

Panchina Tirreniana Auct. and Tyrrhenian Stage in Sardinia

ANTONIO ULZEGA

A. Ulzega - Dipartimento di Scienze della Terra, via Trentino 51, I-09127 Cagliari, (Italy), ulzega@unica.it

Raised marine deposits were first recognized in Sardinia during the last century (La Marmora, 1857) and attributed to the Quaternary (*Panchina Tirreniana Auct.*). Issel (1914) investigated the rich molluscan fauna from raised beaches in southern Sardinia, particularly those near Cagliari, where he established the “orizzonti a *Strombus* in cui sono caratteristiche alcune specie viventi oggi nel Senegal ed estinte nel Mediterraneo” belonging to a new “piano Tirreno” (Tyrrhenian Stage) which lies between the Sicilian and the Holocene of Gignoux (1913). Successively, various authors studied Quaternary deposits in the diverse disciplines of stratigraphy, palaeontology, and geomorphology. The first synthetic approach to the interpretation of morphoclimatic events of the Quaternary of Sardinia was attempted by Vardabasso (1956) but not until the INQUA (SubCommission on Mediterranean and Black Sea Shorelines, 1980) field excursion (Ulzega & Ozer, 1982), was there an assembled collection of raised shoreline (stratigraphic and geomorphic) data, that individually identified most known deposits in Sardinia (Ozer *et al.*, 1980). From that time the stratigraphic studies were enhanced by additional works in palaeontology, geomorphology and sedimentology, as well as by the first attempt at chronostratigraphy using amino acid racemization (Wanet *et al.*, 1980).

Geochemical correlation is provided by epimerization of isoleucine in fossil *Glycimeris* and *Arca* shells with additional calibration by U-series coral ages.

In addition to the associations and correlations achieved through geomorphology, palaeontology and stratigraphy, used isoleucine epimerization (D-alloisoleucine to L-isoleucine or alle/Ile) have been used as a geochemical tool for substantiating these correlations. *Glycimeris* and *Arca* have been shown to be reliable for epimerization studies in the Mediterranean (Ulzega & Hearty, 1986) and for the last interglacial site, these taxa have demonstrated a constant intergeneric relationship (*Glycimeris/Arca* index or ratio) of 1.31 ± 0.05 (13). That is, *Glycimeris* produces an alle/Ile ratio 1.31 times greater than *Arca* collected from the same deposits. This established relationship allows a correlation of deposits from different palaeoenvironments that may contain only *Glycimeris* (from sandy-substrate habitats) or *Arca* (from rocky-coastal habitats).

The results of amino acid study indicate that mean *Glycimeris* values are between 0.40 and 0.46 and *Arca* values between 0.29 and 0.34 for southern and western sites typical of a peak last interglacial age, calibrated to a U/Th on *Cladocora coespitosa* of 138 ± 8 ka. While the substantially cooler northern Sardinian site on Santa Reparata is also interpreted as a peak last interglacial, ca 125 ka and yields an appropriately lower mean *Glycimeris* value of 0.36. In the same temperature framework, San Giovanni di Sinis *Glycimeris* values of 0.32 must represent a younger transgression in the last interglacial (S.L.) to which we ascribe an age of 90 ± 15 ka.

The interpretations of the amino acid data are not unique to Sardinia but are integrated into a basin-wide view of epimerization of *Glycimeris* and *Arca*, complete with a large number of calibration sites. In this basin-wide scheme, an overall mean *Glycimeris* value of 0.43 for Sardinian temperatures would belong to aminogroup E equated with isotopic stage 5. However, the variation of *Glycimeris* values between 0.40 and 0.46 can be explained further both by local microclimatic influences on temperature history and the duration of 10-20 ka of the peak last interglacial period. There is stratigraphic evidence for both effects.

The uranium-series ages on *Cladocora coespitosa* from La Playa (Cagliari) and Quartu are of ± 1 and 6.5 ± 1.5 ka respectively. The presence of *Cladocora* during this interval is interesting because it does not exist today in similar habitats. We thus suggest that a period of around 6 to 7 ka BP may be correlated with a climatic optimum reflected in global isotopic and palynological records. And, considering the *in situ* corals were collected from the present sea level, they must then indicate a slightly higher (0.5-1.0 m) sea level at 6-7 ka than present.

ka	SITES	GEOCHRON. METHOD	FAUNA	PROCESSES AND DEPOSITS	EVENTS	STAGE
0	Molentargius La Playa	U/Th	<i>Cladocora</i>	Littoral sedim.	Minor transgression	Holocene
50			<i>Megaceros</i> <i>Helix</i>	Erosion Pedogenesis Littoral dunes	Major regression	Wurm
100	S. Giovanni Sinis	Rac.	<i>Glycimeris</i> - <i>Arca</i> <i>Helix</i> - <i>Megaceros</i> <i>Elephas</i>	Littoral sedim. Erosion-Pedogenesis Colluvium - Croute	Transgression Regression	Neo Tyrr.
150	Calamosca - S. Reparata	Rac.	<i>Glycimeris</i>	Littoral sedim.	Minor transgr.	Eutyrr.
	Calamosca - Sa Illetta Nora-Fradis Minoris	U/Th	<i>Glycimeris</i> - <i>Arca</i> <i>Cladocora</i>	Impuration-Erosion	Minor regress.	
	Is Arenas-C. Su Turcu Foxi-M. Piccola	Rac.	<i>Strombus</i> - <i>Comus</i> <i>Patella</i> <i>Elephas</i> <i>Megaceros</i>	Littoral sedim. Erosion-Pedogenesis Colluvium-Dunes	Major transgression Regression	

Tab. 1 – Synthesis of assembled results of stratigraphic, geomorphologic and geochronologic data.

The study of the littoral deposits of the Upper Pleistocene of Sardinia, developed on a base of past palaeontological, stratigraphical and geomorphological studies, has revealed interesting results in the light of new geochronological data. The major difficulty for past studies has been, in fact, the tentative correlation of widely disjunct deposits in the dynamic view of diverse sedimentary, biological and geological environments. Tab. 1 is a synthesis of our results when stratigraphical, geomorphological and geochronological data are assembled, and indicates a succession of major and minor sea level movements that were interrupted during lower phases by erosion, terrigenous sedimentation and pedogenesis.

Of particular importance is the stratigraphic and geomorphic evidence for Eutyrrhenian transgression that never exceeded 10 m a.s.l., which confirms the general structural stability of Sardinia from the Upper Pleistocene to the Present. From a palaeontological point of view the “*Strombus* fauna” is exclusively associated with deposits dated during the peak last interglacial, the Eutyrrhenian or aminogroup E.

Geochronological and stratigraphical data have revealed that minor fluctuations in sea level occurred during the peak last interglacial (Fradis Minoris) and possibly a regressive stillstand at the end of this period (Calamosca, Nora, Santa Reparata). In addition, truly younger deposits have been dated at 90 ± 15 ka at San Giovanni di Sinis and are ascribed to a mid or late Stage 5 (“Neotyrrhenian”) event. This datation has a notable importance at this locality because of the complex stratigraphy and evidence for both Eutyrrhenian lagoon and marine deposits succeeded by “Neotyrrhenian” marine deposits overlying continental sediments with vertebrate fossils. This interpretation is in accordance with morphogenetic processes that indicate a pedogenic interval between two last interglacial (s.l.) events.

REFERENCES

- GIGNOUX, M., 1913, Les formations marines pliocènes et quaternaires de l'Italie du Sud et de la Sicilie: Ann. Univ. Lyon, 1 (36): 295-300.
- ISSEL, A. 1914, Lembi fossiliferi quaternari e recenti osservati nella Sardegna meridionale dal prof. D. Lovisato: Rend. R. Acc. Lincei, 233: 759-770.
- LA MARMORA, A., 1857, Voyage en Sardaigne: Bocca Impr. Roy.: 781 pp.
- OZER, A., PASKOFF R., SANLAVILLE P., & ULZEGA R., 1980, Essai de corrélation du Pléistocène supérieur de la Sardaigne et de la Tunisie: C. R. Acad. Sci. Paris, 291, D: 801-804.
- ULZEGA, A. & HEARTY, P.S., 1986, Geomorphology and Geochronology of Late Quaternary marine deposits in Sardinia: Z. Geomorph., N.F., suppl. 62:119-129.
- ULZEGA, A. & OZER, A., 1982, Etat de connaissances sur le Tyrrhénien en Sardaigne avant l'excursion table-ronde: Comptes-Rendus de l'Excursion-Table Ronde sur le Tyrrhénien de Sardaigne, INQUA (avril 1980): 17-46.
- VARDABASSO, S., 1956, Il Quaternario della Sardegna: 4th Int. Congr. INQUA, Rome-Pise 1953, 2: 995-1018.
- WANET, P., LEONE, F., OZER, A. & ULZEGA, A., 1980, Tentative de datation, par racémisation des acides aminés, de coquilles provenant du Tyrrhénien de Sardaigne: Rend. Sem. Fac. Sc. Univ. Cagliari, 52:159-167.