Reconciling ^{14}C timescales for marine isotope stage 3

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Radiocarbon is used to constrain the chronology of a vast array of paleoclimate records, geomagnetic/solar modulation of cosmogenic nuclide production, and dynamics of the past carbon cycle. Carbon-14 timescales have an effective range of > 50 ka, but for the period > 26 ka there is currently a range of alternative records. Here, we reconcile some of the differences between existing archives using a suite of MC-ICPMS U-Th and AMS ^{14}C ages for a new speleothem record from the Bahamas. This represents an attempt to duplicate another stalagmite record (GB89-24-1) from the same cave [1], which attracted much attention because it revealed surprisingly elevated and variable Δ^{14}C (> 1000‰) from 45 to 40 ka. These features are not recorded in recent records from the marine realm (e.g. Cariaco Basin [2])

Adoption of an improved low-blank ^{14}C protocol revealed procedural blank artefacts that significantly influenced the older section of GB-89-24-1. The new record, GB-89-25-3, exhibits elevated Δ^{14}C, up to 600‰ with abrupt 200‰ shifts, for most of the period 45 to 28 ka, but the large peak at ~44 ka is not present. The record is broadly similar to that of Cariaco Basin [2], however, there are some significant differences in timing and amplitude, particularly between 28 and 32 ka. While we recognise that both records can be influenced by varying reservoir effects, much of the difference can be reconciled by adjusting the Cariaco record to the ice core chronology, GICC05 [3].

The Δ^{14}C pattern revealed by the Bahamas and Cariaco records corresponds well with the geomagnetic intensity record GLOPIS-75 [4]. While the latter dominates the temporal pattern of ^{14}C production, Δ^{14}C is also influenced by carbon cycle dynamics. Hence, we explore the nature of ocean-circulation and air-sea exchange during the last glacial period by comparing the Δ^{14}C estimated from the geological record with that from a suite of transient runs using GENIE, a fast, intermediate-complexity Earth-system model.

[1] Beck *et al.* (2001) *Science* **292**, 2453-2458. [2] Hughen *et al.* (2006) *Quat. Sci Rev*. **25**, 3216-3227. [3] Andersen et al, *Clim. Past* **3**, 1235-1260. [4] Laj *et al.* (2004) in *Timescales of the Paleomagnetic Field*, AGU. p255–265.

Structural geology and geometry of subducting and subducted slabs

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Characteristics of subducting plates such as slab age, structure and angle of subduction are key to understanding the geological evolution of the overriding plate. Recent advances in computer technologies have allowed us to interpret and visualize the geometry of subducting slabs with new precision. Results show that slabs are not simple uniform sheets of crust and lithosphere that penetrate the Earth's asthenosphere; rather, they exhibit extremely complex geometries including faults, tears, folds and boudinage. The shape and structure of any given slab or slab segment can be used to help interpret the evolution of subduction zones and associated orogens over time.

The 3D geometry and 4D evolution of: (1) the subducted Nazca slab below South America, (2) the subducted NW Indo-Australian slab below SE Asia and (3) remnant subducted slab(s) below India and the Pamirs are presented here to bring to attention the complexity in slab geometry and how this geometry can be used to explain aspects of the geological evolution of each region including changes in the geochemical evolution of arc volcanics.

Specific features that will be presented include a recumbent, isoclinal fold in the Nazca slab some 400 to 600 k below the south central Andes with its lower, overturned limb resting near the 660 km discontinuity. This folding can be explained by changes in the relative motion between the Nazca and South American plates at around 120 Ma ago.

The formation of vertical and horizontal tears, folds and boudinage of the Indo-Australian plate will also be presented.