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Role of fluid in the formation of high-grade polymetamorphic rocks

L. L. Perchuk & D.D. Van Reenen

Department of Petrology, Geological Faculty, Moscow State University, Moscow, 119899, Russia (llp@geol.msu.ru)

Department of Geology, University of Johannesburg, P. O. Box 524, Auckland Park 2006, Johannesburg, South Africa (dirkvr@uj.ac.za)

In earlier paper (Perchuk et al., 2006) we concluded that the second high-grade metamorphic (HGM) transformations in granulites proceed exclusively along newly formed shear zones with relatively high rate. In contrast we believed that older granulite wall rocks have never experienced the second HGM event because of lack of strong shear deformations. Our new petrologic and geochronologic data (Perchuk et al., 2007; van Reenen et al., 2007) showed that the second HGM has been recorded in the formation of new undeformed reaction textures that can hardly be detected in thin sections because of similarity in their shapes with older reaction textures. In this case both the mineral chemistry and the Pb-Pb ages of rock forming minerals are the only keys for discrimination between two high-grade events.

Completely unsheared granoblastic granulates from the polymetamorphic Central Zone of the Limpopo Complex, South Africa, were subject of detailed study in a view of their preservation from the second high-grade event. The rocks contain well developed Grt+Qtz => Crd+Opx reaction texture. No any deformations were observed in the rock, but Opx lamellae show chemical zoning: Al content first decreases from the contact with garnet and then via minimal concentration Al increases reflecting isobaric heating (Perchuk, 2005). The PbSL garnet dating has resulted in a large spread of ages ($\sim$2.0-2.6 Ga) that reflect the polymetamorphic nature of these undeformed high-grade gneisses. Both the results demonstrate fluid activity during the second

high-grade metamorphism that took place in the Central Zone about of 2 Ga (Holzer et al., 1998). This event is also recorded in the formation of low density fluid inclusions while high density inclusions have never been observed in these distinct rocks (Hisada et al., 2005; Huizenga et al., 2008). These results do not mean that the Neorchaean fluid inclusions cannot be *at all* preserved in the Central Zone. Their relics may occur outside of strongly shear zones, where the Paleoproterozoic fluid had not penetrated and therefore high density CO_2 fluid inclusions have been preserved.

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