Tin-bearing skarns with As mineralization at the south-eastern margin of the Bohemian Massif

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Rare but geochemically significant tin mineralization occurs in calc-silicate rocks (unzoned skarns) in marbles at the south-eastern margin of the Bohemian Massif (Svratka Unit); it is locally associated with arsenic and boron mineralization. The three stage origin of the skarn assemblage commenced by high-temperature reactions in a Fe-poor system, resulting in diopside, grossularite, wollastonite and clinozoisite. During the second stage, fluid infiltration introduced Fe, Sn, As, Bi and locally also B and F in the system, producing Sn-rich titanite and malayaite, Sn-bearing andradite ($Adr_{85-90}Grs_{10-13}$; 1.2-2.4 wt.% SnO_2), löllingite, As-bearing fluorapatite (≤12.24 wt.% As_2O_5), As,B-rich vesuvianite (≤1.97 wt.% As_2O_5; ~1.96 wt.% B_2O_3), bismuth and rare nordenskiöldine and fluorite. The third, retrograde stage caused alteration of the primary phases and produced e.g. secondary cassiterite, stokesite or datolite.

The infiltration of fluids modified the system evolution to the conditions with high fO_2, $a(H_2O)$ and locally elevated a(F) and a(B). Initial tin storage in the Sn-rich titanite and the malayaite as the earliest phases of skarn evolution [cf. 1] was followed by subsequent exsolution of cassiterite from malayaite and corrosion of primary phases. Distribution of As and Sn during following contemporaneous crystallization of silicates (Sn-rich andradite, As,B-rich vesuvianite), phosphates (As-rich fluorapatite) and borates (nordenskiöldine) was constrained also by structures of individual phases rather than by the P-T-X conditions (Tmin > 300°C, elevated activity of fluids) alone. Residual As in the fluid produced löllingite.

The occurrences of tin-bearing calc-silicate rocks are spatially bound to tourmaline orthogneisses with elevated contents of tin and fluorine [2,3]. The orthogneisses were earlier suggested being a source for Sn-anomalies in surrounding metapelites [3]. The tin skarns provide new evidence for metasomatic processes during the multistage metamorphic evolution of the area in a time span between late Cambrian and Carboniferous [4].

[1] Cempírek *et al*. (2008) *Min Mag* **72,** 1293-1305. [2] Houzar *et al*. (2006) *Acta Mus Moraviae* **91,** 3-77. [3] Němec (1979) *Z geol Wiss* **7,** 1437-1447. [4] Schulmann *et al*. (2005) *Am J Sci* **305,** 407-448.

Mid-latitude continental response to falling atmospheric P_{CO2} during the Eocene-Oligocene transition

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The Eocene-Oligocene transition represents one of the most dramatic and permanent changes in global climate during the Cenozoic and was driven in part, by large-scale changes in atmospheric CO_2. Marine sediments provide a detailed record of changes in surface and deep ocean temperature and the development of the Antarctic ice-sheet during this time interval, however continental records that can be correlated to the geomagnetic polarity timescale are relatively few. As a result, there is considerable uncertainty over the magnitude and rate of continental climate response to changing CO_2 levels and the feedbacks associated with these changes. We measured the Δ_{47} of aragonite shells from freshwater gastropods in Eocene to Oligocene sediments in the Hampshire Basin, Isle of Wight, UK, to reconstruct the change in mid-latitude (~50°N) Northern Hemisphere terrestrial temperature during this critical climate transition. Isotopologue data show that growing season water temperatures decrease by more than 15°C from 34.5 to 33 Ma, corresponding to a maximum decrease in mean annual air temperature of more than 10°C. This drop in mid-latitude continental temperature occurs in tandem with a large-scale declines in atmospheric CO_2. The magnitude of this continental temperature change during a near-halving of CO_2 levels indicates a strong regional climate sensitivity for this climate transition. These data highlight the importance of understanding the relationship between the marine record and the continental realm, and spatial heterogeneity in the climate-CO_2 feedback systems.