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ON LATE PLEISTOCENE AND OLOCENE DEEP SEA SEDIMENTATION IN THE TYRRHENIAN SEA

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Detailed biostratigraphical studies were carried out on many cores, collected in more than ten years of activity by I.G.M. of Bologna in the Tyrrhenian Sea off the continental shelf, as part of a program promoted in the years 1983-1985.

The studies were completed by sedimentological, petrographical and radiometric analysis as well as by sub-bottom character interpretations. The main preliminary results point out the existence of six areas different for their depositional characters.

1) The southern bathial plain is the area where the sedimentation is more condensed and undistributed. Here, notwithstanding the terrigenous suplly from the Sicilian Slope and the active regional volcanism, it was possible to chose some cores in which tipical sequences were established and used as a reference for the other areas.

2) The highest sedimentation rate is reached in the area downslope of the Latium-Campania margin, where thick terrigenous deposits accumulate.

3) A second zone with rapid accumulation rate is the area comprising the seamounts East of the Central Fault. Here up to 8 meters of featurless clay was sampled which may be interpreted as due to gravity flows (slumps and turbidites) coming down from the steep slopes of the seamounts, according to the model of unifites or omogenites formation (STANLEY 1981).

4) The south-eastern zone westward of Marsili seamount is characterized by thick terrigenous turbidites containing high percentages of mica, derived from alteration of granitic rocks, and reworked faunas from Pliocene terrains. An origin from the Sicilian slopes is supposed.

5) Little basins interrupt the continental slope of the northermost area. They dont act as sedimentary traps for coarse material, as expected, but show a rather low accumulation rate. Only during negative climatic fluctuations they were affected by organogenous and terrigenous turbidites, triggered by temporary large exposure of continental shelf.

6) A condensed sedimentation with only five, well recongnizable organogenous turbidites characterizes the western part of the bathyal pla in between the Central Fault and the Sardinia basin.

In synthesis, our research has focused these main points:

a) Fine sediments dispersal and accumulation in the Tyrrhenian deep sea is mainly controlled by gravity flows and fluid-driven mechanisms, as suggested by STANLEY 1985 for the Mediterranean margin-basin sedimentation.

b) Structural and morphological framework plays the major control of the sedimentological processes.

c) The accumulation rates during Glacial, Post-glacial and Olocene times have changed only in little basins of the northern and southern continental slopes, while in all the remaining areas the sedimentary supply continued to be rather high. Seldom sediments older than the last-glacial time were reached by a gravity corer (up to 10 m long).

d) Climatic changes seem to have scarcely influenced current directions except during the last interstadial time. Planctonic Foraminifera and Pteropod assemblages suggest for this period the presence of a quite warm current with tropical characters flowing on a cold glacial water mass. That tropical forms at present living only west of Gibraltar may have entered the Mediterranean in this period for different water conditions of circulation or circulation or that winter-summer thermal excursion were higher than at present, seem to us the best explanations for this question..

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G-V2

HEAT FLOW AND SUBSIDENCE OF THE DEEP IONIAN BASIN

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Abstract. The Ionian Sea abyssal plain is a triangle shaped basin within the Central Mediterranean located at 35°-37°N and 16°-19°E. Four major structural units are facing the basin: the Malta Escarpment separates westwards the deep basin from the Sicily-Malta shallow water Plateau, on the south side the Medina Ridge delimitates the Sirte Rise geological provence, on the east the Mediterranean Ridge marks the transition to the Hellenic Trench system and from the north-west margin the sedimentary pile of the Calabrian Rise is expanding, in a south-east direction, onto the deep abyssal floor. The origin, nature and age of the basin is still an open argument. Objective of the present note is the estimate of two important transient effects, such as total tectonic subsidence (TTS) and heat flow (HF), which are related to the age formation of the basin. A wide range of interpretations and models have been proposed to explain the evolution of the deep Ionian Basin starting from geological and geophysical observations. These can be summarized as follow:

- the deep basin has a water depth ranging between 3.8 and 4.1 km and it is covered by a thick sedimentary sequence;
- Bouguer anomalies reach their maximum of 310 mGals on the plain;
- isostasy seems nearly compensated;
- high intensity magnetic anomalies have been recognized at a depth of 4.5-7 km b.s.l. on the westernmost margin, close to the Malta Escarpment, and are probably linked to the rifting processes (Arisi Rota, Fichera, 1985) which affected the basin; oceanic-type magnetic lineations are absent;
- seismic reflection and refraction lines have shown an almost constant thickness of sediments (6-7 km) over the whole abyssal plain, while the underlaying crust has a thickness between 4 and 6 km (Makris et al., 1986);
- HF data shows that the thermal regime of the basin is lower than normal;
- seismic activity seems to be very low, no active faults can be recognized on the basis of the few shallow events recorded; neverthless, sea-beam and echo-sounding profiles proved that recent deformation has occurred (Hieke and Wanninger, 1985).

The TTS, which is the sum of initial subsidence and long-term thermal subsidence, has been estimated on the geologic sections prepared, on the base of seismic reflection and refraction data across the deep Ionian Basin, by Makris et al. (1986). The 6.3 km/s seismic reflector has been assumed as the top of the basement of either a highly attenuated continental crust or of an oceanic-type crust. Sediment loading effects have been removed by standard formulae in the Airy isostatic assumptions. A first approximation of the TTS is calculated in 6.2-6.5 km. This value corresponds to an ocean older than 175 M.y., if age vs. depth relationship of Parsons and Sclater (1977) is applied. On the other hand, if we consider the basin floored by a foundered and/or attenuated continental lithosphere the age of the rifting process could be younger than in the oceanic hypothesis only in the assumption that the mantle beneath Ionian basin would have a density higher than the average values under the present oceans. Eleven new HF measurements, with in situ determination of thermal conductivity, performed during N/O Bannock 9/84 cruise (Table I), are presented. The HF in the deep basin (six stations) shows a relative high variability with a mean value of 31.8 ± 5.0 (S.D.) mW m^{-2}. This value is reasonably close to the 33.5 mW m^{-2} measured at DSDP 374. The other five measurements on the western Messina Cone show a higher variability (27.0 ± 9.1 mW m^{-2}) related to local disturbances. Sedimentation effect, on abyssal plain HF, has been estimated (from profile 1 of Makris et al. 1986) only since Miocene time with the assumption that the low mesozoic sedimentation was thermally compensated in Paleogene time in which an almost absent sedimentation has been hypothized. The overall effect has been evaluated to reduce the regional HF by 20-25 %. To point out the cooling-related HF, flowing out from the lithosphere, the radiogenic heat produced within the overlying sediments has to be taken in account. This production has been estimated to raise the surface HF of about 3-5 mW m^{-2}. The HF reduced to the top of the buried crust will become 35-40 mW m^{-2}. Such a HF is too low to come from a continental lithosphere (which has an equilibrium HF of 46 mW m^{-2}), while it corresponds to an ocean older than 200 M.y., if the HF vs. age relation of Parsons and Sclater (1977) is used. From TTS and HF evaluations, the Ionian Sea abyssal plain appears to be one of the oldest oceanic basins, may be the last remnant of the tethyan ocean.

TABLE I. Summary of heat flow measurements in the Ionian Sea (Bannock 9/84 cruise).

STATION	LAT. N	LONG E	DEPTH (m)	B.W.T. (°C)	PEN (m)	PR. (N)	GRADIENT (mK m^{-1})	CONDUCTIVITY N	CONDUCTIVITY (W $m^{-1}K^{-1}$)	H.F. (mW m^{-2})	
GT 84-1	36° 45.0'	16° 21.2'	3280	14.0	7.0	4	26.1±5.2	--	1.1*	29	
GT 84-2	36° 40.7'	15° 56.6'	3285	13.9	7.0	4	30.3±5.0	2	1.17	35	SW Messina
GT 84-3	36° 33.7'	16° 33.0'	3400	14.0	6.5	4	16.2±2.7	2	1.09	18	Cone
GT 84-4	36° 26.2'	15° 56.6'	3345	14.0	6.5	4	34.4±4.0	--	1.05*	36	
GT 84-5	36° 01.1'	15° 57.9'	3685	14.0	6.5	4	15.7±1.9	--	1.1*	17	
GT 84-6	35° 39.1'	16° 45.0'	3925	14.1	4.5	3	29.5±4.4	2	1.04	31	
GT 84-7	35° 31.8'	16° 57.0'	3980	14.1	6.5	4	31.6±0.7	3	1.24	39	
GT 84-8	35° 28.1'	17° 18.5'	3950	14.1	6.5	4	29.8±5.3	2	1.16	35	Ionian abyssal
GT 84-9	35° 45.6'	18° 21.3'	4085	14.2	6.5	7	24.4±6.3	3	1.01	25	plain
GT 84-10	35° 58.5'	18° 19.6'	4085	14.2	7.0	7	27.6±8.5	3	1.03	28	
GT 84-11 I	36° 13.0'	18° 25.2'	4070	14.2	7.0	5	30.2±7.0	--	1.1*	33	
II	36° 13.3'	18° 23.5'	4070	14.2	7.0	5	28.6±4.6	2	1.13	32	

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