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Holocene multiproxy paleoclimate record from lagoonal organic shales of the Gulf of Cagliari, south Sardinia, Italy

A. M. Porcu (1), P. Pittau (1) C. Cervato (2) & R. Melis (3)

1. Dipartimento di Scienze della Terra, Università di Cagliari, via Trentino 51, 09127 Cagliari, Italy.

(2) Iowa State University, 253 Science I, Ames, Iowa 50011, U.S.A.

(3) Dipartimento di Scienze Geologiche Ambientali e Marine, Università di Trieste, Compr. S. Giovanni, 34127 Trieste, Italy.

Corresponding author: pittaup@unica.it

Palynologic, micropaleontologic, and isotopic data collected from a transitional-coastal sequence of sediments in south Sardinia spanning the last 10.000 years show a series of shifts linked to the establishment of different climatic conditions. The studied sediments were collected from two boreholes in the Gulf of Cagliary and consist of lagoonal organic shales, *Posidonia*-rich peat, and coastal fine and medium sandstones. The 30 meters of sediments were examined using multiple research methods including benthic foraminifers, pollen and spores, and stable isotope (oxygen and carbon) analyses. In addition, radiocarbon was used to date the sediments. Benthic foraminifer associations were identified and assembled into four eco-groups (F1 – F4) based on their paleoenvironmental significance. Group F1 is indicative of brackish –water environments while group F4 is characteristic of marine waters with normal salinity. Detailed attribution of specimens to specific sub-environments was based upon qualitative and quantitative screening of taxa. Groups F2 and F3 represent sub-environments characterized by a range of marine and fresh-waters mixes.

The palaeovegetational reconstruction focused on five phases and one sub-phase. The vegetational response to the climate amelioration in the Early Holocene up to about 7700 years BP resulted in the spread of the Ericaceae *macchia* (*first phase*) and the

succeding establishment of the *Quercus* forest (*sub-phase*). This was followed by a shift toward drier (cold?) and more open vegetation mainly represented by *Chenopodiaceae* (*second phase*) at around 7388$\pm$160 years BP. Between 7200 and 4800 years BP a more persistent peak in deciduous *Quercus* values and a change toward more negative δ^{18}O values signal the re-establishment of wetter conditions and the maximum extent of the *Quercus* forest in the region (*third phase*). This was followed by alternating drier, indicated by the presence of *Chenopodiaceae* (Neoglaciation? at around 4.000 to 3000 years BP) and hot and wetter phases with development of *Quercus* forest even in the coastal plains. We assume the last *Chenopodiaceae*-rich arid and cold phase (*fifth phase*) coincided with the Little Ice Age (216 $\pm$ 100 years BP).

The long-term variability of δ^{18}O values at a multi-centennial (200-400 years) time scale indicates a variable positive trend from 9450 to approximately 7500 years BP, and a negative trend from approximately 7100 to 2000 years BP. The δ^{13}C values indicate a variable negative trend from 10000 to 7700 years BP, that we interpret as a reflection of increasing salinity of the waters culminating with the clear sea-level maximum during the Holocene Climate Optimum. Higher negative δ^{13}C values from 7500 to 3850 years BP are interpreted as indicative of higher precipitation during Atlantic and Sub-boreal stages with higher organic influx of terrestrial origin. The following higher δ^{13}C values are indicative of increasing water salinity up to 200 years BP. Fluctuations of multidecadal fluctuations are superimposed on these long-term trends.