Clumped isotope thermometry of Neoproterozoic cap carbonates from northwest and southeast China

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Cap carbonate sequences are widely associated with Late-Neoproterozoic glacial deposits. They are of great scientific interest and have been used for stratigraphic correlation as well as for reconstructing paleoenvironmental conditions. More recently, the extent of post-sedimentary alteration of these rocks has become of great concern, calling into question whether they represent reliable environmental indicators[1].

Post Marinoan-age cap carbonates were analyzed from the Doushantuo Formation in southeast China and the Zhamoketi Formation in northwest China. Samples from two different sections of the Doushantuo Formation were analyzed to assess regional variability, while samples from the Zhamoketi Formation were included to assess variability between cratons.

To characterize the thermal history of the cap carbonates, we utilized carbonate clumped isotope thermometry. We measured the excess of mass-47 isotopologues (Δ_{47}) in order to quantify the crystallization temperature of these rocks.

Elevated temperatures (70-100°C) were found at all 3 sites. These results are lower than the maximum temperatures previously documented for the Doushantuo Formation[1,2], but are consistent with the temperature measurements of dolomicrite[2]. In addition, the Δ_{47} analyses of the Zhamoketi cap carbonate record a thermal gradient, with maximum temperatures recorded at the top of the cap carbonate and declining towards the base. Temperatures also decline within a few meters above the cap carbonate. Our results better constrain the thermal diagenesis within these two formations and underscore the point that post-sedimentary thermal alteration is potentially a problem for cap carbonates on multiple cratons.

[1] Derkowski, *et al* (2013) *Geochim. Cosmochim. Acta* **107**, 279-298. [2] Bristow *et al* (2011) *Nature* **474**, 68-71.

Subduction-related to post-arc magmatism and Cu-Au-Te metallogeny in the Carpathian orogen, Romania

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The Banat Region and Apuseni Mountains are the northernmost segments of the Cu-Au mineralized Apuseni-Banat-Timok-Srednogorie (ABTS)-belt in southeastern Europe. The ABTS magmatic arc formed due to northward subduction of Neotethys beneath the European continental margin during Late Cretaceous times and is accociated with some of Europe's largest porphyry Cu-Au and epithermal Cu-Au deposits. Moreover, this Mesozoic subduction most likely metasomatized the Apuseni source region for a later, temporally distinct phase of magmatism. Miocene extension and consequent partial melting of the mantle source gave rise to non-arc Cu-Au-Te mineralizing calc-alkaline magmas in the South Apuseni Mountains [1].

New major and trace element whole rock data of Late Cretaceous igneous rocks show calc-alkaline to high-K calc-alkaline magma compositions and normalized trace element patterns characteristic of magmas generated in subduction zones. Samples with adakite-like signatures (Sr/Y≥40 and Y≤18) are rare. $^{87}Sr/^{86}Sr_{80Ma}$ WR ratios (0.704243 to 0.707074), $^{143}Nd/^{144}Nd_{80Ma}$ WR ratios (0.512374 to 0.512663) and initial εHf values of zircons point to a mantle source of the magmas that was variably contaminated by crustal components. Geochemical fingerprinting will test the possibly common source of post-subduction magmas.

In situ U-Pb CA-LA-ICP-MS dating and single-grain CA-ID-TIMS dating were conducted on zircons from igneous rocks from Banat Region and Apuseni Mts. All zircons were treated by chemical abrasion (CA) prior to dating [2]. Late Cretaceous magmatic activity in Banat Region covers a time span from 81.4 to 71.2 Ma. A distinct age zonation with younging of the magmatism from east to west is observed in the southern Banat Region.

[1] Harris *et al*. (2013) *EPSL* **366**, 122-136. [2] Mattinson (2005) *Chem Geology* **220**, 47-66.

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