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Accretionary growth in the Central Asian Orogenic Belt of Mongolia during the Neoproterozoic and Palaeozoic and comparison with the Arabian-Nubian Shield and the present Southwest Pacific

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The Central Asian Orogenic Belt (CAOB) records a ca. 800 Ma history of arc and microcontinent accretion, from S to N, during evolution and closure of the southwest Pacific-type Palaeo-Asian ocean in the period ∼1000 to ∼300 Ma. We contest the evolutionary model proposed by Sengör et al. (1993) and (Sengör and Natal'in, 1996) in terms of a single, large island arc. The earliest history of ocean opening is recorded by the 1020 Ma forearc Dunzhugur ophiolite in southern Siberia that, together with a volcanic arc-blueschist accretionary wedge, was thrust onto the margin of the Siberian craton (Khain et al., 2002). The next younger event, farther S, is exemplified by the evolution of the ∼850-650 Ma Baikal-Muva-Dhzida arc-ophiolite terrain, including the 800 Ma Shishkhid ophiolite complex of northern Mongolia that formed in an extensional island-arc environment (Kuzmichev et al., 2005). Several ophiolites were generated at around 570 Ma in a broad belt extending from southern Tuva (Agardagh Tes-Chem Complex) via western Mongolia (Dariv and Khantaishir) to Bayankhongor (Pfänder et al., 2002; Khain et al., 2003; Buchan et al., 2002), followed by earliest Palaeozoic subduction/accretion and suturing during which some of the arc terrains

were metamorphosed to granulite-facies (Tuva-Mongolian Massif, Salnikova et al., 2001). The existence of Precambrian microcontinental fragments is documented by Archaean to Mesoproterozoic ages in the Baydrag block (Mitrofanov et al. 1985) and granitoid gneisses of the Dzabkhan block onto which the Dariv and Khantaishir ophiolites were thrust (our unpubl. data). We also found numerous Archaean to Neoproterozoic detrital zircons in Mongolian arc-derived clastic sediments, suggesting derivation from continental sources. In northern and central Mongolia, voluminous intermediate to felsic magmatic rocks were generated in the narrow time period 460-417 Ma during the Ordovician and Silurian, presumably in an island arc environment, and within a broad belt extending from northern Mongolia to the Gobi Desert. We consider it unlikely that these large volumes of predominantly felsic rocks were generated entirely from juvenile sources since Nd mean crustal residence ages for some of these felsic rocks are between 600 and 1300 Ma, suggesting that older material was involved in their generation. New SHRIMP detrital zircon ages for arc-derived sandstones from northern, central and southern Mongolia support this view and document continental input dating back to the late Archaean. By the end of the Ordovician, the northern part of the CAOB had amalgamated to create a new continental margin (the Main Mongolian Lineament of Windley et al., 2004). Evidence of stabilization by this time of the northern region is provided by Eocambrian to Cambrian shelf carbonates, Ordovician clastic basins, and virtually undeformed, extensive Ordovician ash-fall tuffs and rhyolites. Possibly, the Main Mongolian Lineament is a major boundary separating two crustal provinces with different isotopic characteristics. Oceanic crust and island arc formation was still active in central and southern Mongolia in Carboniferous to earliest Permian time (Tomurtogoo et al., 2004, and new SHRIMP ages) that we ascribe to opening and closure of the Mongol-Okhotsk ocean, and granitoid magmatism is documented by $\sim$300-290 Ma granites in the Tseel Terrane of the Gobi Desert. These rocks are unlikely to have formed in an intraoceanic environment, and we favour an Andean- or Japan-type setting. Our data do not support a purely juvenile origin for the early Palaeozoic rocks in the accretion belt of S Kazakhstan. Overall the CAOB records the formation of southwest-Pacific style small forearc and backarc ocean basins that probably evolved between island arcs and microcontinents during the period $\sim$1020 to $\sim$290 Ma and were closed during continuous accretion between the Neoproterozoic and Palaeozoic. During this time the southward-growing southern margin of the Siberian craton always faced an open ocean. Final closure of the Palaeo-Asian ocean probably occurred in the late Permian when the North China craton (NCC) was attached to the CAOB, leading to formation of the Solonker suture zone (Xiao et al., 2003). Our data do not support evolution of the CAOB from a single, long-lived arc system as proposed by Sengör et al. (1993) but suggest a setting similar to the present southwest Pacific. The presence of large volumes of felsic

volcanic rocks in the Mongolian arcs, together with ubiquitous Precambrian detrital zircons, argue for significant involvement of older material in the production of CAOB crust, and previous crustal growth models for this region require substantial revision. The above features make the CAOB distinct from the Arabian-Nubian shield which largely evolved in an intra-oceanic environment.

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