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Tectonic overpressure as an alternative driving force of high-*P* assemblages within the Cambrian high-grade orogens of East Antarctica

Gulbin, Yu.L.[1], Mikhalsky, E.V.[2], Vasillyev, E.A.[1] and Galankina, O.L.[3]

[1]National Mineral Resources University, 21 Liniya, 2, St. Petersburg 199106, Russia
[2]VNIIOkeangeologia, Angliiskii Prospekt, 1, St. Petersburg 190121, Russia
[3]Institute of Precambrian Geology and Geochronology, Makarova Emb., 2, St.-Petersburg, 199034, Russia

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The Sodruzhestvo Group in the southern Prince Charles Mountains (PCM) of East Antarctica is a 6 km to 10 km thick deformed and metamorphosed shallow-water sedimentary pile (preserving cross bedding and other sedimentary structures). The strata are thrust over the Archaean to Palaeoproterozoic crystalline basement. The Sodruzhestvo Group may have accumulated either on a plate margin or within an intraplate depression, which experienced Early Palaeozoic inversion [1]. The crystalline basement has undergone coeval metamorphism and shearing at 530–490 Ma [2].

A thermobarometric study was carried out for the Sodruzhestvo Group metasedimentary rocks and intruded metabasites from the Cumpston Massif in the southern PCM. Metasedimentary rocks are metapsammites, quartzite schists and metapelites collected from a thrust zone. The rocks contain Qtz–Bt–Ms–Pl–Grt assemblage. The peak metamorphic conditions were estimated by conventional and multiequilibrium thermobarometry. Metamorphic paths have been determined from zoned garnets and pressure–temperature pseudosections modeling in the MnNCKFMASHT system with Theriak/Domino. These paths are clockwise and show pressure and temperature increasing from 6.5–8.5 kbar, 490–510 °C up to peak conditions of 10–11 kbar, 580–610 °C followed by cooling and decompression down to 7 kbar, 550 °C. The composition of white micas serves as an additional indicator of the high pressure. The thermobarometry of garnet-amphibolite sills containing embayed garnet with Pl–Bt–Ilm symplectic coronas shows peak conditions of 10–11 kbar and 620–650 °C followed by near isothermal decompression to 6–7 kbar.

Raman quartz-in-garnet barometry was applied [3]. The Raman shifts of the 464 cm^{-1} α-quartz peak were measured in quartz inclusions. Calculations of the entrapment pressure, which were based on spectroscopic data and take into account the host rock's thermal history, have demonstrated a fast increase of *P* from 5 to 11–12 kbar as the temperature increases from 525 to 550 °C, followed by isobaric heating to 650 °C.

Taken at face values, these calculations imply burial to low crustal levels and essential subsequent decompression. However, preserved sedimentary structures and only minor deformations outside thrust zones may hardly be reconciled with low crustal conditions. An alternative notion of tectonic overpressure may be utilized [4]. Within-crust inhomogeneities (e.g., mafic swarms) and crustal discontinuities (e.g., terrain boundaries) do cause tectonic overpressure [5]. Thus the calculated pressure estimates and *P–T* paths must be treated with greater caution. It may be noted that many if not all other the Cambrian high-*P* assemblages reported from East Antarctica (i.e., Shackleton Range, western Dronning Maud Land, Lützow-Holm Bay, Rauer Islands) are confined to boundaries between the Archaean and the Proterozoic terranes which might be responsible for or at least contribute to elevated pressure calculations.

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