel to the direction of flow which was toward the lowest central part of the chamber. As the momentum in these currents decreased the paired package would have stagnated and accumulated on the instantaneous floor, preserving the preferred bi-directional fabric of the plagioclase. Turbidity currents forming sedimentary rocks are well-known to contain such combined bed-load and suspended load of material. However, there the difference is based on grain size, not mineral density, and they have no elongated grains to demonstrate direction of flow. Planar fabrics have been inferred to have resulted from compaction from a random array of grains. However, such a process could not have produced the observed alternating linear fabrics seen in the leucocratic and melanocratic layers. These observations also provide evidence for lateral migration and modal redistribution of grains.