GUADIX-BAZA BASIN

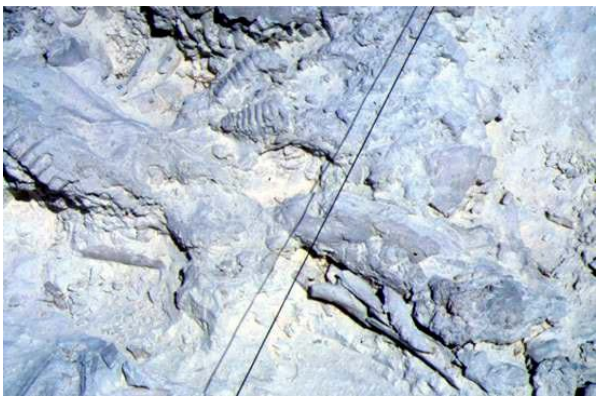
353 m thick section in the Guadix Baza Basin (Granada, SE Spain)

Brackish-water pelecypods (Cerastoderma glaucum) from the Guadix Baza Basin

Sampling in the lacustrine section from the Guadix Baza Basin (Canada de Murcia area)

Earthquake record in the Guadix Baza Basin

Displacive gypsum of Torre del Salar site in the Guadix Baza basin

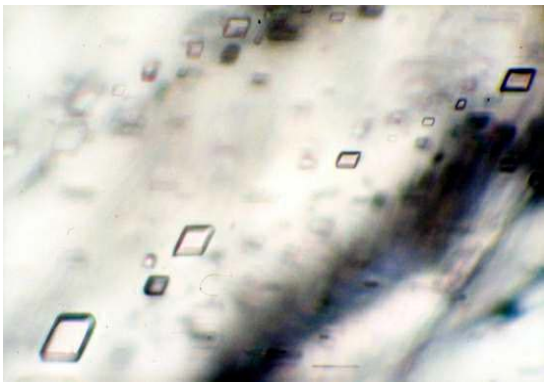


Mammal bone accumulation of Venta Micena site in the Guadix Baza Basin

A general view of the Guadix Baza Basin (near Galera)

Guadix Baza paleontological site dated at ca 45 ky

Sampling for ostracodes in the Guadix Baza composite type section



Fluid inclusions in gypsum allow to obtain palaeonviromental information

Palustrine deposits in Guadix Baza composite type section in which biomarkers were extracted and studied

Guadix-Baza Basin is a “basin and range” endorheic depression that covered approximately 4,500 km 2 . It is located in the central part of the Betic Range, (Fig. 1) in the northeast extreme of the Granada Province (Andalusia, Southeastern Spain). It has a irregular shape with its maximum length oriented SW-NE and placed 900-1000 m a.s.l.. The climate is Mediterranean with a strong continental influence: winters are cold and dry whereas summers are extremely hot, with maximum temperatures reaching over 40ºC. The rainfall annual average ranges 300 to 350 mm yr -1 , the evapotranspitration is 700-900 mm yr -1 and the mean annual temperature is between 12-15ºC. This semi-arid climate favoured the development of a bad-land landscape, mainly covered by steppe plants finding major trees only along the scarce rivers that run through the basin. Along the basin there are springs characterised by their brackish waters either carbonated or sulfated.

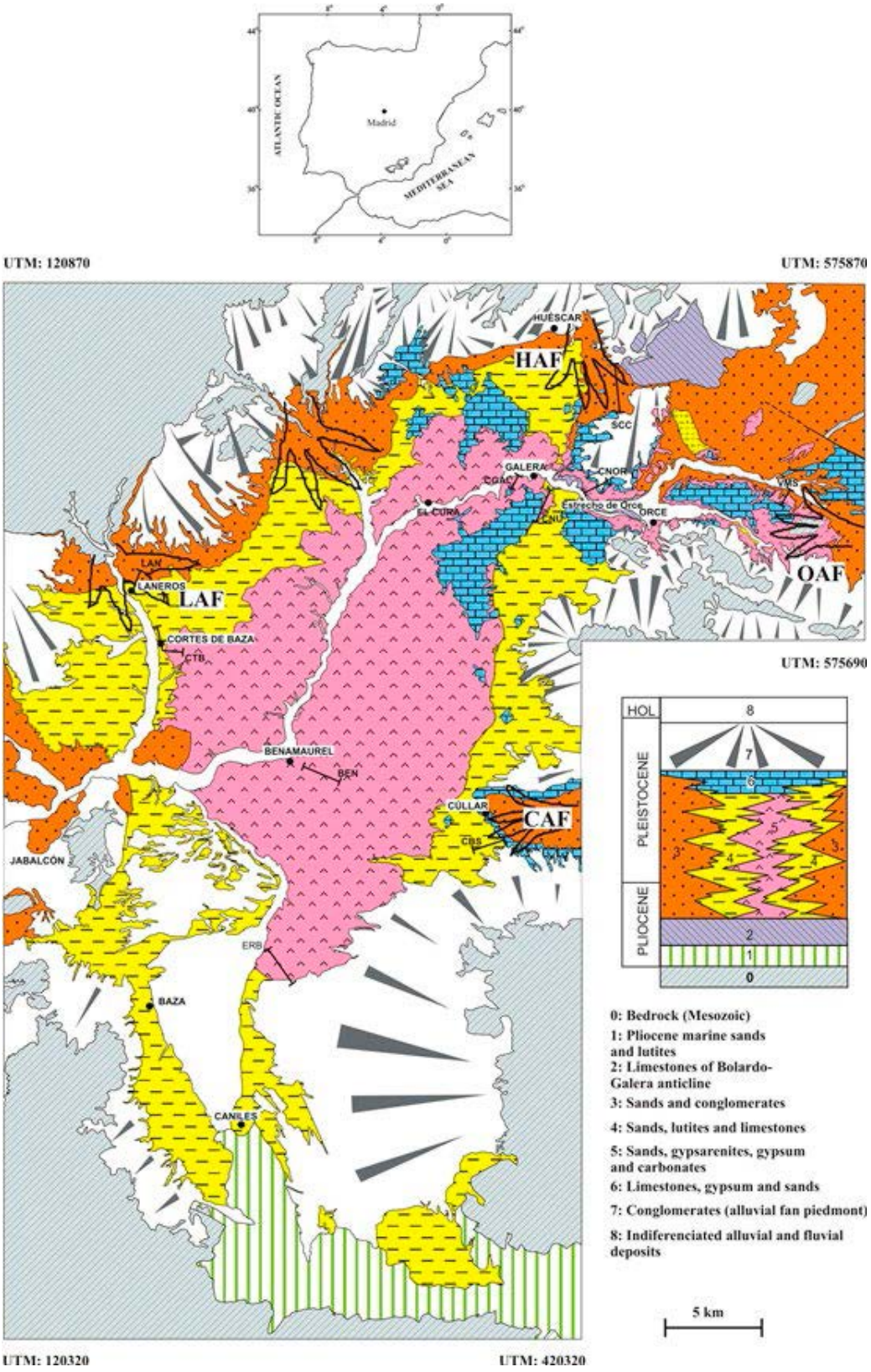


Figure 1. Geographical location and Geological setting of the Guadix-Baza Basin.

The origin of Guadix-Baza basin is related to the Alpine Orogeny which affected Mesozoic and Cainozoic rocks within the region. In brief, the basin can be understood within a centripetal depositional model, that is, coarse grained alluvial fans at the foot of mountain ranges, which gradually pass into a system of channels that flowed out to a central system of small shallow saline lakes distributed in a mosaic pattern with sedimentation of gypsiferous lutites, gypsiferous sands, gypsum and, sometimes, d ecimetrical lutite beds with displacive gypsum crystals (Torres et al ., 2003).

At the end of Middle Pleistocene, erosive processes began, and the current fluvial system was established (Ortiz et al ., 2000), producing the typical bad-land landscape that can be observed nowadays. Likewise the basin drainage was deeply modifed, from endorheic to exorheic towards the Atlantic Ocean via the Guadalquivir river.

Three main different depositional settings (facies) are distinguished (Fig. 2):

1) Upper alluvial fan gravels and lens-shaped channeled sands.

2) Sand playa deposits and mud flat playa (red lutites).

3) Lacustrine sands with abundant ostracod valves and grey lacustrine gypsiferous lutites and sands, carbonate and gypsum beds.

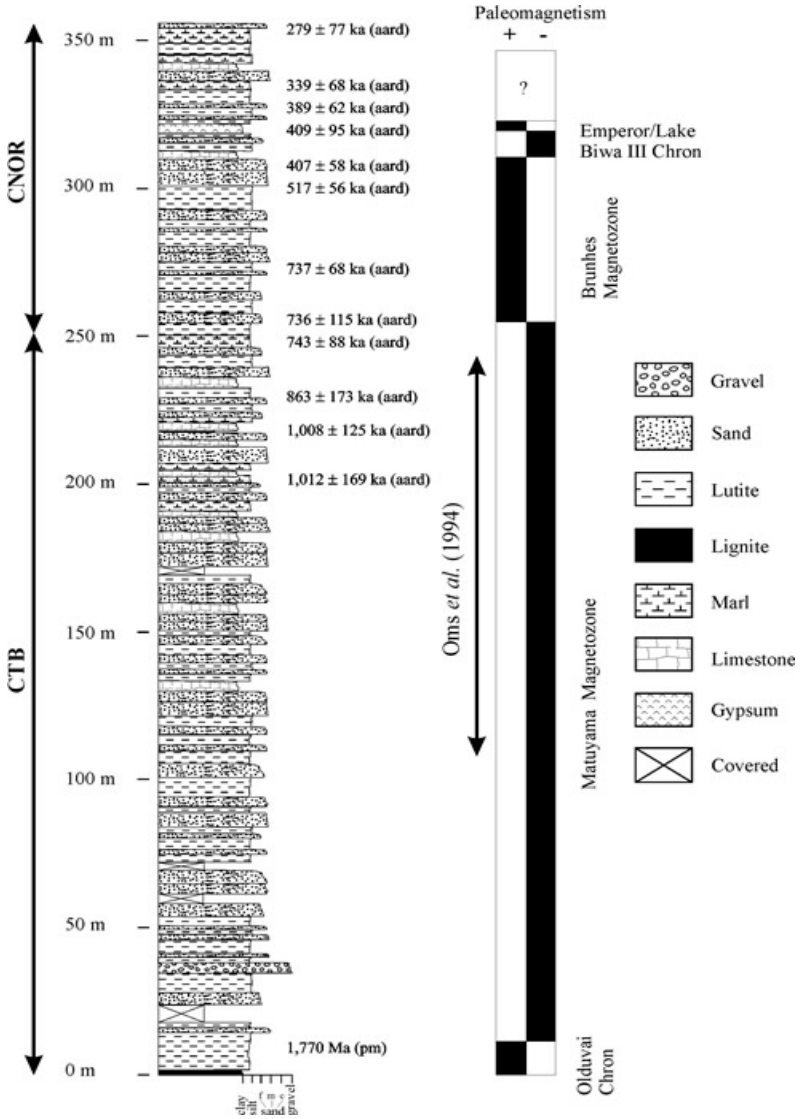


Figure 2. Chronostratigraphy of the Guadix-Baza Basin representative stratigraphic section using the amino acid racemization method and paleomagnetism.

The composite-stratotype-section established for the Pleistocene palaeoenvironmental study in the East domain of Guadix-Baza Basin is 356 metres-long whose chronostratigraphy was obtained by Ortiz et al. (2004) based on paleomagnetism and amino acid racemization dating method (Fig 3). It is representative of the depositional history of the basin from nearly the Pliocene-Pleistocene boundary (ca . 2 Ma) to the upper part of the Middle Pleistocene. The detailed lithological and stratigraphical description of the section is found elsewhere.

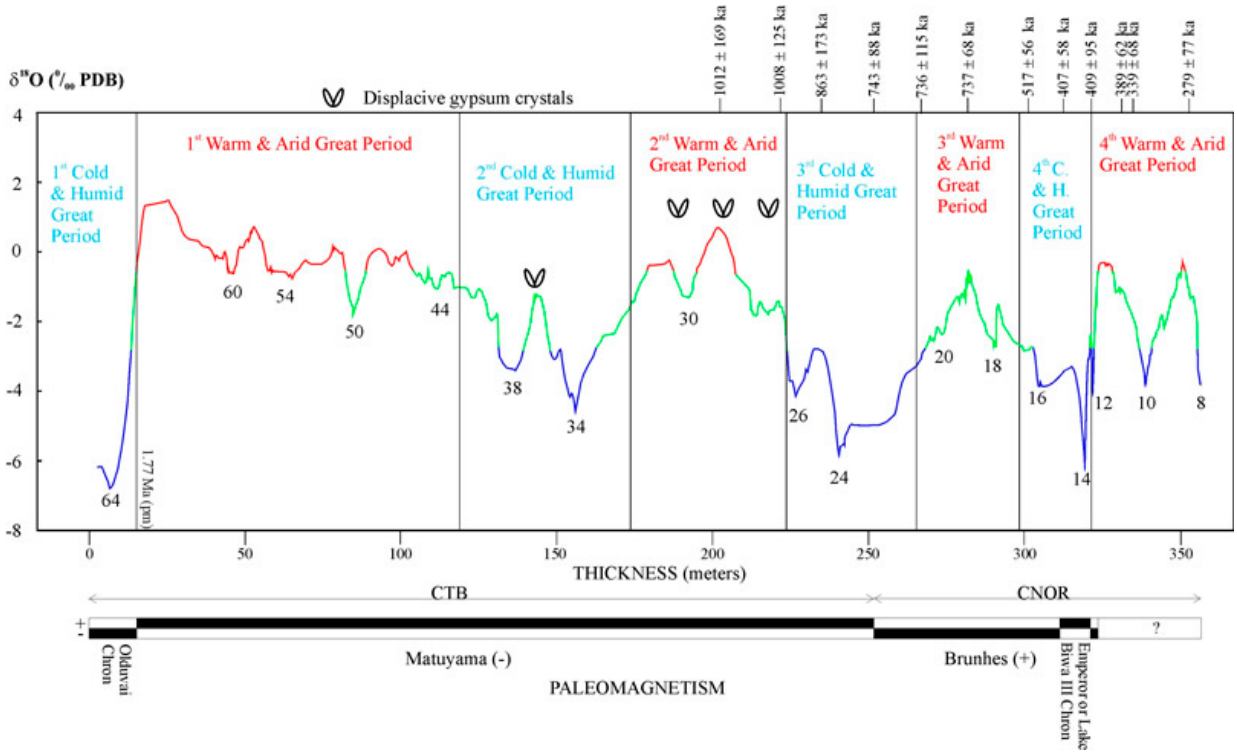


Figure 3. Smoothed curve of the d 18 O values obtained in Cyprideis torosa (Jones) ostracodes from Guadix-Baza Basin with the identified palaeoenvironmental periods and the oxygen isotope stages (MIS). The position of displacive gypsum crystals is also shown.

Results

The d 18 O signal obtained in the ostracod Cyprideis torosa (Jones) valves from Guadix-Baza Basin, reflects the global climatic variations from 2 Ma to the upper part of Middle Pleistocene (279 ± 77 ka) (Ortiz et al ., 2004, 2006). They resulted from changes of the evaporation/infill ratio in the water bodies and in the rain amount.

Periods with high d 13 C and d 18 O values have been associated with warm and arid paleoenvironmental conditions, while low d 13 C and d 18 O values have been correlated with cold and humid episodes. Four Cold and Humid Great Periods alternating with four Warm and Arid Great Periods were established from the ostracod smoothed d 18 O curve (Fig.4) . This interpretation was reinforced by other geochemical signals: the presence of displacive gypsum crystals, which are developed under high salinity and arid stages, during mostly the 2 nd Warm and Arid Great Period.

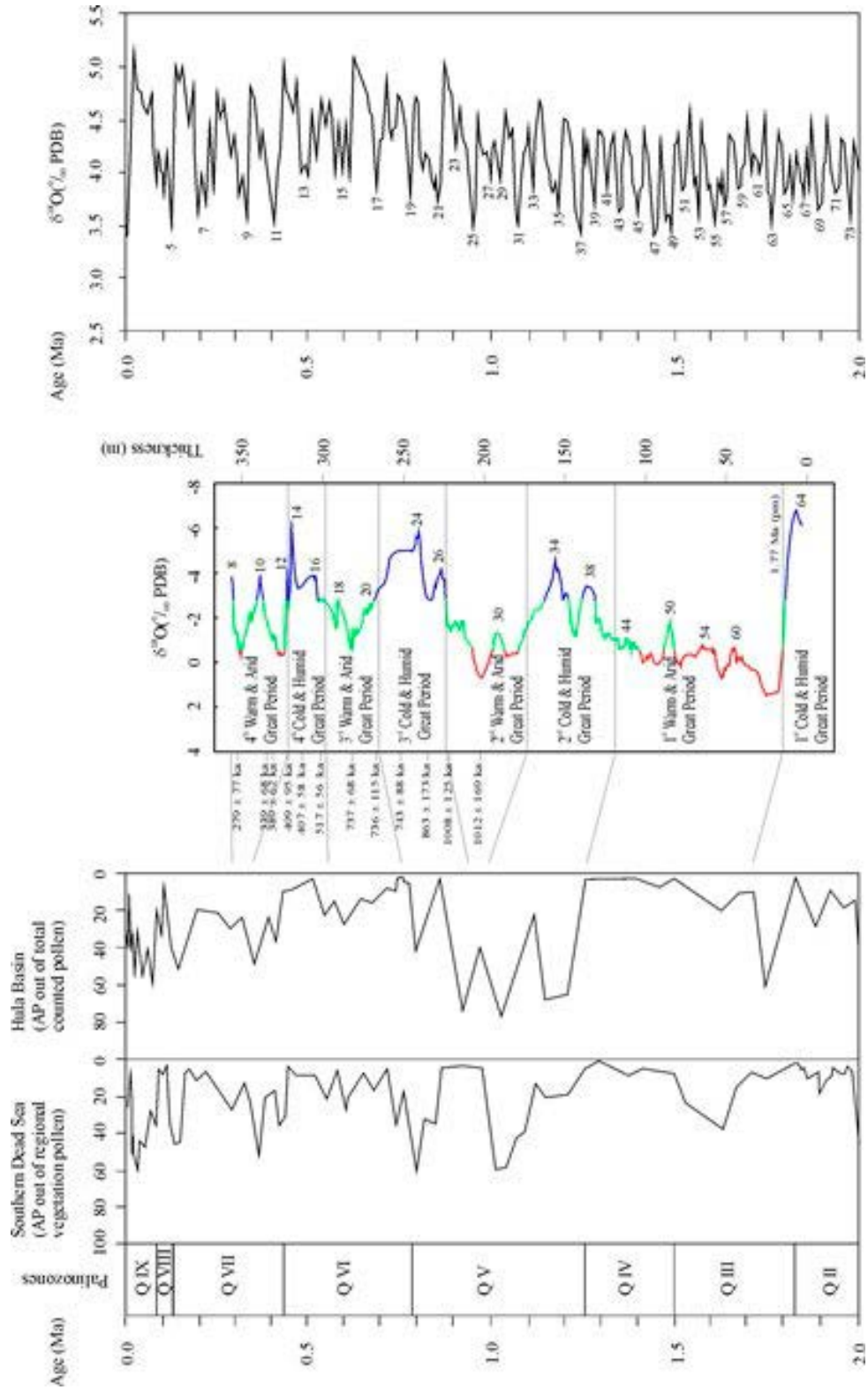


Figure 4. Correlation of the palaeoenvironmental sequence (smoothed d 18 O obtained in Cyprideis torosa ostracodes) from Guadix-Baza Basin, the pollen sequences (percentage of arboreal pollen) obtained in the Southern Dead Sea region and the Hula Basin (Horowitz, 1987, 1989), both in Israel, and the marine oxygen isotopic record (Shackleton, 1995).

The curve for the Hula Basin is mainly based on a pollen diagram from Notera 3 borehole. The curve for the southern Dead sea is mainly based on the pollen dagram for Amazyahu 1 borehole, with additions from Melekh Sdom 1, Ami´az 1, Sdom 2 and Har Sedom 1. The percentage of arboreal polen is interpreted as an increase in humidity. The data of the marine oxygen isotope record derive from the SPECMAP stack for the interval 0-0.62 Ma and OPD site 677 for the interval 0.62-2.0 Ma.

This alternating “warm-arid” and “cold-humid” episodes is inverse to palaeoclimatological record of the Northern Hemisphere. The Guadix-Baza Basin is located in the Mediterranean Area where Glacial Periods did not produced ever-frozen soils (permafrost) and the scarcity of liquid water such as in Northern Europe. In those latitudes during Interglacial episodes, higher precipitation rates should occurred.

A good correlation between Guadix-Baza Basin and the deep-sea oxygen-isotope record (Shackleton, 1995) has been obtained (Fig.4) . There is also a good correspondence with basins located at the Mediterranean area (Horowitz, 1987, 1989) (Fig.4) . Similar palaeoenvironmental models have been found in North America pluvial lakes. This indicates that climate at the Guadix-Baza Basin was responding to global climatic changes.

References

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