GSA DATA REPOSITORY 2011202

Taphonomic study of Ediacaran organic-walled fossils confirms the importance of clay minerals and pyrite in Burgess Shale-type preservation

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Stratigraphic Information

Chuaria and *Vendotaenia* fossils used in this study came from the Ediacaran Doushantuo and Denying formations, respectively, in the Yangtze Gorges area of South China (Fig. DR1). The Doushantuo Formation includes four informal lithostratigraphic members (McFadden et al., 2009): in ascending order, Member I (~5m-thick cap dolostone atop the Nantuo diamictite), II (70–100 m of argillaceous/dolomitic pelletal packstone and calcareous mudstone/siltstone with chert nodules), III (50–80 m of dolomitic pelletal packstone and ribbon rock with scours, microbial laminations, and sheet cherts), and IV (up to 20 m of black shale or organic-rich mudstone). Previous studies have shown that abundant silicified microfossils are present in Member II chert nodules (Xiao et al., 2010), and carbonaceous compressions (including *Chuaria* fossils) are found in black shales of Member II (Tang et al., 2006) and Member IV (Xiao et al., 2002). We analyzed 16 *Chuaria* specimens collected at the Jiulongwan, Sixi, and Sifangtang sections (Fig. DR1) from Member II argillaceous packstone and calcareous siltstone/mudstone, which were deposited in lower subtidal environment in a semi-restricted basin (Ader et al., 2009). Available geochronological data constrain the analyzed *Chuaria* fossils between 632.5±0.5 Ma (Condon et al., 2005) and 593±17 Ma (Zhu et al., 2010).

The Denying Formation overlies the Doushantuo Fomration and consists of three members. The basal Hamajing Member is 20–190 m of light gray karstified dolostone. The Shibantan Member is 100–160 m thick and consists of dark gray, recrystalized bituminous limestone interbedded with siltstone laminae. The Baimatuo Member, ~60–570 m thick, is characterized by light gray, heavily recrystallized and karstified dolostone. *Vendotaenia* fossils occur in siltstone laminae of the Shibantan Member (Yin and Gao, 1995). Material for this study was collected from the Shibantan Member at the Miaohe and Wuhe sections (Fig. DR1). They fossils typically occur in mm-thick siltstone layers sandwiched between recrystallized bituminous limestone beds. Available age constraints indicate that the *Vendodtaenia* fossils are between 551 Ma (Condon et al., 2005) and 543 Ma (Amthor et al., 2003; Bowring et al., 2007).

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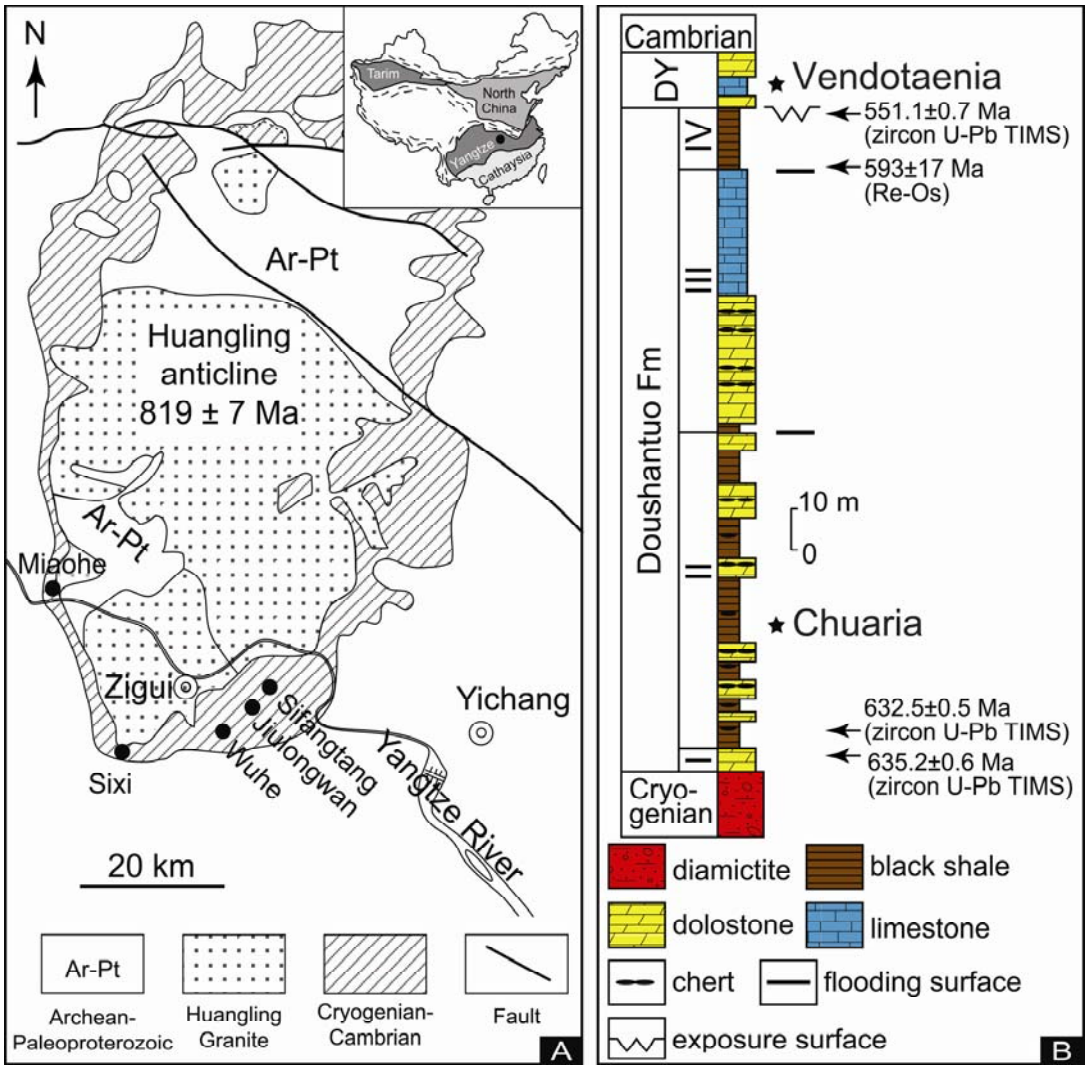

Figure DR1. Sample localities and stratigraphic horizons. (A) Geological map of the Yangtze Gorges area (black dot in inset map) showing sample localities. (B) Generalized stratigraphic column of the Doushantuo and Denying Formations in the Yangtze Gorges area, showing stratigraphic occurrences of analyzed *Chuaria* and *Vendotaenia* fossils. Zircon U-Pb TIMS ages from Condon et al. (2005). Re-Os age from Zhu et al. (2010).