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## PALEOCLIMATE RECONSTRUCTION DURING THE LAST 30 000 YRS OF THE MIDDLE ATLAS IN MOROCCO USING SPELEOTHEMS

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**Palavras-chave:** *Paleoclimate reconstructions, speleothems, Middle Atlas, Morocco,*

### ABSTRACT

A precisely dated speleothem record by U-Th method allows a potential reconstruction of past climate and environment changes occurred in the Middle Atlas in Morocco (TAZA region). Those U-Th dates obtained from three different speleothems indicate a record covering the last 30,000 yrs of regional paleoclimate changes. Three periods will be well documented based on these first results, the late glacial including the LGM, the Holocene and the last millennium. Based on the growth rate of those speleothems, an interdecadal to millennium time scale variability of climate conditions of this region will be reached and well documented.

### I. INTRODUCTION

The speleothems are widely used to reconstruct paleoclimate and paleoenvironment changes. They offer the possibility to reconstruct past climate changes during large millennium times scales, precisely dated by U-Th (Fairchild et al., 2006). Another important aspect of the use of those paleoclimate archive is that variations in some inorganic elements composition (Sr/calcium and Mg/calcium) and/or oxygen and carbon isotopic composition are, in general, sensitive to changes in climate (precipitations, temperatures) and environmental (vegetation) parameters (Cruz et al., 2009). Several studies have shown changes in precipitations and temperatures during the last 30 000 yrs (Cheddadi et al., 1998; Lamb et al., 1989, Roujatti et al., 2010). These studies indicate also that the early Holocene was dry followed by wet conditions in the middle Holocene, which correspond to the most northern extend (30°N) of the Inter Tropical Convergence Zone (ITCZ). Further north this limit (30°N). However; the continental records are still very scarce in northern Africa. Here, we will present the first of stalagmite of the Middle Atlas in Morocco, which can help to illustrate the complexity of the climate system at the triple point of the Mediterranean, North Atlantic and Saharian/Monsoonal climate systems.

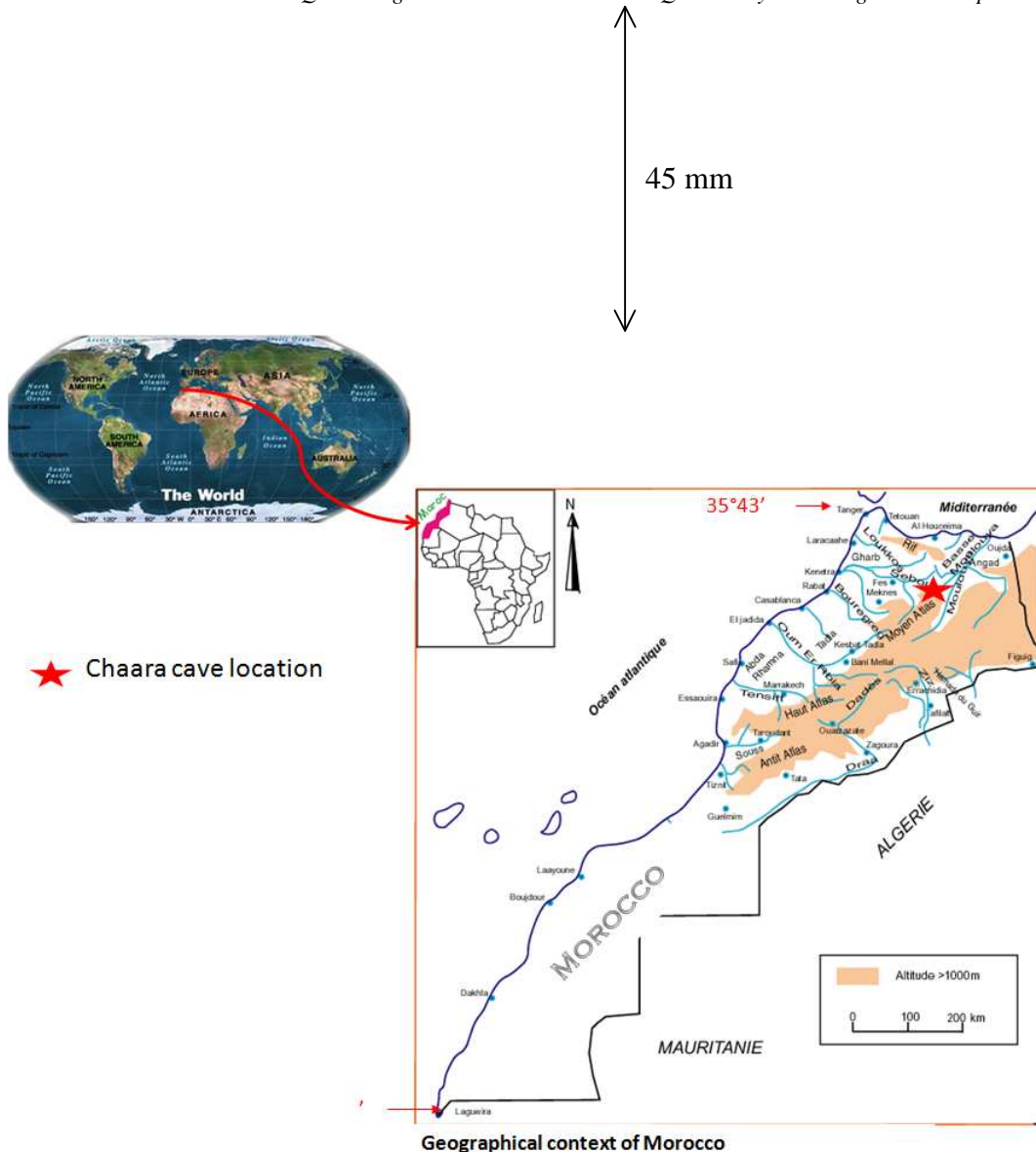


Figure 1: Localization of the Chaara cave (Middle Atlas, TAZA region) located in southern part of Taza. ( $x = 606,5$  ;  $y = 373,7$  ;  $z = 1200$  m, it developed along 7650 m length). This cave constitutes the second important one in Morocco after Win Timdouine in Agadir area and the fourth one in Africa.

## II. RESULTS and DISCUSSION

The preliminary results of this study concern mainly the chronology of three stalagmites collected in the cave situated near TAZA city in the middle Atlas in Morocco. Ten U-Th ages indicate a compiled paleoclimate record of 30 000 yr (Figure 2). These results also indicate that two stalagmites show approximately continuous growth rate. One covering the part of the glacial period and second one the Holocene, which might imply in wet enough for past deposition of speleothems. Future Oxygen isotope analyses of those speleothems will help us to confirm our hypothesis.

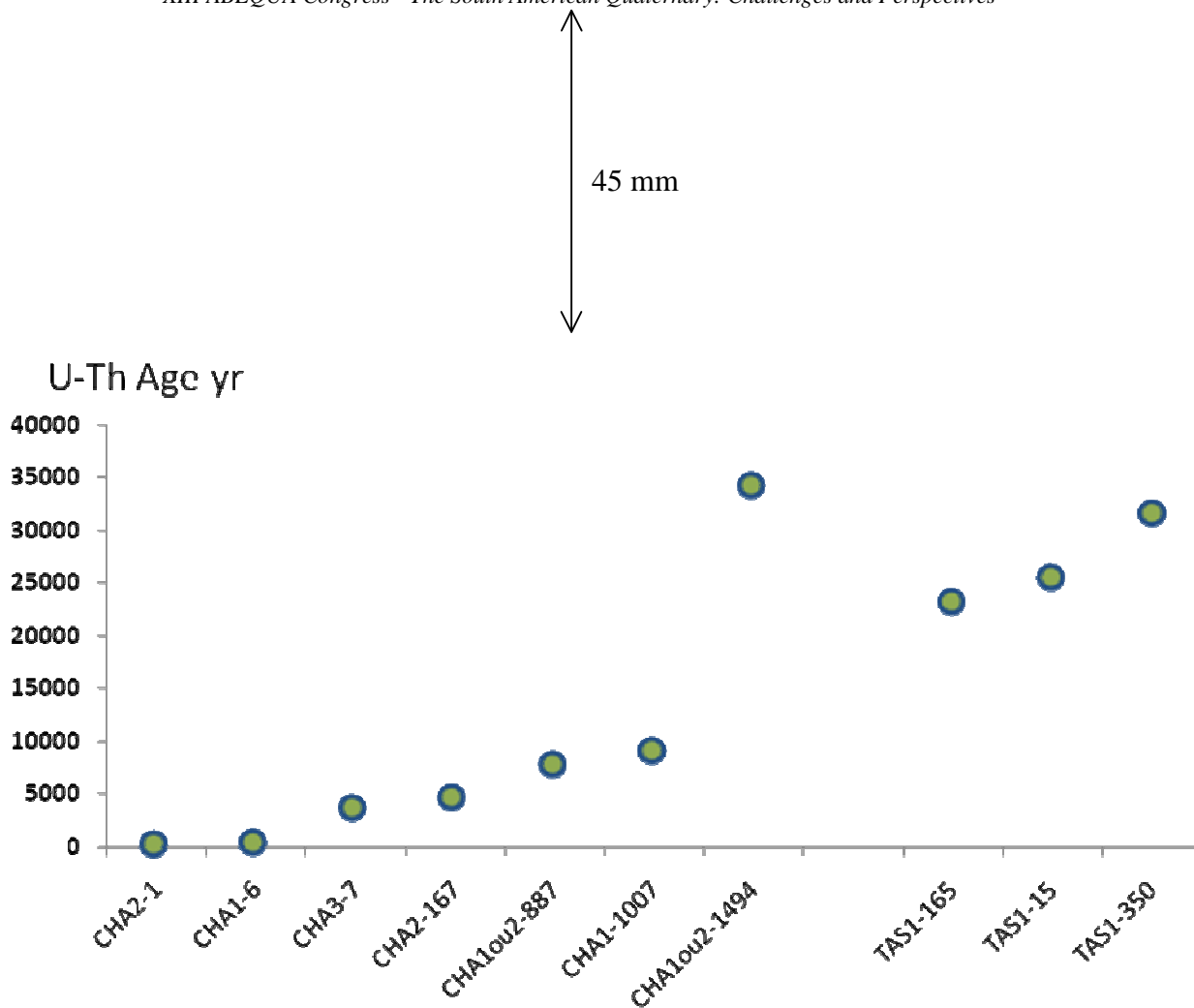


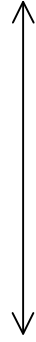
Figure 2 : U-Th ages of the Chaara speleothems (CHA1, CHA2, CHA3 and TAS1)

**Acknowledgements:** The authors thank Faouzi L. and A. Ighous members of Association sportive et spéléologique d'Agadir (ASS) and Houceine El Mansouri from Association of speleologist of TAZA for their appreciable help in the field and their wonderful hospitality.

### III. REFERENCES

- Lamb, H F U Eicher, Switsur, V. R. An 18,000-Year Record of Vegetation, Lake-Level and Climatic Change from Tigalmamine, Middle Atlas, Morocco. *Journal of Biogeography* (1989). *Journal of Biogeography* (1989) 16, Issue: 1, Pages: 65–74
- Rhoujjati A. Cheddadi, R. Taïeb, MBaali, . A. and Ortu, E. Environmental changes over the past c. 29,000 years in the Middle Atlas (Morocco): A record from Lake Ifrah. *Journal of Arid Environments*, 74, 7, Jul, Pages 737-74
- Cruz, F.W.; Vuille, M.; Burns, S.J.; Wang, X.; Cheng, H.; Werner, M.; Edwards, R.L.; Karmann, I.; Auler, A.S.; Nguyen, H. Orbitally driven east-west antiphasing of South American precipitation. *Nature geosciences*, v. 2, p. 1-5, 2009
- Fairchild, I.J.; Smith, C.L.; Baker, A.; Fuller, L.; Spotl, C.; Matthey, D.; McDermott, F. E. I. M. F. Modification and preservation of environmental signals in speleothems. *Earth-Science Reviews*, v. 75, p. 105-153, 2006.

*XIII Congresso da Associação Brasileira de Estudos do Quaternário ABEQUA  
III Encontro do Quaternário Sulamericano  
XIII ABEQUA Congress - The South American Quaternary: Challenges and Perspectives*



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