Geospeedometry applied to El'gygytgyn impact glass

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The El'gygytgyn impact glass has been investigated with the method of relaxation geospeedometry. The sibirian impactite was found in the 3.6 Myr old El'gygytgyn impact structure in lacustrine terraces.

The aim of this research was to determine the natural cooling rate of the El'gygytgyn rhyolitic glass (71.3 % SiO_2, 14.9 % Al_2O_3, 4.1 % K_2O, 2.8 % CaO, 2.8 % Na_2O_3, 2.7 % FeO, 1.1 % MgO, 0.3 % TiO_2, in wt-% by 20 EMPA analysis).

The method of geospeedometry based on the structural relaxation in silicate melts was first applied to natural glasses by [1]. The procedure is referred to the Tool-Narayanaswamy approach [2]. The cooling history of the impactite is frozen in its structure. The temperature-dependent reheating across the glass transformation was used to obtain the original cooling history. The relaxation of the enthalpy was achieved by measurements of the heat capacity.

Therefore, differential scanning calorimetry (DSC) measurements with certain heating and cooling rates were performed. The impact glass was heated above the glass transition (T_g) to ensure the complete relaxation of the glass structure. Thereupon, the kinetic parameters were adjusted for each thermal cycle.

We can deduce that the cooling rate for the impact glass is between 0.15-0.85 K/min. The cooling rate is comparable to the data determined for phonolite obsidian flows on Tenerife [3] but significantly slower than for tektites reported in literature. Hence, we present that the final cooling of the El'gygytgyn impact glass originated witin the hot impact structure.

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The influence of physically-induced porewater advection, benthic photosynthesis and respiration on $CaCO_3$ dynamics in reef sands

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Reduced net calcification owing to increasing pCO_2 from the burning of fossil fuels suggests a potential reduction in carbonate accumulation in continental margins, where a large fraction of global carbonate accumulation occurs. This feedback in the ocean carbonate cycle lends particular importance to understanding the factors controlling carbonate accumulation and dissolution in coastal and shelf deposits. Permeable biogenic carbonate sediments in reef environments are poised to play a crucial role in the response of ocean margin environments to ocean acidification, because of the interplay between porewater exchange, benthic community metabolism and $CaCO_3$ dynamics in these deposits.

Sediment oxygen consumption rates, porewater profiles and benthic fluxes of oxygen, pH, calcium, alkalinity, and dissolved inorganic carbon were determined in reef sands (Heron Island, Australia) of different permeability across a range of hydrodynamic conditions. In these biogenic deposits, porewater advection and light stimulate rates of benthic photosynthesis, which, in turn, fuels calcification in surface sediments. Furthermore, our results indicate an important damping effect of porewater advection on the efficiency of respiration-driven carbonate dissolution in sediments. Therefore, we argue that the synergistic effects of porewater advection, benthic respiration, photosynthesis, calcification and carbonate dissolution promote carbonate preservation in permeable ocean margin deposits, and have a direct bearing on past, present and future changes in the ocean carbonate cycle.