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Rates of orogenic processes in two unusual Palaeoproterozoic high-grade terrains of southern Africa and northern China

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Precambrian orogenic processes resulting in polyphase ductile deformation and high-grade metamorphism are usually ascribed to continental collision and often expose gneiss terranes that record an evolution lasting several hundred million years. This is in contrast to most Phanerozoic collision belts where pre-orogenic sedimentation and magmatism are followed, within tens of m.y., by orogenic deformation and metamorphism. We summarize the evolution of two Palaeoproterozoic granulite terranes which consist predominantly of Archaean granitoid gneisses and minor shallow-water sediments with minor additions of early Palaeoproterozoic granites, and which were subjected to intense deformation and metamorphism in the late Palaeoproterozoic, 500-700 Ma after their generation in arc-related settings. These are the Central Zone (CZ) of the Limpopo belt in southern Africa and the Hengshan Complex (HC) within the Trans-North China Orogenic Belt in northern China.

The CZ predominantly consists of TTG gneisses and minor supracrustal rocks with crystallization or depositional ages between $>$3.3 and 2.5 Ga and a fragmentary record of Archaean deformation and metamorphism. These rocks were subjected to intense ductile deformation and granulite-facies metamorphism at $\sim$2 Ga, followed by relatively fast cooling and uplift as recorded by mineral ages. The HC also predominantly consists of TTG gneisses and minor supracrustal rocks, formed between 2.7 and 2.5 Ga and displaying no record of strong Archaean tectonism. These rocks were intruded by a mafic dyke swarm at 1.92 Ga, followed by intense ductile deformation and HP

granulite-facies metamorphism at 1.85 Ga and fast cooling and uplift before 1.8 Ga.

In both cases continental collision has been inferred, but there is no record of pre-orogenic continental margin evolution and ocean closure, instead both terranes show evidence of having been generated in magmatic arc environments. We suggest that these terranes were rifted off from unknown Archaean active continental margins in the Palaeoproterozoic, similar to present-day Japan, and were then displaced before becoming attached, through terrane collision, to different Archaean blocks with which they share no common history. We speculate that much of the rock record along the margin of such terranes was lost through tectonic erosion and post-collisional uplift.