Deglaciation pattern during the Late-Glacial / Holocene transition in the Southern French Alps. Chronological data from the Clarée Valley (Durance catchment, S. France)

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The Southern French Alps, characterized by many climatic influences, remain a scientific problem for palaeo-environmental studies. Indeed, the lack of chronological benchmarks hitherto hampered the definition of sequences of glacier variations since the Last Glacial Maximum (LGM), even if a scenario was established in the Ubaye valley. This scenario was then considered as a regional model by many geomorphologists, but this valley is not necessarily representative of the entire region. We focus here on the upper part of the Durance watershed because it corresponds to the accumulation zone of the main glacier of the Southern French Alps during the LGM. Thanks to extensive fieldwork and geomorphic mapping of remnants of past glaciations, and thanks to new chronological data (about 35 cosmic ray exposure –CRE– ages) we propose the first absolute scenario established in the very upper part of the catchment. To assess CRE ages, we sampled glacially-polished surfaces, in order to assess both the retreat of the front and the thinning rate of the glacial tongue. We also paid attention to morainic ridges and glacio-fluvial remnants. The results show that cirque glaciation began only at the beginning of the Holocene, and that thick valley glaciers still occupied the upper valleys during the Late-Glacial period, until the Younger Dryas stadial. The disappearance of the tongue occurred rapidly, between Younger Dryas and Preboreal sequences due to both ELA rise and a topographic threshold effect. Finally, this scenario appears to be well in accordance with new data obtained in other parts of the Alps.

The composition of the Earth's outer core from first principles

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The exact composition of the Earth's core remains an unanswered question. Published models for the outer core allow a mixture of several coexisting light elements (Si, S, O, C), and many arguments have been put forward over the years for and against each of those elements.

In this study we performed *ab initio* molecular dynamics calculations on liquid Fe and liquid Fe-(Si,S,C,O) mixtures at different P and T conditions of the Earth's outer core in order to attempt to constrain the light-element concentration based on densities and bulk sound velocities. By fitting equations of state to our P-V data, we were able to obtain density and velocity vs. concentration profiles for each iron-light-element liquid alloy; this allowed us to estimate the density for different outer core compositions found in the literature and compare them with seismic models such as PREM and AK135. We find that the density of liquid Fe containing 4% of Ni (no light elements) is approximately 7% denser than the core. Incorporating light element increases the bulk sound velocity while decreasing density. We also find that many of the published compositional models for the outer core result in densities lower than the seismological models. This indicates that the light element concentrations predicted in those models are slightly overestimated. Our data agree with an O-rich outer core (up to 6.3wt. %), and we find that large amounts (more than 3 wt. %) of Si cannot be incorporated in the outer core.