Δελτίο Ελληνικής Γεωλογικής Εταιρείας τομ. XXV/1, 485-490, 1991
Πρακτικά 5ου Επιστημονικού Συνεδρίου, Θεσσαλονίκη, Μάιος 1990

Bulletin of the Geological Society of Greece vol. XXV/1, 485-490, 1991
Proceedings of the 5th Congress, Thessaloniki, May 1990

PASSIVE MARGIN SEDIMENTATION AND COLLAPSE IN THE NEOTETHYS OF S. GREECE

P. D. Clift* and A. H. F. Roberston*

ABSTRACT

The closure history of the Neotethys ocean in southern Greece has for some time been poorly constrained, both in time and how it relates to ophiolite emplacement. Our work within the Argolis Peninsula has been aimed at constraining this history by study of the platformal and marginal units exposed in this area. Below we summarize the main results of our work to date, while further studies of the Cretaceous and Tertiary sedimentology and tectonics are currently in preparation.

Intra-platform Basins

In the past the classical Argolis area of the central southern Hellenides was interpreted as comprising essentially <u>in situ</u> carbonate platforms and basins or alternatively far-travelled thrust sheets derived from a Mesozoic ocean basin sited well to the east (Vardar ocean).

Our fieldwork demonstrates that at two key localities an important unit of Middle Triassic-Early Jurassic deep-water redeposited carbonates (Asklipion Unit) passes laterally into shallow-water platform carbonates (Pantokrator Unit). The deep-water limestones represent basins within the platform, rather than far-travelled thrust sheets, while other slices of deep-water limestone record a platform margin, further east. The basins originated during Middle Triassic (Ladinian) rifting of the Neotethys and are floored by extrusive of intermediate composition. Highly condensed Ammonitico Rosso pelagic limestones (Asklipion Limestone) accumulated on an inferred volcanic seamount during the Mid-Late Triassic (Anisian-Carnian). The platforms slowly subsided in Early Jurassic time, while the basins partly filled with redeposited carbonates (Adhami Limestone). Shallow-water carbonates locally transgressed the margins of the deeper-water basins. The platforms were submerged in the Mid Jurassic (Toarcian-Bathonian), with the deposition of pink pelagic Ammonitico Rosso, followed by marked

*Grant Institute. Department of Geology and Geophysics.
University of Edinburgh, West Mains Road, Edinburgh, EH9 3JW SCOTLAND.

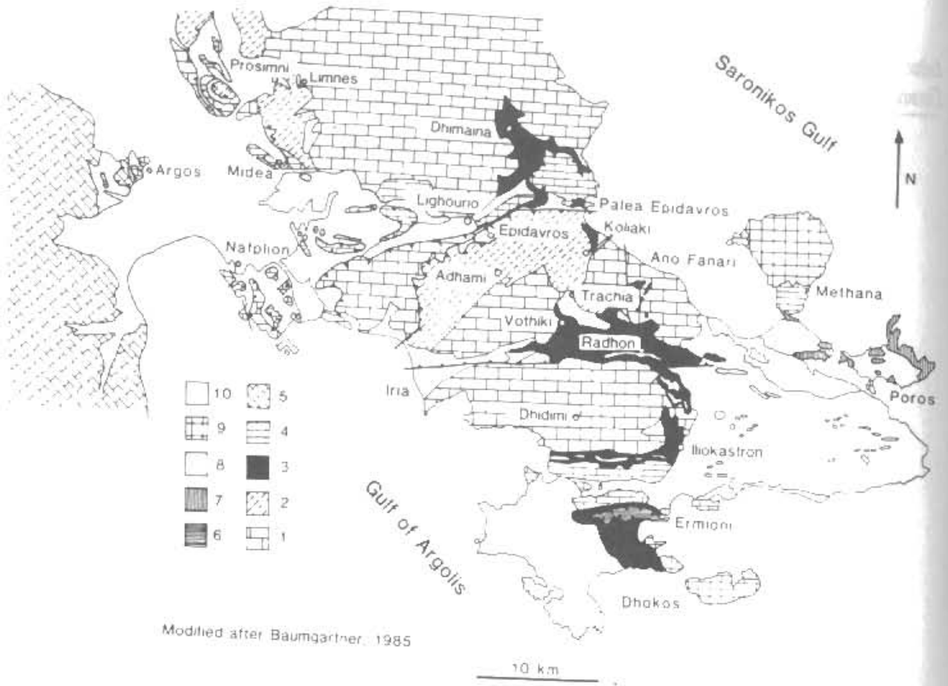

Figure 1: Geological map of the Argolis Peninsula. Key to lithologies:- (1) Pantokrator Limestone, neritic (Middle Triassic-Liassic); (2) Adhami Limestones, pelagic (Middle Triassic-Liassic); (3) Ophiolitic units (Upper Jurassic), (4) Akros Limestone, neritic (Lower-Upper Cretaceous); (5) Pindos limestones (Upper Cretaceous); (6) Ermioni Limestones, pelagic (Upper Cretaceous), (7) Poros limestones, pelagic (Lower-Upper Cretaceous.); (8) Flysch (Eocene); (9) Volcanics (Quaternary); (10) Neogene-Recent deposits.

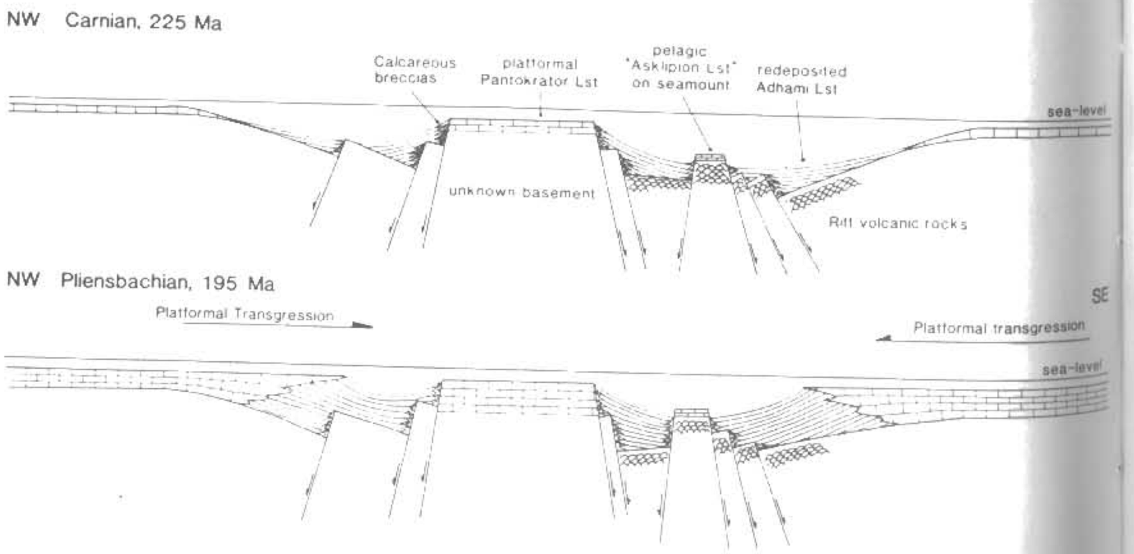

Figure 2: Reconstruction of the Adhami Limestone basins; i) Upper Trias[illegible] the volcanic floor of the basins, the fault control of the facies distribution and the asymmetry of the graben; ii) Liassic times. Cessation of active faulting resulted in the progradation of the neritic Pantokrator Limestone over the unfaulted margins of the basins.

subsidence and ribbon radiolarite deposition below the CCD (e.g. Koliaki Chert). In early Late Jurassic time (Kimmeridgian), the area was regionally compressed ("Eohellenic" phase), and the intraplatform basins, founded on thinned continental crust were inverted, and thrust up to several kilometres over the adjacent platform units. The deformed continental margin then flexurally subsided, ahead of emplacing Jurassic ophiolites, largely olistostromes (Migdhalitsa Unit). After taking account of up to 90 degrees clockwise palaeorotation of assumed Neotectonic age, kinematic indicators and facies trends suggest the ophiolite was derived from a Pindos ocean basin originally sited to the west. Early Cretaceous transgression resulted in the deposition of shallow-water limestone and was followed by Late Cretaceous deep-water limestone, then terrigenous flysch accumulation in a foreland basin related to final suturing of the Neotethyan ocean. Later, the area was dissected by a series of mainly E-W trending, high-angle Neotectonic normal faults, related to the Aegean back-arc extensional system.

The Jurassic Migdhalitsa Ophiolite

Work recently undertaken on the Migdhalitsa Ophiolite confirms its tectonic position over the platform units and suggest derivation from the present northeast. We have identified two distinct suites of basalts, an N-type MORB suite and a within-plate suite (J.E.Dixon 1990, pers. comm.). Immediately overlying these Mid-Jurassic lavas are manganese ores, precipitated from low-tempearture hydrothermal vent waters on the axis of a relatively unrifted ocean ridge, which was possibly slow spreading. The deep-sea sediment cover comprises pelagic carbonate accumulated on the ridge flanks, then ribbon radiolarites deposited on the abyssal plain below the CCD, located close enough to a continental margin to allow deposition of shallow water-derived calciturbidites.

Cretaceous Passive Margin

The Argolis Peninsula, southern Greece is believed to form part of a Pelagonian microcontinent located between two oceanic basins, the Pindos to the west and the Vardar to the east in Triassic to Tertiary time. In eastern Argolis, two important units are exposed. i) the Ermioni Limestones cropping out in the southwest; ii) the Poros Formation, observed on an offshore island in the northeast, and on the adjacent mainland. Both these units comprise

Late Cretaceous (Aptian-Maastrichtian) pelagic limestones, calciturbidites, lenticular matrix- and clast-supported limestone conglomerates and slump sheets. However, the Poros Formation is distinguished from the Ermioni Limestones by the presence of bituminous micritic limestones and an increasing proportion of shale up-sequence. These successions are deep-water slope carbonates that once formed the southeast-facing passive margin of the Pelagonian platform (Akros Limestone). Beyond this lay a Late Cretaceous ocean basin within the Vardar Zone. This ocean was consumed in an easterly-dipping subduction zone in latest Cretaceous (?) to Early Tertiary time, giving rise to an accretionary complex (Ermioni Complex). During the Early Tertiary (Palaeocene-Eocene) the passive continental margin (Pelagonian Zone) collided with the trench and accretionary complex to the east. As the suture tightened, former lower slope carbonates (Ermioni Limestones) were accreted to the base of the overthrusting thrust sheets and emplaced on to the platform. Farther west, bituminous upper slope carbonates (Poros Formation) flexurally subsided and passed transitionally upwards into calcareous flysch and olistostromes in a foreland basin. These sediments were then overridden by the emplacing thrust stack and themselves underplated. Late stage high-angle faulting then disrupted the tectonostratigraphy, in places juxtaposing relatively high and low structural levels of the complex.

Ermioni Complex; Early Tertiary subduction/accretion complex

The previously poorly documented Ermioni Complex, Late Cretaceous-Early Tertiary, in the east of the Argolis Peninsula (Adheres), Peloponnesus, comprises a thick (15-20 km) wedge of terrigenous, Early Tertiary (Palaeocene-Eocene) flysch, interleaved with thin, tectonically disturbed sheets of basic lavas, massive sulphides and metalliferous pelagic sediments. Geochemical studies of the basalts in the Ermioni Complex suggest an oceanic subduction-related origin. The planktonic foraminifer Globotruncanita elevata in pelagic limestones depositionally overlying the basalts are Campanian-Maastrictian in age.

The massive sulphides and metalliferous oxide sediments occur in association to these lavas and the terrigenous turbidites. The massive sulphides were precipitated from high-temperature vents sited near the axis of a relatively unrifted spreading ridge which was possibly fast spreading. Ferruginous ochres and ferromanganiferous umber sediments were dispersed around

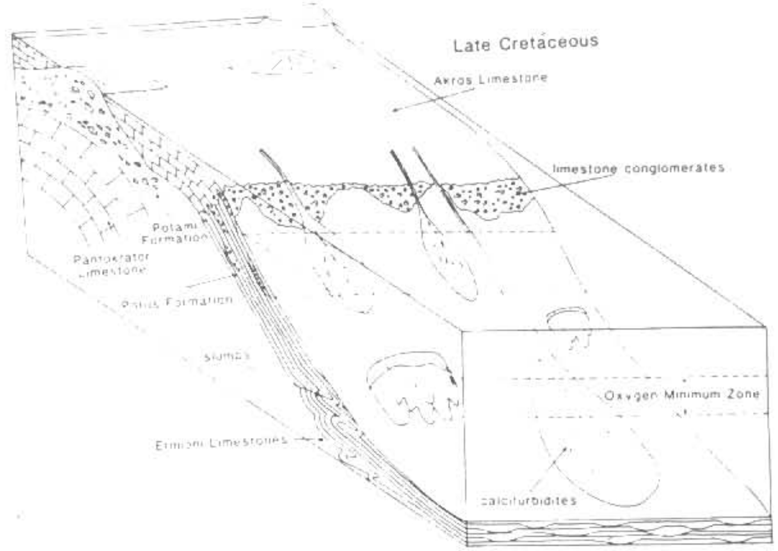

Figure 3: Reconstruction of the continental margin of the Pelagonian Zone during Cretaceous times. The Akros Limestone has partially transgressed the eroded ophiolite units. The middle-upper slope is represented by the Poros Formation and the lower slope by the Ermioni Limestones. Slumps are consistently towards the present south- southwest.

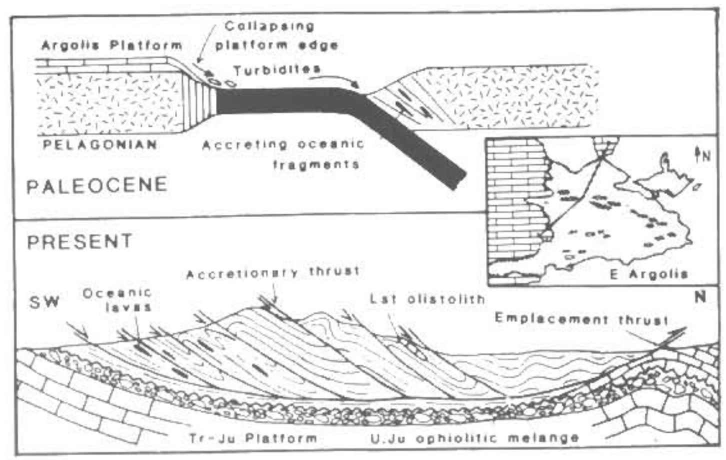

Figure 4: Tectonic Evolution of the Ermioni Complex. In Palaeocene times active subduction resulted in accretion of oceanic lavas and quartzose sandstones at the trench of an east-dipping subduction zone. Present day structural setting of the Ermioni Complex, with the thrust stack thrust over the collapsed Cretaceous cover and underlying Jurassic/Triassic sequences.

these vents, whereas strongly fractionated manganese ores precipitated from separate low-temperature hydrothermal sites. We propose that the basaltic slices represent fragments of Neo-Tethyan oceanic lithosphere of Late Cretaceous age in the southern Greek area. This basin subsequently closed in the Early Tertiary (Palaeocene-Eocene), with trench-type flysch accumulation and accretion of oceanic lava slices. The new evidence has important implications for the history of Tethyan ocean basin closure and suturing in the Hellenides.

References

Clift, P.D. and **Robertson, A.H.F.** 1989 a. Tectonic reinterpretation of the Argolis (South Hellenides) in the light of isopic zone and terrane hypotheses. Terra Abstracts, 1, No.1, European Union of Geosciences V, Strasbourg, March 1989, 57.

Clift, P.D. and **Robertson, A.H.F.** 1989 b. Evidence of a late Mesozoic ocean basin and subduction/accretion in the southern Greek Neo-Tethys. Geology, 17, 559-563.

Clift, P.D. and **Robertson, A.H.F.** 1990 a. Deep-water basins within the carbonate shelf of the Argolis Peninsula, Greece. Journal of the Geological Society, in press.

Clift, P.D. and **Robertson, A.H.F.** 1990 b. A Late Cretaceous carbonate margin of the S.Greek Neo-Tethys. Geological Magazine, in press.

Robertson, A.H.F., Varnavas, S.P. and **Panagos, A.G.** 1987. Ocean Ridge origin and tectonic setting of Mesozoic sulphide and oxide deposits of the Argolis Peninsula of Peloponnesus, Greece. Sedimentary Geology, 53, 1-32