Results of recent geological research on the flysch zones of Greece

by

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1. The flysch of the Ionian zone (see fig. 1)

The flysch deposition begins in the Preabonian with a pelitic limestone succession. The development of transitional series shows that there was a period of undisturbed deep water sedimentary conditions in the Ionian furrow.

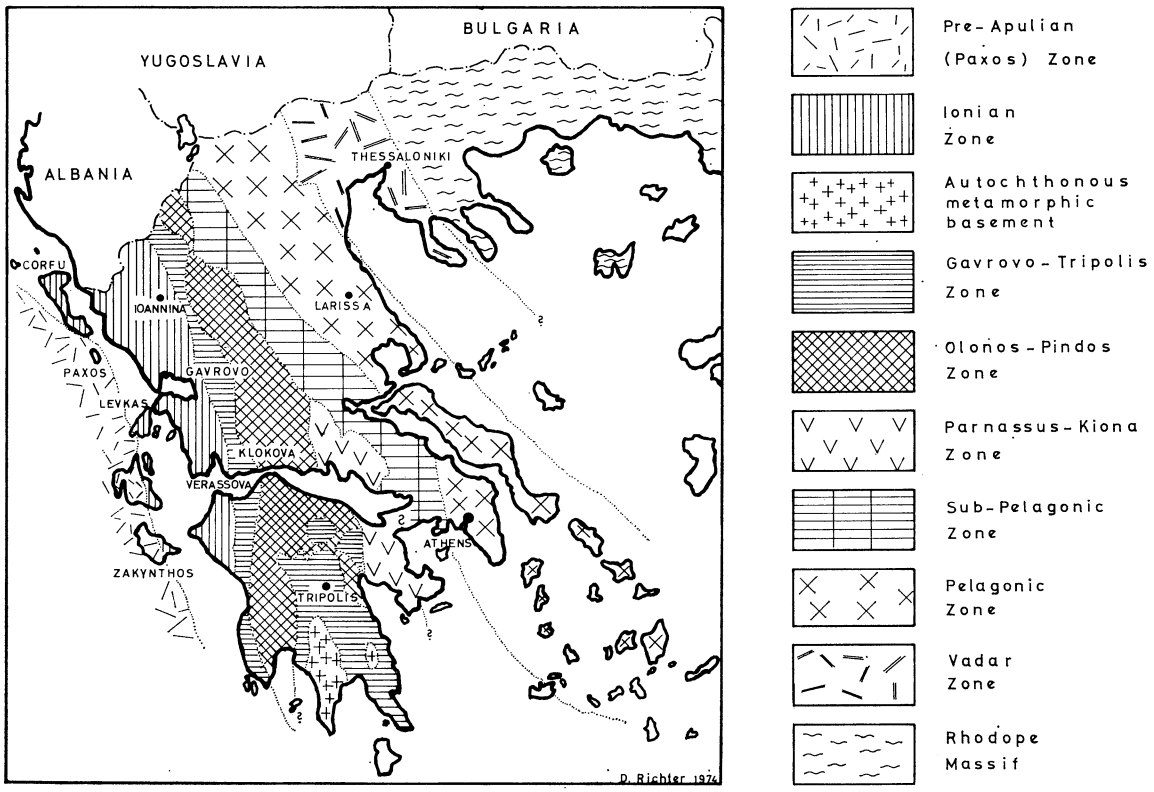

FIG. 1. — Outline map of Greece showing isopic zones.

Rapp. Comm. int. Mer Médit., **23**, 4a, pp. 183-186, 2 figs., (1975).

The flysch consists of mudstones, siltstones and graded sandstones (turbidites), the thickness ranges from 1000 m in the west to 4000 m in the east. At the beginning of the Oligocene the first tectonic movements occured leading in the Epirus region to the formation of three parallel minor troughs (subzones): the transport of psammitic material in continental Greece was mainly towards the south, but in the Peloponnesus it was towards the north. Flysch deposition ended in the Aquitanian at the commencement of the main tectogenesis. On Levkas island the flysch succession was intensely folded and partly denudated during this time as indicated by the overlying Upper Aquitanian molasse series unconformably resting on the folded flysch. The main tectogenesis in the Ionian zone, except Levkas island — occured before (and perhaps at the beginning of) the Langhian since on Corfou island and in the Parga area molasse beds of Middle Miocene age lie unconformably and transgressively on the strongly folded flysch.

2. The flysch of the Gavroro-Tripolis zone

The flysch of the Internal Ionian subzone passes without any facies boundary into that of the Gavrovo-Tripolis zone. Probably many parts of this zone in continental Greece (being hidden today under the flysch cover) emerged above sea-level at the beginning of Priabonian resulting in an extensive erosion and karstification of the Upper Cretacious-Tertiary limestones (Fig. 2). Thus the flysch lies transgressively over the limestones in the central and western parts of the Gavrono massif.

In the Priabonian the Gavrono massif rose strongly. Numerous faults resulted and huge blocks, more than one kilometre in length, broke off and slid downslope into the flysch sea.

On the Peloponnesus an important regression of the Eocene sea in the early Priabonian terminated the Tripolitsa limestone deposition. An extensive erosion followed. Subsequently, but still during the Priabonian the Gavrono-Tripolis zone subsided and the flysch sea advancing from the Ionian zone and probably also from the Olonos-Pindos zone flooded transgressively the karstified and faulted surface of the Tripolitsa limestone. From the elevated horst areas huge blocks broke off and slid downward into the sea. The flysch reaches in continental Greece a thickness of more than 5000 m.

A typical feature of this flysch are rounded olistholiths in olisthostromes consisting of Olonos-Pindos material, indicating that there a cordillera existed.

As in the Ionian zone it is possible to trace major sandstones or groupes of it for considerable distances. There is no obvious source for most of this detritus because the earlier sediments are carbonates and cherts. Flysch sedimentation began earlier in the Olonos-Pindos, Parnassus-Kiona and Sub-Pelagonic zone, and these deposites may have contributed to the flysch detritus in the Gavroro-Tripolis and Ionian zone. On the other hand the directional structures suggest that currents flowed along the flysch trough both from the north as well as from the south.

The youngest flysch beds of the Gavrovo-Tripolis zone in continental Greece and on the Peloponnesus contain an Aquitanian microfauna. Thus it seems likely that the main tectogenesis of the Gavrovo-Tripolis zone occured during the Lower Miocene, i.e., probably together with the main folding of the Ionian zone.

3. The flysch of the Olonos-Pindos zone

In this trough an early flyschoid tendency developed during the Cenomanian within the pelagic radiolarites (" First Pindic flysch " after AUBOUIN, 1969). The main flysch conformably overlies Maestrichtian limestones. In the lowest flysch mudstones a Palaeocene assemblage has been obtained, hence some intermediate transitional layers supposedly represent Danian. The flysch series consists of a thick sequence with olisthostromes containing pebbles which originated from the Sub-Pelagonic and Pelagonic zone. The flysch sedimentation continued until the Priabonian. The deepest part of the flysch trough was situated in the Epirus region where the thickness exceeds 4000 m.

The tectogenesis started probably with the beginning of the Oligocene as the olisthostromes in the Gavrovo-Tripolis flysch indicate and came to an end with the overthrust of the Olonos-Pindos nappe on the Gavrono-Tripolis zone. This final movement must have occured following the tectogenesis of the Gavrovo-Tripolis zone since the Olonos-Pindos nappe lies on a denudation relief of the latter.

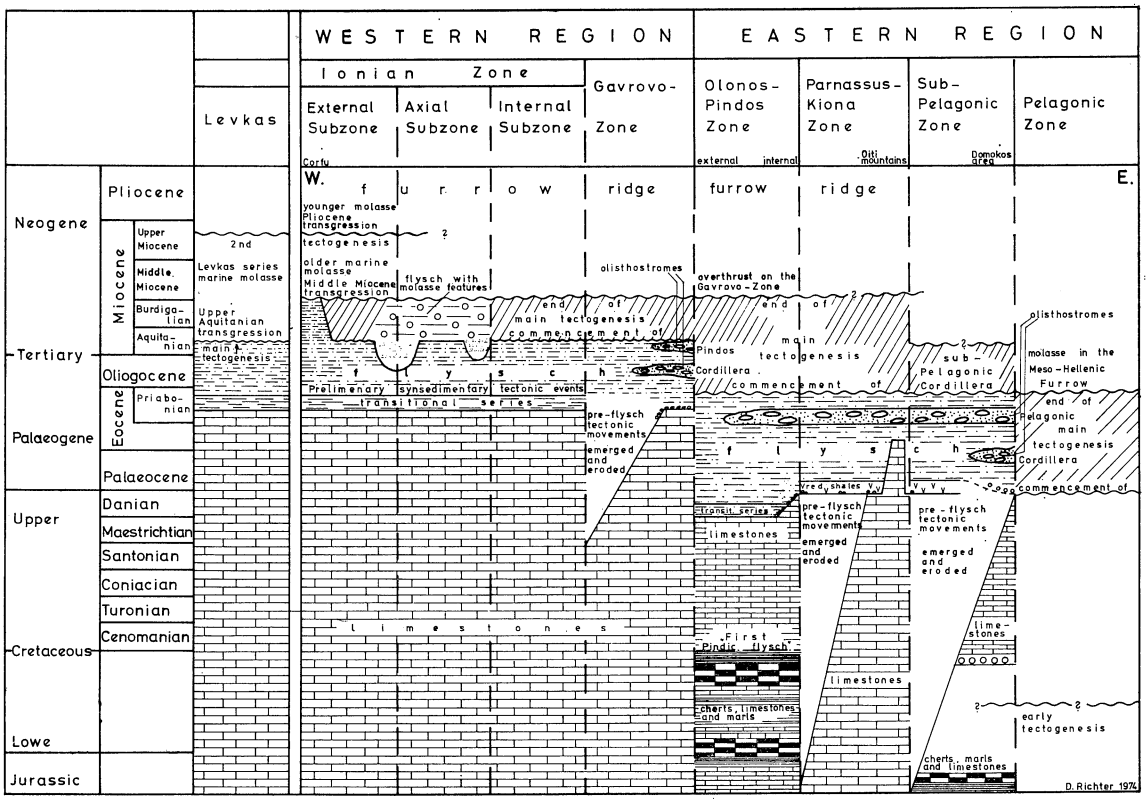

FIG. 2. — Diagram illustrating the pre-flysch development and the flysch periods over the isopic zones in continental Greece.

4. The flysch of the Parnassus-Kiona zone

The flysch of the Olonos-Pindos zone passes without a facies boundary into that of the Parnassus - Kiona zone. A significant orogenic uplift phase took place before the sedimentation of basal red beds. The elevation of several areas led to erosion partly down to the Jurassic beds and karstification. Other parts remain as sea-floor and sedimentation continued.

Later in the Palaeocene the whole Parnassus-Kiona zone was buried under a 800-1100 m thick flysch succession of sandstones etc. The flysch sedimentation ended during the Priabonian. Several olisthostromes in Priabonian deposits contained pebbles consisting of sediments and cristalline rocks of the sub-Pelagonic or Pelagonic zone which were rounded by fluvial transport. They indicate that mud streams moved from the rising Pelagonic/sub Pelagonic cordillera far towards the west over the Parnassus-Kiona (and Olonos-Pindos) zonal substrata.

5. The flysch of the sub-Pelagonic zone

Again we have a gradual transition from the preceding flyschs into that zone. Thus in its western part red shales form the basal beds. Again a widespread elevation of the Upper Cretacious limestones above sealevel in the area between Lamia and Domokos led to faulting and karstification. The flysch transgression occured in the vicinity of Domokos during the Danian, in the Lamia area not before Palaeocene.

The flysch deposition continued through the Eocene and terminated in the Priabonian.

Final remarks

The flysch of the Hellenides can be divided into two large regions. In the eastern region the earliest flysch sedimentation occured in the Olonos-Pindos zone at the end of the Maestrichtian, while in the Parnassus-kiona zone and parts of the sub-Pelagonic zone the flysch sedimentation started in the Danian or Palaeocene, it ended in the Priabonian. At the same time in the western region flysch sedimentation started and passed up to the Burdigalian in the external Ionian subzone. Thus, for a very short time only, a uniform flysch sea covered almost the entire Hellenides in the Priabonian. The oldest flysch is found in the internal eastern zones and the youngest in the external areas. This polarity reflects a migration of the orogeny of the Hellenides. The commencement of the tectogenesis seems to have jumped in three steps : end of the Upper Cretacious, Upper Eocene, Lower Miocene. Since the lithology of the whole flysch-cover was not influenced by the respective substratum, it can be regarded as a particular level independent of the usual scheme of the isopic zones. The strata which underly the flysch were developed under completely different depositional conditions. The flysches cannot be derived from sources which they cover.

Intervention

G. Flores — You mention the Gavrovo uplift as due to salt uplift. Do you have any gravity data to support this theory?

Réponse — Not yet.

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