

## **Review of manuscript by Burns et al, Climate of the Past**

The manuscript entitled "A tropical speleothem record of glacial inception, the South American summer monsoon from 125 to 115 ka" presents a high quality record, probably the best record of changes in South America Monsoon during the last interglacial period. I think it certainly deserves to be published but only after a more detailed discussion on the meaning of the paleoclimate reconstruction proposed here. I particularly do not agree that a speleothem isotope record could be used to constrain the timing of glacial inception at about 120 ky B.P. I organized my comments according to the manuscript sections.

### **Abstract**

Two points needs to be more adequately addressed in the paper.

1 – The rapid increase in the SASM at about 120.8 ky B.P. cannot be attributed to the insolation forcing alone. However, I disagree that it is resulted from expansion of land ice in Northern Hemisphere. It is likely to be resulted from an abrupt millennial cold event originated in the Atlantic Ocean instead.

2- line 15-16 :

What are the full glacial conditions inferred from speleothem records? I think speleothem records from tropical regions such as Peru are considered a good proxy for precipitation changes not temperature. The SASM are more directly influenced by changes in summer insolation or SST gradient in Atlantic Ocean and there is no direct impact in the SAMS because of expansion in the Northern Hemisphere land Ice Cover. The ice cover can influence the SAMS through changes in the oceanic circulation; however the abrupt change in  $\delta^{18}\text{O}$  observed at 120.8 ky is probably resulted from sea Ice cover mainly. If this fact is correct, the 120.8 ky event cannot be used as the age of last glacial inception because it is not necessarily reflecting the changes in land ice over the continents.

#### **4.1 Interpretation of oxygen isotope variability**

The steps observed in the isotope curve of the Huagapo record cannot be attributed to insolation forcing. It likely to be a response to millennial events because changes in SST gradient in Atlantic ocean. These events are superimposed on the insolation trend observed in the stable isotope curve of speleothems. The changes in SAMS due to insolation forcing are expected to be a response to gradual variation in thermal sea-land gradient in South America; therefore they probably have nothing to do with abrupt stepped shifts in  $\delta^{18}\text{O}$  values observed just before the demise of last interglacial period.

#### **4.2.2 Comparison to ice core records**

To me the text confuses the reader and needs some clarification. The speleothem records from Peru are not a proxy for Ice growth and cooling in Northern Hemisphere. In fact, the insolation forcing acts together with millennium scale events in the abrupt shifts of oxygen isotope ratios in the speleothems. There is a interstadial period from 119 ky to 117 Ky B.P. observed in the Greenland ice-core record that is apparently disrupting the insolation trend by forming these steps in the isotope curves (Fig. 3). Indeed, this corresponds to the GIS 26 event that is characterized by occurrence of significant Ice raft debris event over Atlantic ocean (please see Oppo et al., QSR, 2006, 25, 3268–3277). Thus, it is possible that the abrupt decrease in isotope values observed in the Peruvian speleothem record is probably associated with the millennial changes in SST gradient in tropical Atlantic resulted from collapse of AMOC rather than changes in summer insolation. This is a common response of SAMS to the Heinrich Stadial events throughout last glacial period and should be considered here.

#### **4.3 Implications for sea-level reconstructions**

23-28 – Again, the changes in South American Monsoon cannot be considered a direct response to cooling and increasing land-ice over the N.H. continents. For instance, a typical Heinrich stadial event impacts positively the SAMS through changes in Atlantic SST gradient that could be independent of a large increase in N.H.Land Ice volume. This might be the case of large drop in isotopic values observed at about 120 ky in this Peruvian speleothem record. For this reason I still think that the Coral records show with more confidence the end of sea-level highstand that mark the demise of last interglacial period at about 117 B.P.