Effect of increased glacier melt on diagenetic Fe cycling in marine sediments at King George Island (Antarctica)

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The glacier melt of the Western Antarctic Peninsula and its surrounding islands influences biogeochemical processes in the water column and the marine sediment by changing the flux of mineral particles and nutrients (e.g. Fe) into the ocean. Sediment and pore water samples were collected at King George Island (South Shetland Islands) to unravel how the vicinity of ice-covered and -uncovered terrestrial environment affects redox zonation and diagenetic processes in the coastal sediments. The post-depositional dissolution of Fe-minerals and the stable Fe isotope signatures of pore water and specific Fe minerals were of special interest since changing Fe supplies - as reactive particles via melting icebergs or meltwater streams or dissolved via diffusion from the sediment into the bottom water - might not only impact local biogeochemical cycles but most likely also impact productivity in the Southern Ocean.

Sediment cores of up to 45 cm length were retrieved in Potter Cove, Marian Cove, and Maxwell Bay. In vicinity to the glaciers the sediments showed an extended redox zonation. The post-oxic zone with Fe^{2+} concentrations of up to 300 μM ranged from 1 to 25 cm depth. Most probably, microbial activity in sediments close to the glaciers is sluggish due to low input of organic matter (OM). More condensed redox zones prevailed in troughs where OM from terrestrial or marine sources accumulates and in vicinity to research stations. The upward directed diffusive Fe^{2+} fluxes as inferred from pore water profiles range between 0 and ~1050 $\mu M\ m^{-2}\ d^{-1}$. However, the correlation to the intensity of diagenesis is not straightforward. Fe isotopes of specific minerals were used to assess the intensity of Fe cycling. With ongoing Fe-oxide dissolution, the residual Fe pool becomes enriched in ^{56}Fe, whereas dissolved Fe and secondary Fe-oxides become enriched in ^{54}Fe. Thus, easily reducible Fe oxides show lowest δ^{56}Fe values at the top of the sediment column. We suggest that the retreat of the glaciers indirectly results in higher OM fluxes to shelf areas fueling diagenetic processes/nutrient recycling.

P-T evolution of Neoproterozoic and Ordovician metamorphic rocks in the Iberian Massif, Central Portugal

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The study area is located at the boundary of the Ossa Morena-Central Iberian zones in the Iberian Massif. An island arc and a continental margin setting were active during the Ediacaran period. Both events are represented in the Sardoal Complex (SC) by amphibolites and felsic orthogneisses, respectively. An Ordovician rift magmatic event is recorded, in the Mouriscas Complex (MC), by a protomylonite trondhjemite and a garnet amphibolite with a MORB signature. We present the first *P-T* diagrams based on the thermodynamic modelling, which were computed using the Perple_X. The ID-TIMS U-Pb metamorphic zircon age from the SC amphibolite is 539 ± 3 Ma. The estimated *P-T* conditions were based on the compositional isopleths for key mineral phases in the stability field (Cpx-Am-Pl-Ilm-Ttn) at 7–8 kb and 640-660º C. The ID-TIMS U-Pb metamorphic monazite age from the felsic orthogneiss is 539 ± 2 Ma. The *P-T* path indicates an evolution from 4.5 kb and 590º C in the Bt-Pl-Ms-Grt-Sil-Qtz-Rt-Ilm field towards lower pressure and temperature field Bt-Pl-Ms-Grt-Qtz-Ilm at 4-4.5 kb and 570-580º C. The ID-TIMS U-Pb igneous zircon age from MC protomylonite trondhjemite is 483 ± 1.5 Ma. The estimated *P-T* conditions were based on the compositional isopleths for key mineral phases in the stability field (Bt-St-Pl-Ms-Grt-Sil-Qtz) at 4.5-6.2 kb and 590-650º C. The ID-TIMS U-Pb igneous zircon age from the MC garnet amphibolite is 477 ± 2 Ma. The estimated *P-T* conditions were based on plagioclase and biotite isopleths in the stability field (Bt-Chl-Ep-Am-Pl-Ilm-Mag-Grt-Qtz) at 6.5 kb and 550º C. Two major geodynamic events at the amphibolite facies conditions were identified in this study. The first one, the continental arc accretion of the Ossa Morena Zone to the Iberian Autochthon passive margin (Northern margin of Gondwana) occurs at ca. 540 Ma. The second one, younger than ca. 477 Ma is probably connected to the opening of the Rheic ocean.

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