The diagenesis effect on paleo-temperature reconstruction from Precambrian cherts

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Cherts are considered as possible proxies of paleo-environmental conditions of the Early Earth. Variations in $\delta^{18}O$ and $\delta^{30}Si$ in Precambrian cherts have been used to reconstruct oceanic temperature [1, 2], and to try to address the Faint Young Sun Paradox. However, these reconstructions did not calculate the diagenesis effect, assumed small, on the isotopic compositions. The *in situ* ion microprobe study $\delta^{18}O$ and $\delta^{30}Si$ of microquartz in cherts of different ages, from 3.50 Ga to 1.88 Ga, allowed better understanding of the origin and the formation of these rocks. These results impact the paleo-temperatures reconstruction for Precambrian seawater [3].

The correlation between Al_2O_3 content and $\delta^{30}Si$ can discriminate diagenetic cherts from hydrothermal or silicified cherts. The diagenetic cherts are from the Gunflint Iron formation (1.88 Ga). These cherts show a typical 2-14 ‰ range for $\delta^{18}O$ and 2-5 ‰ range for $\delta^{30}Si$ at the scale of microquartz grains (~ 2 μm). We interpret this heterogeneity as inherited from the diagenesis. Hence, these variations could be explained by a simple model of dissolution-precipitation of an amorphous silica precursor.

The calculated temperatures from this model ranges from +37° to +52 °C, suggesting an hot ocean during the Precambrian Era if Gunflint cherts are representative of global environment conditions [3]. Taking the diagenesis account decrease the seawater temperatures found by bulk analysis previously.

[1] Knauth L.P. Lowe R.D. (1978) *Earth & Planetary Science Letters*. **41**, 209–222. [2] Robert F. Chaussidon M. (2006) *Nature* **443**, 969–971. [3] Marin-Carbonne *et al*. (2010) *GCA* **74**, 116–130.

The Manicouagan impact crater: A site for testing the accuracy of revisions to the K-Ar system

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Compared with the U-Pb geochronometer the K-Ar system still retains relatively large systematic uncertainties. Recent studies have attempted to improve the accuracy of the Ar/Ar method by determination of an accurate age for Fish Canyon sanidine (FCs) [2, 4] and the K-Ar decay constants [3]. The results vary by 1%, beyond what is expected from analytical precision. Although the magnitude of this uncertainty is difficult to assess in single experiments, one can examine whether the amount of dispersion in the three latest revisions represent true external reproducibility and thus reflect geological uncertainties?

Inter-comparison of one Ar/Ar (sanidine) age with one U-Pb (zircon) age is problematic (e.g. zircon magma residence time). Sanidine and zircon have markedly different closure temperatures for the retention of daughter products so we are commonly faced with the question: what are these minerals dating and at what level can we assume equivalence?

Melt rocks from large terrestrial impact events are an ideal target for an Ar/Ar – U-Pb inter-comparison study as they have a somewhat simple crystallization and cooling history and do not suffer the protracted crystallization histories that typify magma-chamber process. Ramezani *et al*. [1] determined a high-precision ID-TIMS ^{206}U-^{238}Pb age for zircon from the Manicouagan impact crater. Here we present a high-precision Ar/Ar age for the coeval sanidine. We will discuss revisions to the age of FCs and the K-Ar decay constants, and show that the latest proposed age for FCs (Channell *et al*. 2010) is not consistent with our data. The approach allows us to get beyond the question of 'what are we dating?' and assess the inter-calibration of the Ar/Ar and U-Pb chronometers at a level approaching analytical precision.

[1] Ramezani *et al*. (2005) 19th Goldschmidt Conference abstract, 321. [2] Kuiper *et al*. (2008) *Science* **320**, 500–504. [3] Renne *et al*. (2010) *GCA* **74**, 5349–5367. [4] Channell *et al*. 2010, *G-Cubed* **11**, 1–21.