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Preliminary results on the magnetic susceptibility records along the Frasnian–Famennian Fuhe section, China

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Introduction

In 2010, the IGCP-580 meeting was held in Guilin, China and during this event a field trip team work (guided by Daizhao Chen) was organized in order to sample various key Palaeozoic sections. Our team focused on the Frasnian–Famennian boundary, in two different sections: the Detergent Factory section (shallow water deposits), 10 km south of Guilin and the Fuhe section (deep water deposits), about 40 km south of Guilin. The sequence stratigraphy of the Fuhe section was examined by CHEN & TUCKER (2003) and CHEN et al. (2005) documented carbon and strontium isotopic variations within a well-established conodont stratigraphic canevas.

Geological setting

Starting from the early Devonian, a main transgression progressively flooded Southern China and led to the deposition of deeper and deeper-water deposits, with increasing proportion of carbonates. The maximum transgression was reached during the Frasnian. Although, during the Givetian and Frasnian, active tectonic influenced patterns of sedimentation in different areas. The Fuhe section was located within the offshore spindle-shaped Yangshuo basin which was surrounded by shallow-water carbonate platforms and isolated from significant continental siliciclastic influx (CHEN et al., 2005).

Magnetic susceptibility

The section is 33 m thick and cuts through Early to Late *rhenana*, *linguiformis* and *triangularis* conodont zones. The first 27 m (Frasnian) was sampled every 50 cm and the upper 6 m, corresponding to the upper Kellwasser F–F interval was sampled every 10 cm. The sedimentation is mostly characterized by two main facies: (1) autochthonous pelagic nodular mudstones, with abundant sponge spicule networks and ostracods and with some clotted micrite; intercalated with (2) coarser intervals of allochthonous calciturbidites with lithoclastic grainstones beds or lenses, displaying oblique and convolute stratifications, grading into bioturbated mud-wackestones (T_{c-e} Bouma subdivision). The mean MS value for the entire Fuhe section is $3.23.10^{-8}$ m³/kg, which is in the range the MS marine standard of 5.5×10^{-8}; the median value for ~11,000 lithified marine sedimentary rocks, including siltstone, limestone, marl and shale samples (ELLWOOD et al., 2011). The MS values range between $-1.46.10^{-9}$ and $9.25.10^{-8}$. The first part of the section (0-9 m) is dominated by turbiditic deposits and the MS values are relatively low (~ 9.10^{-9} m³/kg). Then, between 9 and 27 m, the facies are dominated by mudstone with *in situ* sponges (autochthonous sediments) and MS is higher ($6.45.10^{-8}$ m³/kg), with some sharp variations. The last 6 m, correspond to the upper Kellwasser event of the F–F interval (Fig. 1). Below the F–F boundary, facies alternate between autochthonous and allochthonous and the MS values decrease from $5.46.10^{-8}$ to $5.23.10^{-9}$ m³/kg. Above the F–F, autochthonous facies dominate once again and MS values sharply increase.

Gamma-Ray Spectrometry (GRS)

GRS measurements were made with a handheld apparatus every 50 cm between 7 and 27 m and every 20 cm in the upper 6 m, encompassing the upper Kelwasser F–F boundary. Concentrations in K are quite low (almost always below 2.2 %) with a mean value of 1.0 % for the whole section. There is a slight increase of the K concentrations from 7 m to 29 m until the maximum value (2.1 %) in the

linguiformis Zone. After that, between 29 and 30.6 m, the K concentrations (< 0.65 %) are very low (end of the Frasnian) and there is a new increasing trend in the lower Famennian. Th concentrations are weak (below 12 ppm) with a mean value of 5.38 ppm for the whole section. Th concentrations seems to be stable during the Frasnian before a peak towards high Th concentration (11.38 ppm) in the *linguiformis* Zone followed by an interval of low Th concentrations (< 4.5 ppm) just before the F–F boundary. In the early Famennian, the Th concentrations are fluctuating but an increasing trend could be observed (similar to the increasing K concentrations). Concentrations of K statistically correlate moderately well with Th concentrations throughout the whole section (r=0.75). Th and K concentrations are usually related to the presence of aluminosilicates (illite and other clay minerals, potassium feldspars, micas) in carbonates. A good correlation between K and Th is considered to reflect a fine-grained siliciclastic admixture in carbonate rocks (EHRENBERG & SVANA, 2001; FABRICIUS et al., 2003).
The U/Th ratio is highly fluctuating between 0.2 and 1.1 ppm with a mean trend corresponding to decreasing values up-section. The mean value for U/Th ratio corresponds to 0.55. Six distinct peaks are present along the section with values above 0.75 indicating probably local dysoxic conditions (2.0-0.2 ml O_2/l, bottom-water oxygen level sensu TYSON & PEARSON, 1991). The last peak in U/Th values is contemporaneous with the low K and Th concentrations at the end of the Frasnian in the *linguiformis* Zone.

Geochemistry
Carbon isotopic analyses were performed in order to evaluate the relationship of our measured section with the published conodont zonation and carbon isotopic curve (CHEN & TUCKER, 2003; CHEN et al., 2005) and with the conodont zonation.
Geochemistry of major and trace elements were measured on the Fuhe section (upper 6 m) and it appears that there is a moderate positive correlation between elements which are proxies for lithogenic inputs and magnetic susceptibility (r = 0.6), showing that the MS signal is probably of primary origin, related to lithogenic inputs (e.g. RIQUIER et al., 2012; DA SILVA et al., 2012).

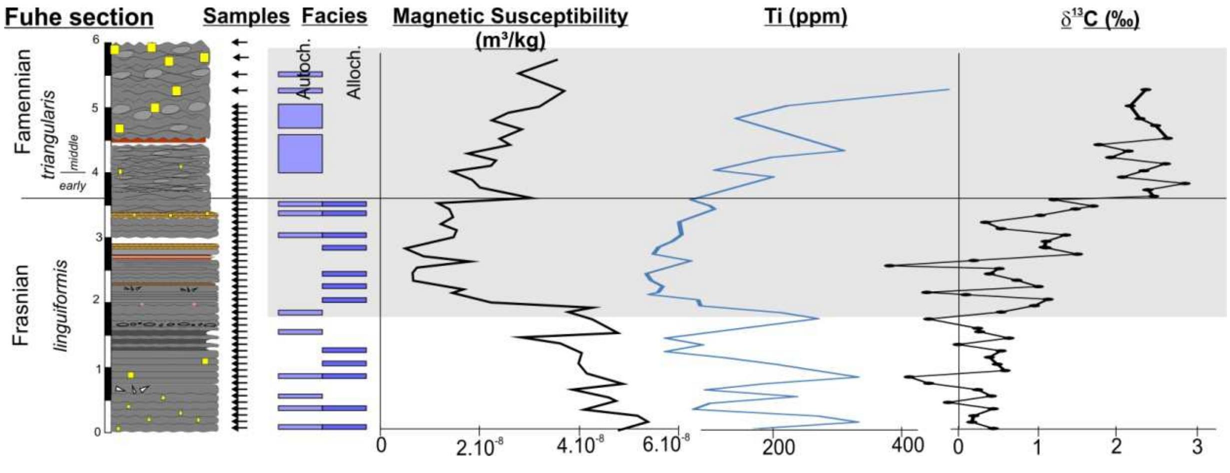

Fig. 1: Upper part of the Fuhe section (last 6 m) with the F–F boundary; position of sample (arrows), facies (autochthonous or allochthonous), magnetic susceptibility, Ti (ppm) and carbon isotopes. The conodont zonations are from CHEN et al. (2005) and the grey area corresponds to the upper Kellwasser interval.

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