Geochronological evidence for ~ 530–550 Ma juxtaposition of two Proterozoic metamorphic terranes in the Musgrave Ranges, Central Australia

Author(s)

Makenya A. H. Maboko, Ian Mcdougall, P. K. Zeitler, I. S. Williams

Abstract

Contrasting temperature-time paths from two Proterozoic metamorphic belts in the Musgrave Ranges, central Australia suggest that they represent district tectonothermal terranes. The thermal histories of these terranes converged about 530–550 Ma ago, as they were juxtaposed along the Woodroffe Thrust. Amphibolite fades metamorphism in the gneissic terrane north of the thrust is dated by zircon U-Pb ages at ~ 1600 Ma. Subsequently, the gneiss was intruded by granitoid at ~ 1500 Ma, followed by a second metamorphic event which may be dated by a few zircon ages at ~ 1400 Ma. Age maxima of ~ 1300 Ma and ~ 1260 Ma from steadily rising Ar-Ar spectra date cooling below closure temperatures of hornblende and K-feldspar respectively, following the latter metamorphism. In contrast, zircon U-Pb ages date granulite facies metamorphism in the terrane south of the Woodroffe Thrust at ~ 1200 Ma. Post-metamorphic cooling in the granulite terrane was slow with hornblende and biotite remaining open to argon diffusion until after ~ 930 and ~ 690 Ma respectively. The thermal histories of the two terranes converged ~ 530–550 Ma ago, when metamorphism associated with burial of the gneiss under an overriding ~ 15 km thick thrust sheet of granulite led to the growth of syn-tectonic muscovite in both terranes and caused near total resetting of Ar-Ar ages in pre-existing biotite and K-feldspar in the gneiss. Cooling from this event was slow with the gneiss dropping below temperatures of ~ 260° C at ~ 350 Ma and the granulite cooling below ~ 200°C at ~ 400 Ma.