



IGCP

PROJECT N. 5

CORRELATION OF VARISCAN AND PRE-VARISCAN EVENTS  
OF THE ALPINE-MEDITERRANEAN MOUNTAIN BELT

FIELD MEETING, TURKEY, SEPTEMBER 13-19, 1987

GUIDE BOOK  
FOR THE FIELD EXCURSION  
ALONG WESTERN ANATOLIA, TURKEY



GENERAL DIRECTORATE OF MINERAL  
RESEARCH AND EXPLORATION OF TURKEY

# GEOLOGY OF THE ARMUTLU PENINSULA

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## INTRODUCTION

Armutlu Peninsula lies at the western part of the Pontides, limited to north and south by Kocaeli and İznik depressions which are formed by the North Anatolian Fault.

Akartuna (1968) stated that the amphibolites and schists at the basement of the region are of Pre-Permian-Carboniferous age. Kaya (1977) correlated the metamorphic rocks of the Gemlik area to the nonmetamorphic Paleozoic sequence of İstanbul area. Akartuna and Atan (1981) mentioned that the gneissic-amphibolitic basement is unconformably overlain by Devonian schists and marbles. Non-metamorphic Mesozoic cover in Geyve area starts with Jurassic limestones.

In their model for the tectonic evolution of Turkey, Şengör and Yılmaz (1981) locate an oceanic zone on the Armutlu Area (Intra-Pontide Suture), which opened between Rhodope-Pontide fragment and Sakarya microcontinent in Early Jurassic. Northward subduction of this oceanic plate in Late Cretaceous generated the ophiolitic melange (compare with metamorphic olistostome in this study) that extended from Saros Bay to Sinop area. The final closure of the ocean in Paleocene-Lutetian is followed by retro-charriage of the melange prism to the north. Subsequent island arc volcanism affected the basement of the northern continent (Rhodope-

Pontide Fragment) and the melange prism respectively. The data summarised in this work and the geological map of the area (Fig. 1) are the preliminary results of a recent study (Göncüoğlu et al, 1986) in the Armutlu Peninsula.

## STRUCTURAL OUTLINE

The pre-Late Cretaceous metamorphic basement of Armutlu Peninsula is composed of two different tectonostratigraphic units (Fig. 2).

The basement of the first unit (Pamukova Metamorphics) is composed of amphibolites with marble and quartzite interlayers, which is intruded by granites. This metamorphic basement is unconformably overlain by metaclastics and recrystallized limestone (Fig. 3).

The second unit (İznik Metamorphics) consists of low grade metamorphics, where three different types of metamorphic subunits are presented (Fig. 4).

Structural relation of İznik and Pamukova Metamorphics is not very clear. Mutual contacts are covered by Maestrichtian and Tertiary sediments. At a few limited outcrops at the southern part of the area, İznik Metamorphics are tectonically overlain by Pamukova Metamorphics. Exact age of the reverse faulting is spe-

culative, as the area is intensively effected by the North Anatolian fault, which regenerated the structural elements. However, we assume that the juxtaposition is not later than Upper Cretaceous.

## STRATIGRAPHY

### Pamukova Metamorphics

This unit covers extensive areas to the north (Gölcük-Armutlu Belt) and south (Doğançay-Mekece Belt) of the Peninsula.

The structurally lowermost part of the sequence at the southern belt is composed of white quartzites with minor carbonate lenses. At the middle part dominating rock type is amphibolite, whose protolith is diabase and/or basaltic rocks. Massive carbonate and metagreywacke bands and lenses are observed as intercalations in basic volcanics and volcanoclastics at the top of the sequence.

The whole sequence is strongly deformed and undergone low amphibolite facies metamorphism. Postmetamorphic granite intrusion is widespread. Extensive shearing generated blastomylonitic zones in metamorphics and granitoides respectively.

This metamorphic assemblage is unconformably overlain by metaclastics containing well rounded granite, quartz and amphibolite pebbles, Gray-green quartzites, green siltstone, conglomerate and black-grey shale with rare carbonate lenses resemble the lower part of the sequence. To the top the clastics grade into sandy-pebbly limestone and dolomite which contain deformed *Megalodont?* fragments.

At the northern belt (Gemlik and Gölcük areas), the basal clastic sequence unconformably overlying the metamorphic basement is directly

followed by a thick series of black, green and purple silt- and mudstones with disrupted sills of quartz-porphry. In this areas, carbonates are missing.

The age of the basement metamorphics is highly speculative, as no fossils are determined yet and radiometric data is absent. Regional considerations based on correlations to the similar metamorphics in Northern Anatolia indicate following possibilities:

- The cover rocks are of Paleozoic age (Kaya, 1977) and the metamorphic basement resemble to Precambrian metamorphics described by Arpat et al (1978) at Safranbolu region.

- The basement is the metamorphic equivalent of the Karakaya Complex (Bingöl et al, 1973).

In a recent study we observed an interesting sequence at Kadirler anticline to the south of Geyve, previously mapped by Saner (1980). In the core of the anticline it occurs a metamorphic sequence consisting of quartzites, amphibole-schist and carbonates intruded by granitoides (Fig. 5). Clastic rocks containing mainly of quartz and feldspar unconformably overlie the metamorphics. These clastic rocks containing mainly of quartz and feldspar unconformably overlie the metamorphics. These clastics are grading into highly fossiliferous sandy limestones and limestones followed by gray dolomites with sparse fossils. *Pseudoschwagerina* sp., *Parafusulina* sp., *Pseudofusulina* sp., *Stafella* sp. etc at the lower part of the carbonates indicate to an Early Permian age for this unit. At the northern flank of the anticline, a coarse grained quartz-feldspatic sandstone level conformably overlies the Permian carbonates. This level is followed by pyroclastics, pillow basalts, with gray micritic intercalations and finally by greywackes with blocks of amygdaloidal basalts and Upper Permian lime-

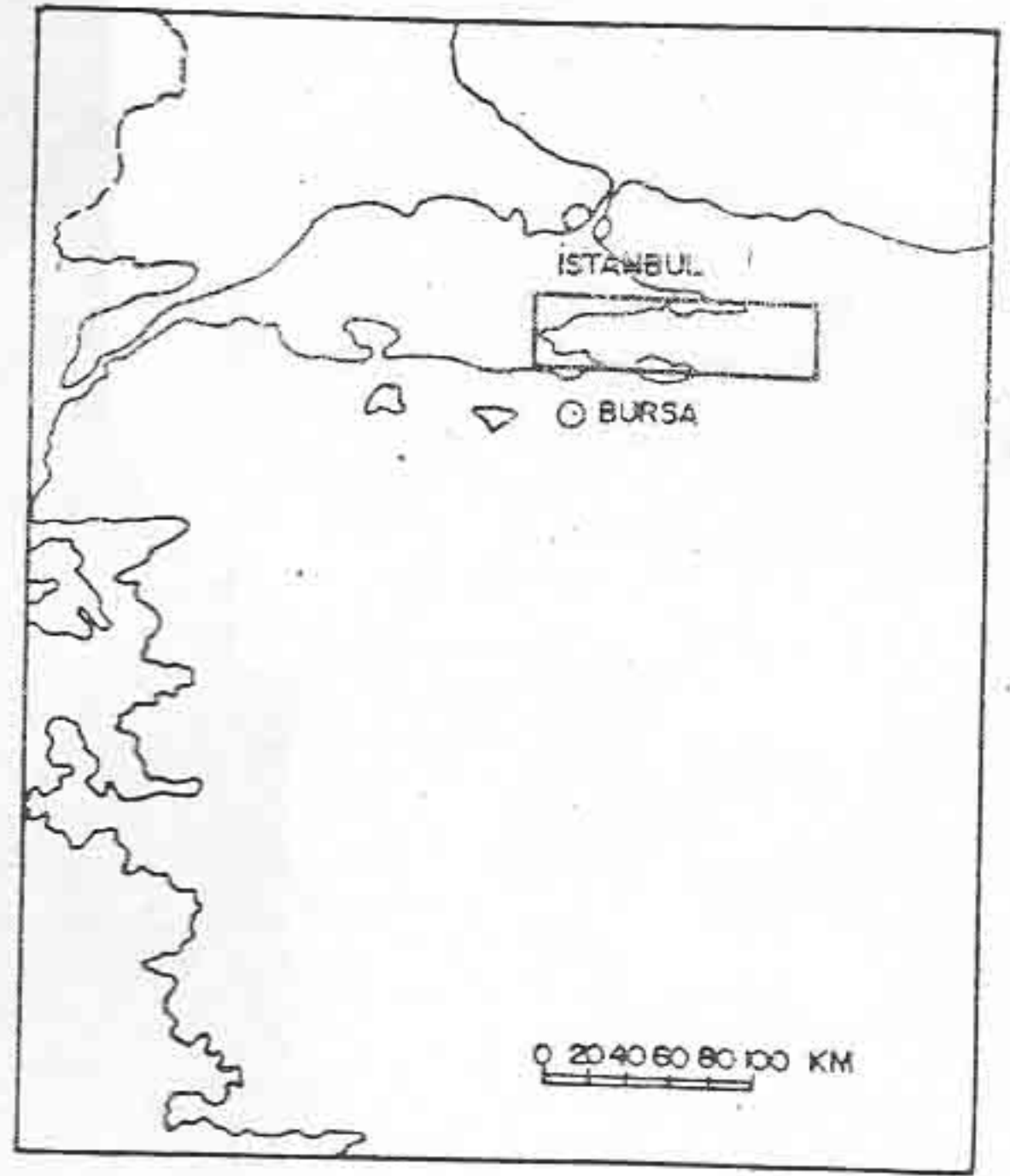
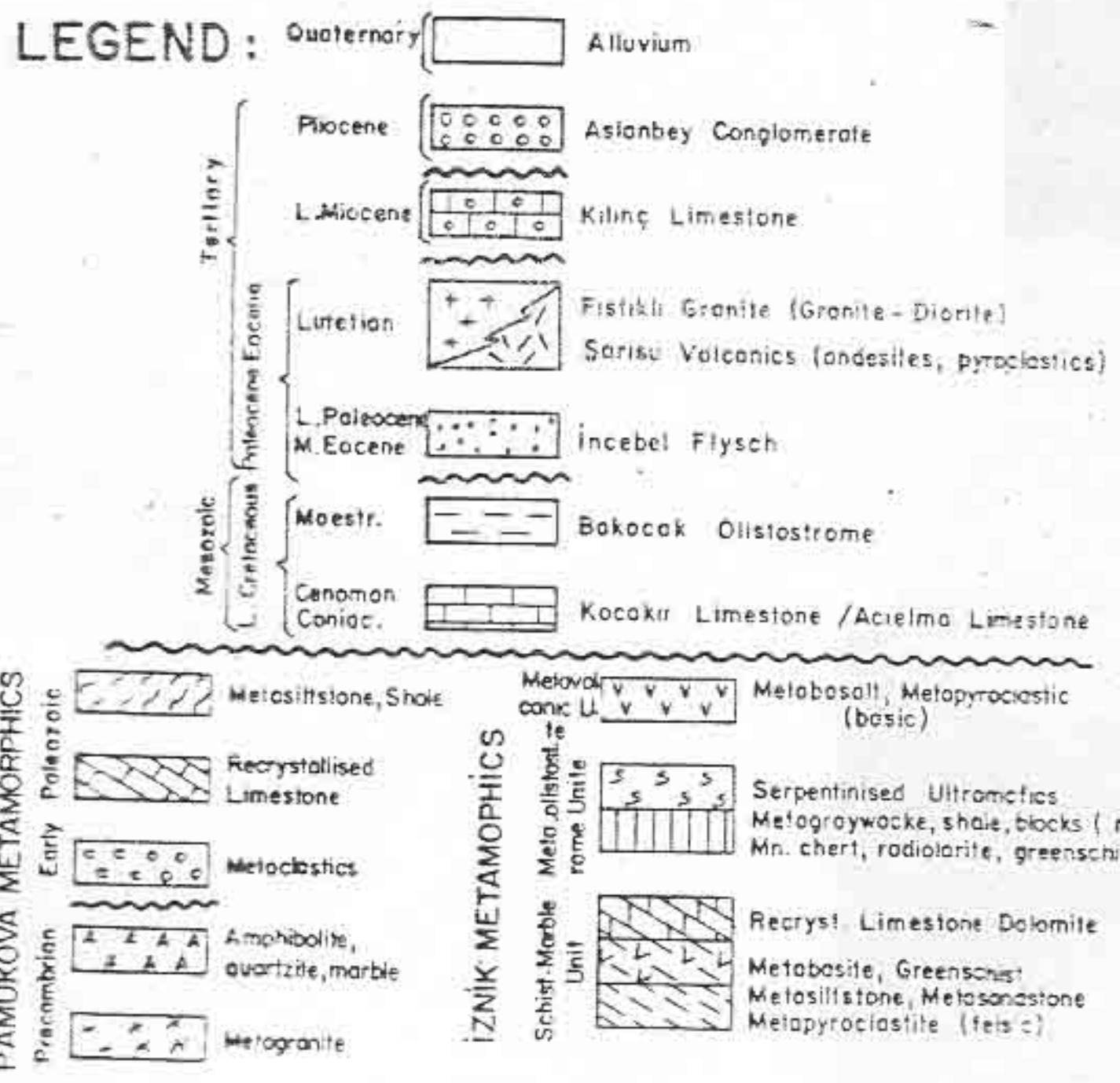
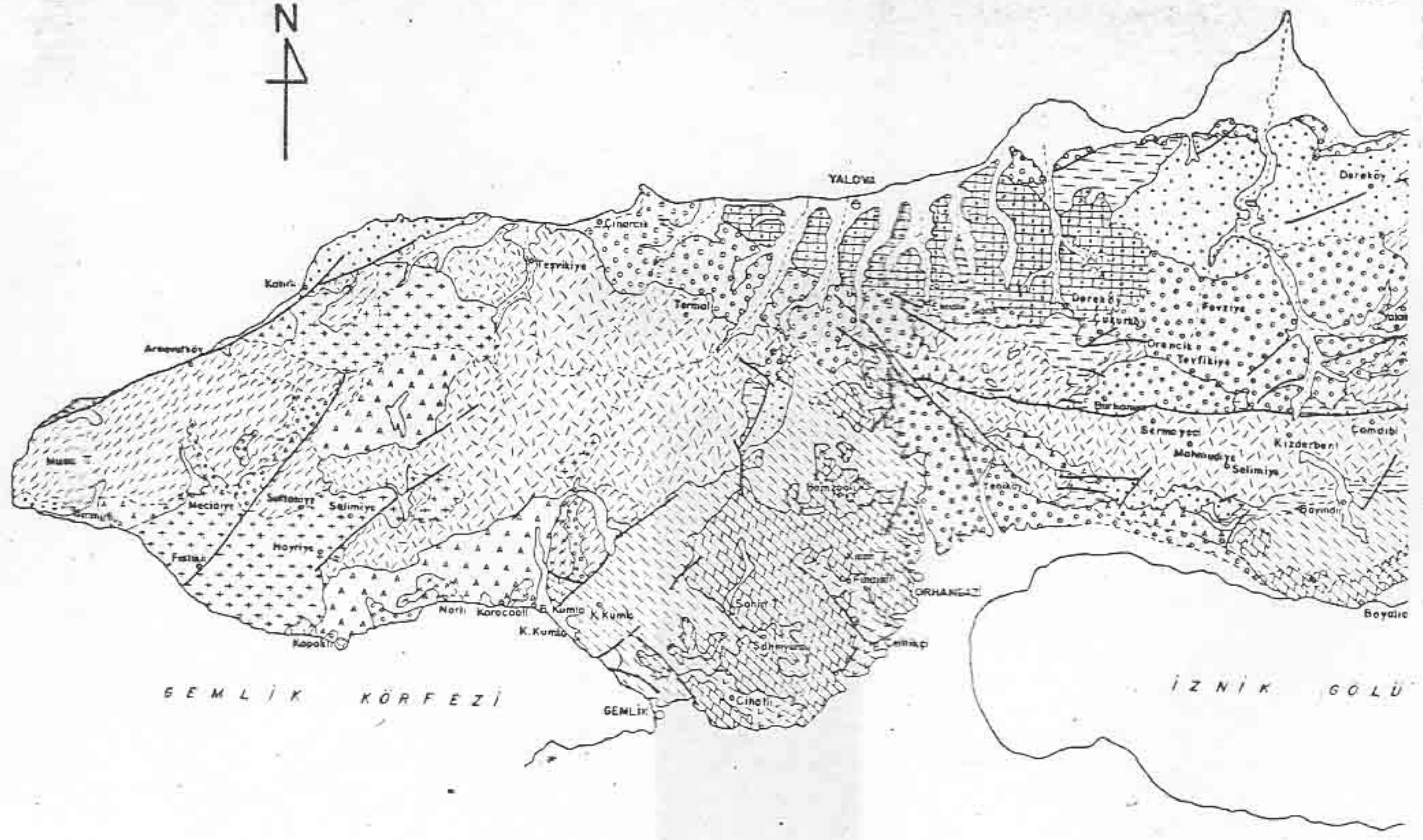


Fig.1— Geologic map of the Armutlu Peninsula.



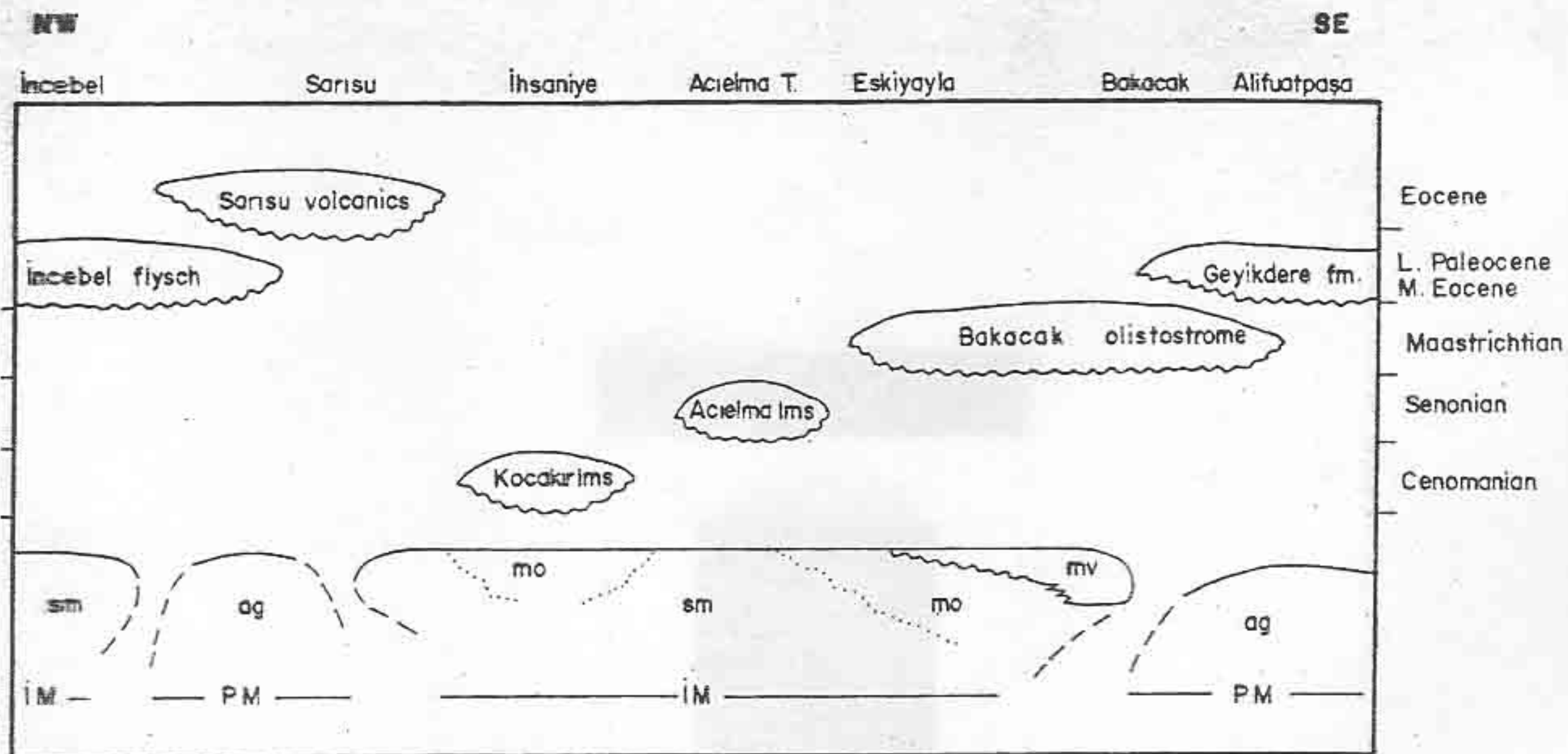


Fig.2— Structural and stratigraphic relationship of the units on Armutlu Peninsula.

İM: İznik Metamorphics; PM: Pamukova Metamorphics; ag: Amphibolite - metavolcanic unit, granite; sm: Schist-marble unit; mo: Metamorphic olistostrome; mv: Metavolcanic unit.

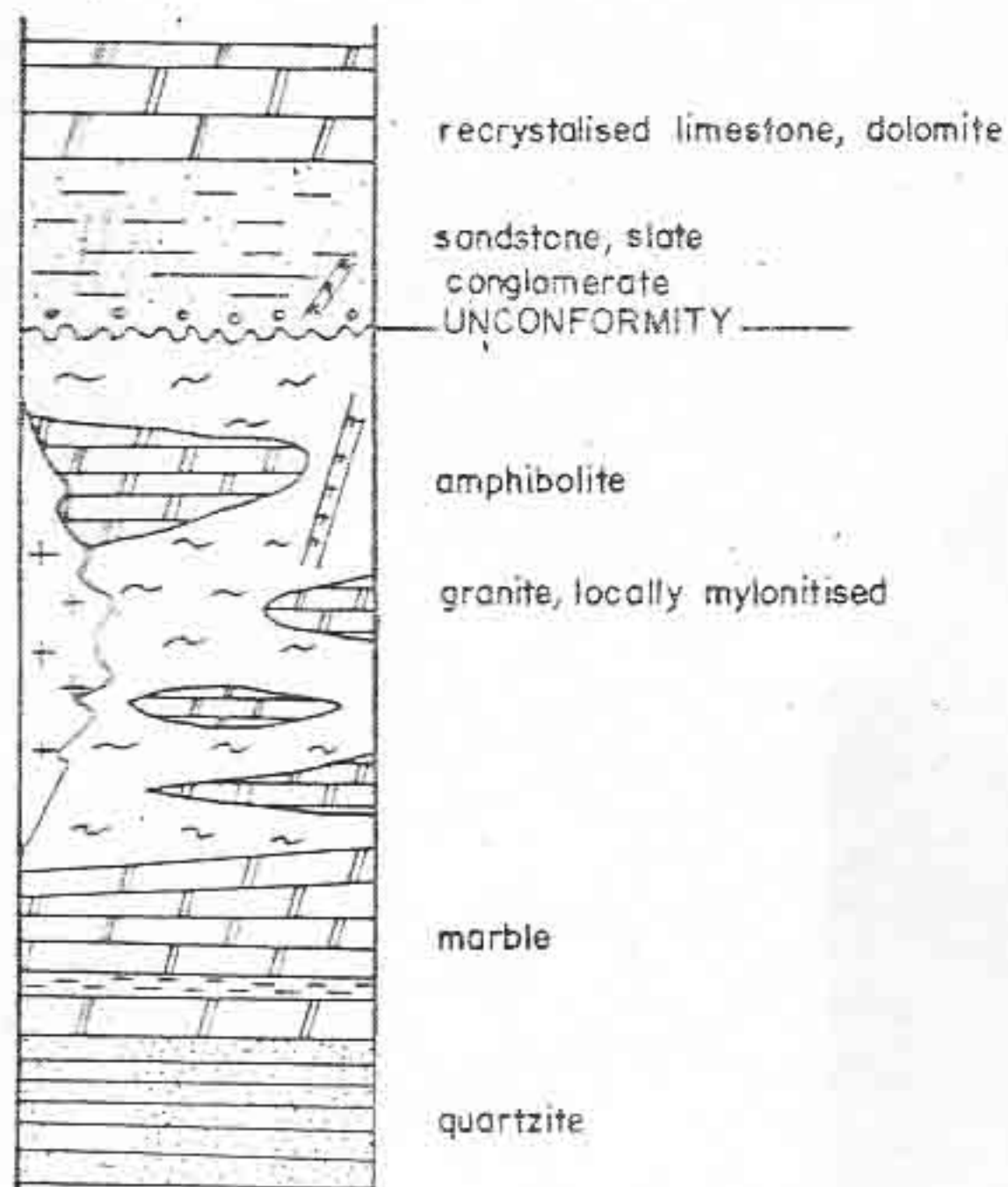


Fig.3— Generalized columnar section of Pamukova Metamorphics.

is commonly composed of felsic volcanics and volcanoclastics grading up into purple-red-pink coloured mudstones and micritic limestones. The uppermost part is transitional to the underlying units and comprises of massive limestones with chert interlayers. Dolomites at the lower part are devoid of fossils whereas varicoloured micritic layers yield pelagic bivalvia very similar to Daonellides which indicates to Triassic age. Regional correlation with Central Pontides support this data (F. Önder, oral commun., 1986),

#### Metamorphic Olistostrome

The basal part of this unit starts with conglomerates and/or green siltstones upon the cherty limestones of schist-marble unit. The rest of the sequence is represented by a thick series of turbiditic sandstone, shale,

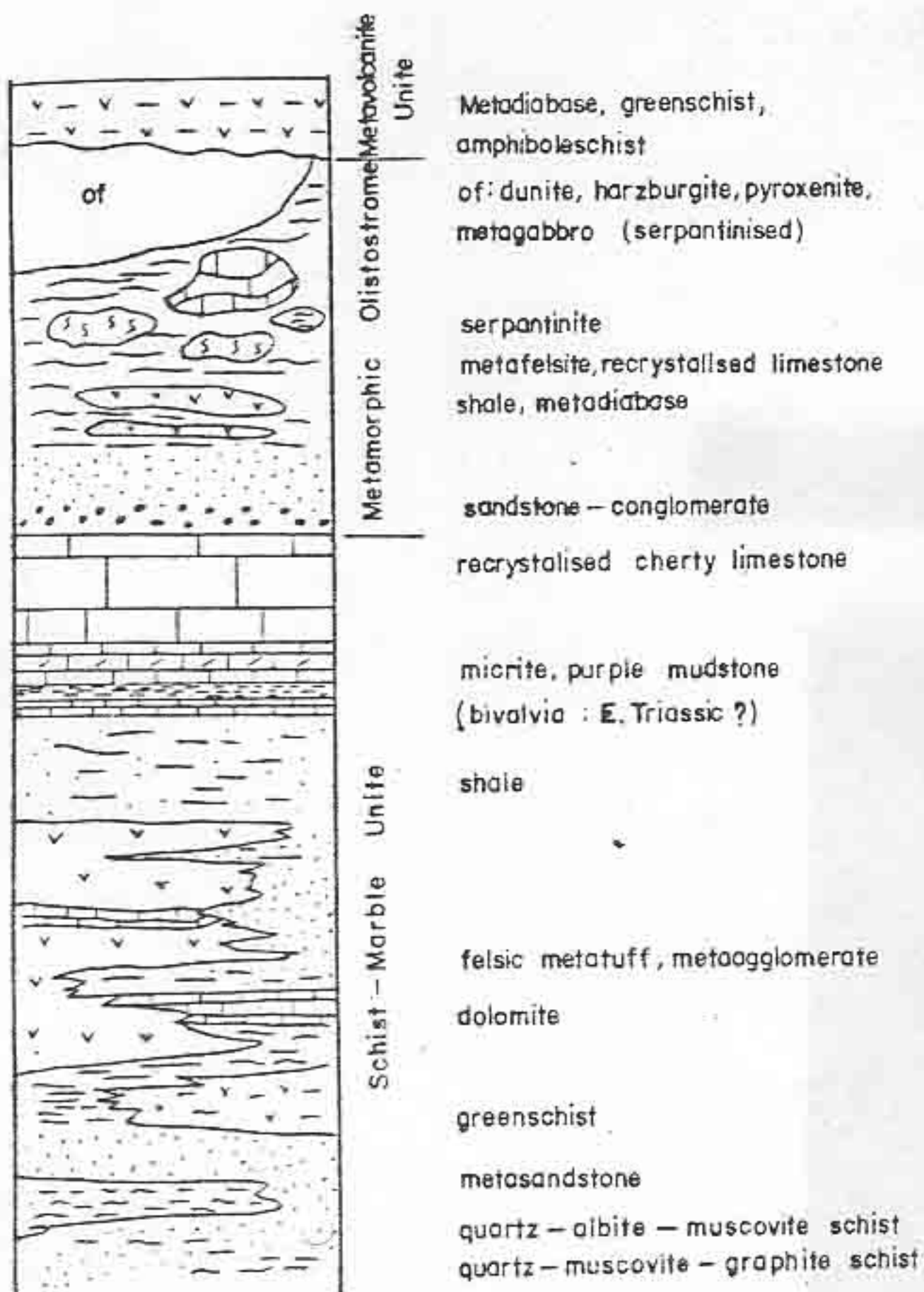


Fig.4- Generalized columnar section of İznik Metamorphics.

felsic pyroclastics, conglomerate, tuff and argillites comprising olistolithes of marble, radiolarian mudstone, manganiferous cherts, amphibolite, metabasic rocks, serpentinised ultramafites, andesites etc. The matrix is sheared and metamorphosed in low grade greenschist facies. The blocks however show separated PT-paths (high pressure greenschist facies, amphibolite facies) indicating different PT conditions prior to the deposition. This unit is interpreted as a fore-arc assemblage, whose exact age is unknown. We suggest a tentative Upper Triassic-Early Mesozoic interval for the deposition.

#### Metavolcanic Unit

The upper most part of İznik Metamorphics is composed of metabasic

rocks up to 250 m in thickness metabasalts and metadiabase with minor sills of microgabbro and mafic breccias are the common rock types.

#### Non-Metamorphic Cover

Late Cretaceous sediments unconformably overlie Pamukova and İznik Metamorphics respectively.

Kocakir and Acielma Limestones with their limited outcrops directly overlie İznik Metamorphics and yield Cenomanian-Coniacian fossils.

Bakacak Olistostrome covers extensive areas to the north and south of the peninsula, at the northern part of the area this formation consists of clastics and neritic limestones, whereas olistostromes and flyschoidal rocks dominate to the south. Neritic limestones, matrix of the olistostrome and native pelagic limestone blocks yield Maestrichtian-Earliest Paleocene fossils. Olistostromal part of the unit contain limestone blocks of Devonian, Jurassic and Early Cretaceous age. Further blocks consist of marble, granite, metabasalt, serpentinit and amphibolite. Incebel Flysch of Paleocene-Eocene age unconformably overlie the metamorphics and Bakacak olistostrome respectively.

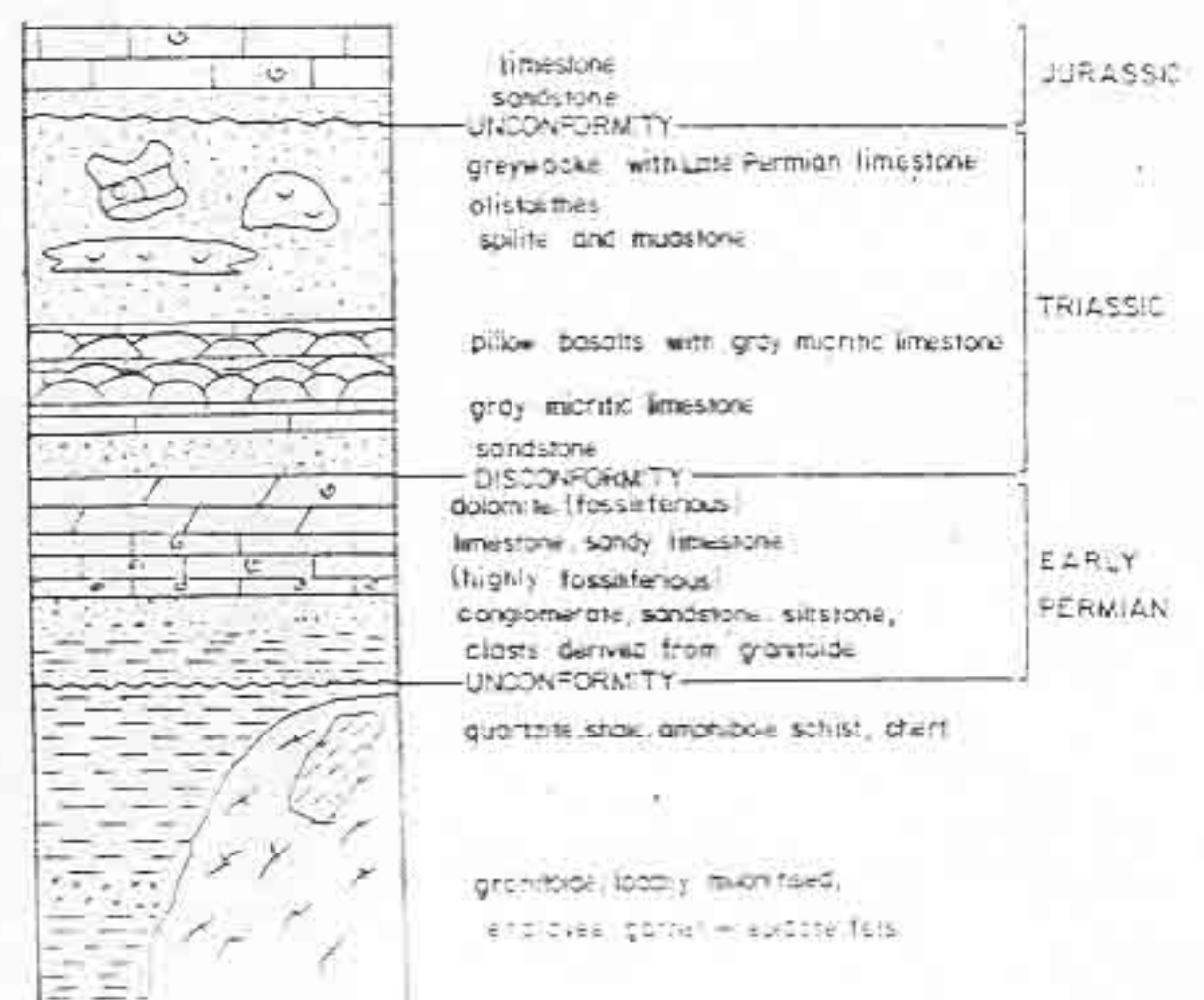


Fig.5- Section of the Kadirler area synthetic stratigraphic.

This formation is composed of a ca 3000 m thick sequence of sandstone-mudstone-marl-conglomerate intercalations. To the upper part of the sequence andesitic tuffs and agglomerates dominate, which is in turn transitional to Lutetian Sarisu Volcanics composed of andesites, basaltic andesites and their pyroclastics.

Late Miocene and Pliocene clastics resemble molassic sedimentation locally effected by neotectonic events.

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- STOP 1.3. On the road-cutting we see basal amphibolites of Pamukova Metamorphics intruded by granitoides.
- Metamorphism and subsequent shearing has destroyed the initial structure. In less altered parts a ghost magmatic texture is recognisable.
- At the contact to granitoid sills epidotisation and chloritisation are common features. Post metamorphic overprint caused intensive milonitisation and recrystallisation of chlorite+albit+pale green actinolite+sericite parallel to the new foliation planes.
- STOP 1.4..At the north of Paşalar Village we see the upper part of Pamukova Metamorphics presented on Fig. 3.
- STOP 1.5. From the distance we see the structural position of the major units. The southern branch of North Anatolian Fault running through Geyve-İzmit depression, Pamukova Metamorphics of the southern Doğançay-Mekece belt underlying southward tilted Upper Cretaceous Bakacak Olistostrome of the southern basin and İzmit Metamorphics overriding the olistostrome.