Tracing the late Paleozoic to early Mesozoic crustal evolution of coastal Southern Peru

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Subduction related magmatism along the Andean margin started as early as 550 Ma ago. Previous studies reveal a complex magmatic history from the late Paleozoic to the early Mesozoic that involved contributions from both mantle and crust.

This study aims to trace crustal growth and recycling through time along the South Peruvian margin with U-Pb laser ablation ICPMS dating on (Jurassic) plutonic and (Carboniferous – Jurassic) detrital zircons combined with a LA-MC-ICPMS Hf isotope study. This margin is especially suited for this type of study as no evidence is know of terrane accretion along this part of the margin since the Ordovician.

Our ages on detrital and plutonic zircons confirm periods of subduction related magmatism in the Ordovician, Permo-Carboniferous, and late Triassic-Jurassic, but also show periods of magmatic quiescence in the early Triassic and late Devonian.

A combination of Hf, Sr, Nd and Pb isotopes on the Jurassic plutonic rocks will be employed to quantify the relative contributions of mantle and crust to the melts formed along this part of the Andean margin. Additionally, Hf isotopes on detrital zircons will reveal periods of recycling and juvenile input. Preliminary results point towards crustal recycling as the dominant process of crustal evolution along the south Peruvian Andean margin between Carboniferous and Jurassic.

Aerosols, chemistry and the onset and evolution of fog layers

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In Western Europe, the occurrence of fog is on the decline since the 1980's. A reduction in the emission of anthropogenic aerosols due to increasingly strict regulatory measures and technological improvements on car and industrial exhaust seems a plausible reason for this decline. However, the onset and evolution of fog is the result of an interplay between a number of complex meteorological and aerosol – chemical factors. Here we model the evolution of fog and its sensitivity to atmospheric cooling rate, variation in aerosol size parameters and the aerosol chemical hygroscopicity parameter. First conclusions from these simulations can be summarized as follows:

1) Below RH=100% the three most important parameters controlling the visibility are the hygroscopicity parameter ($\varkappa$), the total number of aerosols and the relative humidity (RH) itself. For moderate to high values of $\varkappa$ (>0.4) and aerosol concentration typical for continental conditions (2000 - 4000 cm^{-3}), visibility can easily be reduced to below 1 km so that the meteorological condition for the occurrence of fog is satisfied, even though RH < 100%.

2) When RH > 100% and particle activation occurs, the parameter $\varkappa$ rapidly loses it significance in determining visibility. Rather it is the radiative cooling rate that exerts control over the value of visibility. The physical interpretation is that only a few particles (typically less than 150 cm^{-3}) are activated no matter what the value of $\varkappa$ is. Since these few particles grow rapidly upon activation they become increasingly more important in contributing to the reduction in visibility in the fog as the cooling progresses, so that the original sensitivity of visibility to $\varkappa$ when RH was still below 100% is quickly lost.

In atmospheres with RH<100% improved visibility may have been caused by reduced numbers of aerosols. However, for RH = 99% a reduction of $\varkappa$ from 0.9 to 0.5 yields an improvement of visibility from 1 to 2 km. Further work will be necessary to investigate whether changes in emission sources and land usage combined with possible changes in the relative humidity are contributing factors in explaining improved visibilities in the last three decades.