

Pointon *et al.* High-precision U–Pb zircon CA-ID-TIMS dates from western European late Viséan bentonites.

## **Supplementary Material**

### **Mean Cycle Periodicity Calculations**

Mean cycle periodicity values were calculated employing the same methodology as used by Pointon *et al.* (2012) for Namurian to early Westphalian siliciclastic cycles within the Pennine and Ruhr basins of northern England and Germany respectively. This is as follows:

#### **Time duration between bentonites W8 and W13**

$$\begin{aligned}
 &= \text{Bentonite W8 weighted mean } ^{206}\text{Pb}/^{238}\text{U date (Ma)} - \text{Bentonite W13 weighted mean } ^{206}\text{Pb}/^{238}\text{U date (Ma)} \\
 &= 335.59 \text{ Ma} - 332.50 \text{ Ma} \\
 &= \underline{3.09 \text{ Ma}}
 \end{aligned}$$

#### **Uncertainty of the time duration between the two bentonites**

$$= \sqrt{(\text{uncertainty of bentonite W8 } ^{206}\text{Pb}/^{238}\text{U date})^2 + (\text{uncertainty of bentonite W13 } ^{206}\text{Pb}/^{238}\text{U date})^2}$$

where date uncertainties are at the 95 % confidence level and exclude systematic uncertainties arising from tracer calibration and the  $^{238}\text{U}$  decay constant (i.e. the  $\pm X$  uncertainty level of Schoene *et al.* 2006).

$$= \sqrt{(0.19 \text{ Ma})^2 + (0.07 \text{ Ma})^2}$$

$$= \pm \underline{0.20 \text{ Ma}}$$

#### **Mean cycle periodicity calculation**

$$\text{Mean cycle periodicity (ka / cycle)} = \frac{\text{time duration between bentonites W8 and W13 (ka)}}{\text{number of intervening cycles}}$$

The uncertainty of the mean cycle periodicity estimate arising from uncertainties in the time duration (ka) is:

$$= \left( \frac{1}{\text{number of cycles}} \right) \times \text{uncertainty in time duration (ka)}$$

These calculations are repeated for the minimum and maximum number of intervening cycles between bentonites W8 and W13 (25.5 and 28.5 cycles respectively; Table S1).

Number of sedimentary cycles	Time duration (Ma)	Uncertainty in time duration ( $\pm$ Ma; 95% confidence)	Mean periodicity (ka / cycle)	Uncertainty in mean periodicity ( $\pm$ ka / cycle)
<u>Between bentonites W8 and W13</u>				
25.5	3.09	0.20	121	8
28.5	3.09	0.20	108	7

**Table S1.** Mean periodicity estimates for early Warnantian sedimentary cycles calculated using the new U–Pb zircon CA-ID-TIMS dates from bentonites W8 and W13

## **References**

Pointon, M. A., Chew, D. M., Ovtcharova, M., Sevastopulo, G. D. & Crowley, Q. G. 2012. New high-precision U–Pb dates from western European Carboniferous tuffs; implications for time scale calibration, the periodicity of late Carboniferous cycles and stratigraphical correlation. *Journal of the Geological Society*, **169**, 713-721, DOI: 10.1144/jgs2011-092.

Schoene, B., Crowley, J. L., Condon, D. J., Schmitz, M. D. & Bowring, S. A. 2006. Reassessing the uranium decay constants for geochronology using ID-TIMS U–Pb data. *Geochimica et Cosmochimica Acta*, **70**, 426-445, DOI: 10.1016/j.gca.2005.09.007.