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"LIGNITIC SANDSTONES" OF THE TRAKYA BASIN

Muzaffer SİYAKO*

ABTRACT.- Uppermost Eocene - Lowermost Miocene Yenimuhacir Group of the Trakya Basin consists of clastic sediments representing deltaic facies associations with a total thickness of 3500 meters. Major facies associations of prodelta, delta front and delta plain can be differentiated both in the field and in the oil exploration wells, and they are named as Mezardere, Osmancık and Danişmen formations respectively. The unit described as "lignitic sandstones" in early studies, represents delta front and delta plain environments of the system forming the Yenimuhacir Group. They are the equivalent of Osmancık and Danişmen formations described in this paper.

Key words: Trakya, Yenimuhacir, deltaic fasies, sekans stratigrafi, seismic data

INTRODUCTION

A unit named as "lignitic sandstones" by the previous investigators is seen in a large area extending from S of Uzunköprü to Keşan, Malkara, Tekirdağ, Marmara Ereğlisi and Büyükçekmece in the Thrace region (Figure 1, Ternek, 1949, Koop et al., 1969, Lebküchner, 1974). This unit has been described as Danişmen formation in Boer, 1954, Beer and Wright, 1960, Umut et al., 1983, 1984, Sümengen et al., 1987, Umut, 1988 *a, b,* İmik, 1988, Sümengen and Terlemez, 1991, Şentürk and Karaköse, 1998, Şentürk et al., 1988 *a, b,* Duman et al., 2004 or Osmancık formation in Kasar et al., 1983, Atalık, 1992. It is indicated as Oligocene-Lower Miocene clastics on İstanbul sheet of 1/500,000 scale Turkish Geological Maps published by MTA (Türkecan and Yurtsever, 2002).

The unit mentioned as lignitic sandstones are two discrete formations including delta front and delta plain facies rather than a single unit. Knowing detailed stratigraphy of the oil and gas productive reservoir sandstones of Oligocene and overlying claystone and shales which have been investigated by national and foreign companies in drillholes, is very important for economic expectations of the investments. It is obvious that well defined stratigraphy contributes lots of benefits to the expensive drilling explorations.

For this purpose, this paper, aimed to reveal the stratigraphy of Oligocene, which the unit described, as a single formation and named differently in southern Thrace in 1949, but, accepted as the same unit, hereby, with conducting field as well as subsurface data, the units seemingly to be as two individual formations will be exlained in the article.

GENERAL STRATIGRAPHY

Whether or not pre-Tertiary sedimentary units are present and how the sedimentation begun are certainly not obvious at the base of Tertiary units exposing on different basement rocks in different regions of Thrace and the vicinity, but the estimated maximum thickness of the Tertiary sequence seems to be about 9.000 meters, near Muratlı (Koop et al., 1969, Turgut et al., 1991, Siyako, 2005, 2006). It is possible to obtain the information of the basin evaluation and the stratigraphy in this region by the southern outcrops and geophysical as well as borehole data (Figure 2). According to the data, the Thrace Tertiary Basin, where generally clastics have deposited, seems to be a considerably fast subsiding and is filled

* Türkiye Petrolleri Anonim Ortaklığı, Arama Dairesi Başkanlığı, Ankara msiyako@tpao.gov.tr

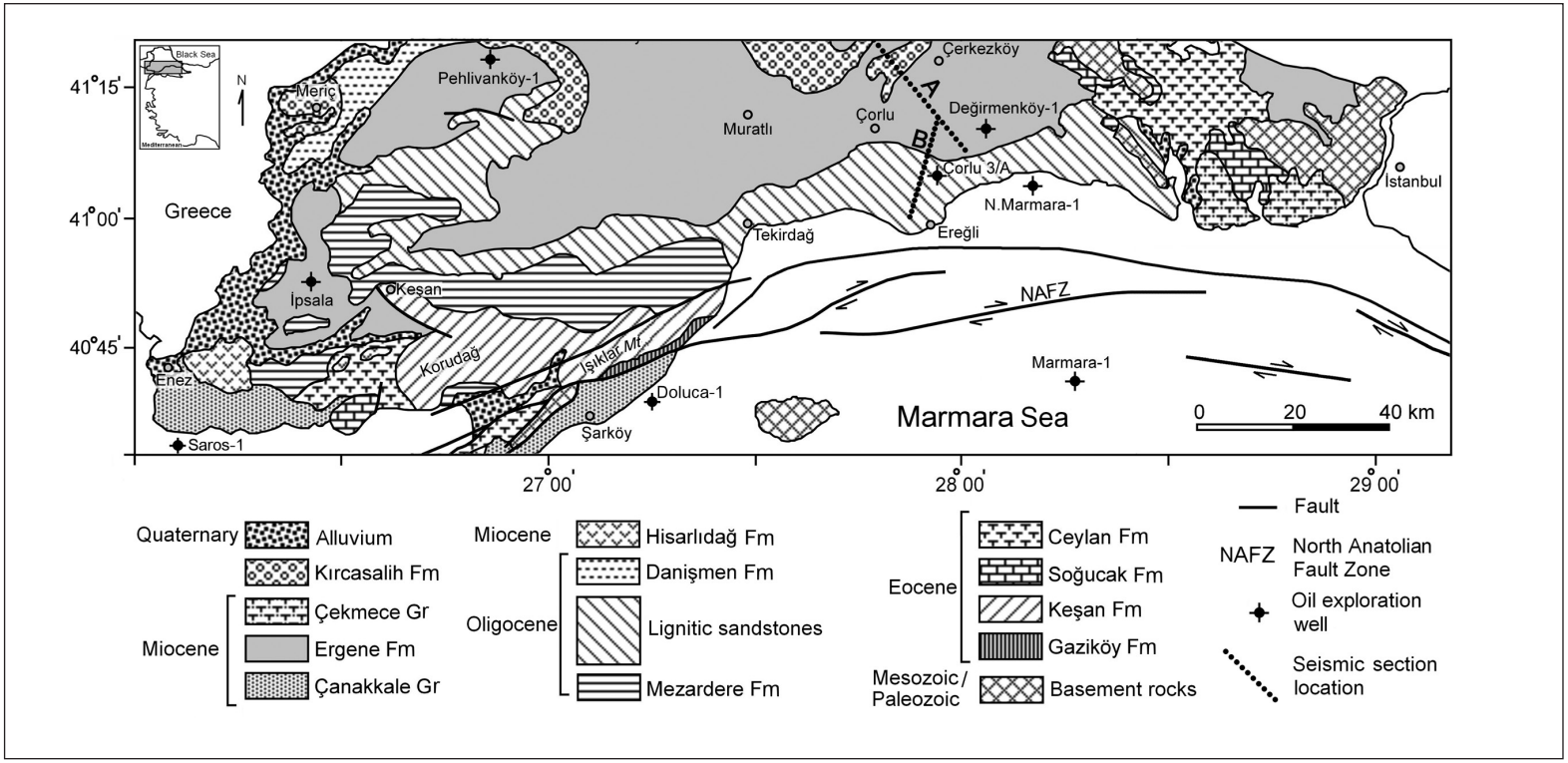

Figure 1- Geological map of the southern Thrace (Siyako, 2005).

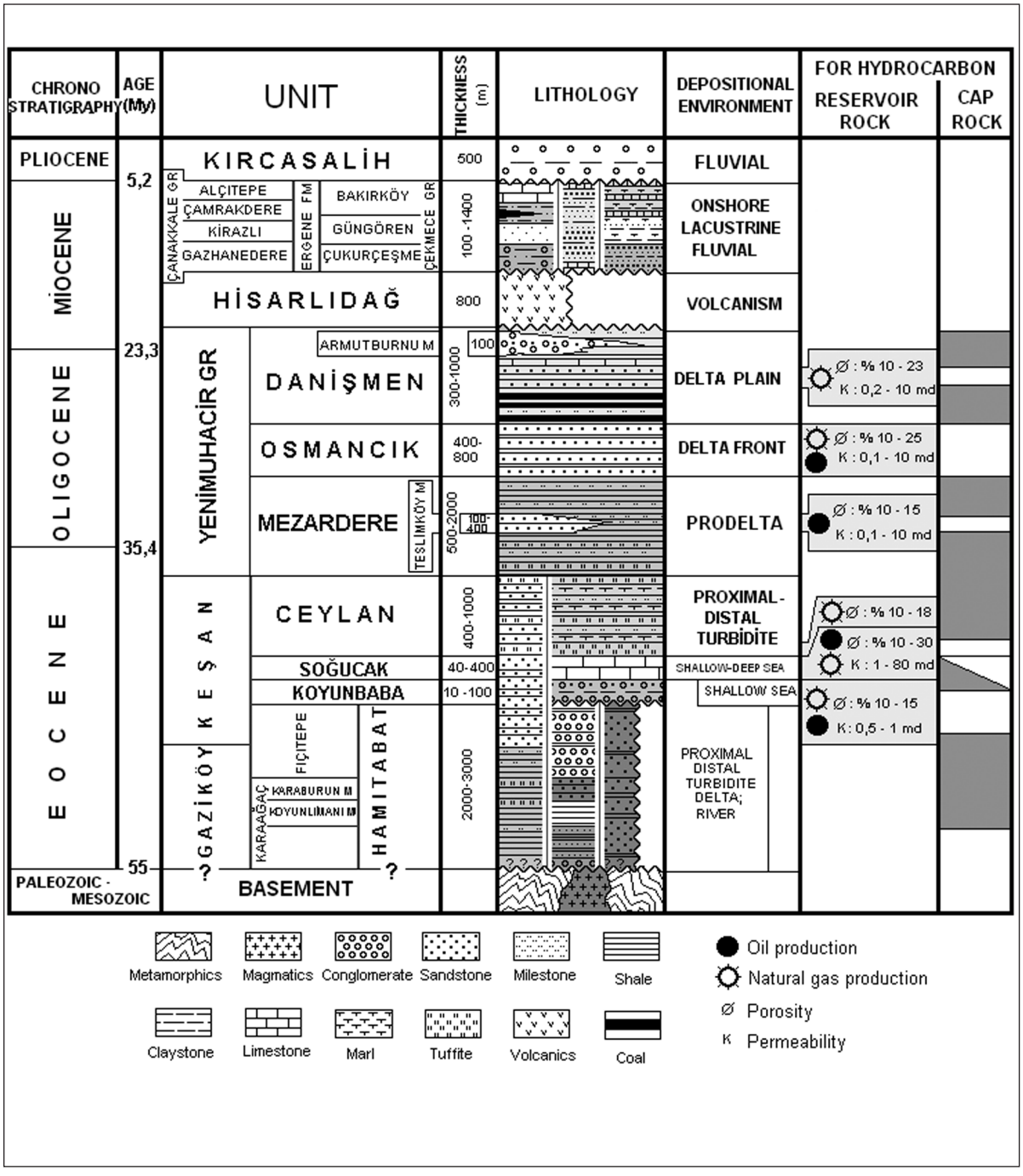

Figure 2- Generalized stratigraphic section of Tertiary sequence in Thrace (pers. comm. with Hasan Emiroğlu, 2004).

while subsiding, basin which partially showed continuous sedimentation and partially ceased sedimentation and erosion phases. Some portions of the basin have a partially continuous sedimentation, and some have occasionally breaks and erosional phases. Probably the sedimentation commenced in Early Miocene has continued up to the recent if the sedimentation breaks and erosions are not taken into considerations (Figure 2).

It is understood that various units deposited at terrestrial and marine environments are in lateral and vertical transition with each other on the basin during Early-Middle Eocene time interval (Figure 2, Siyako, 2005, 2006). Keşan Formation and Ceylan Formation corresponding to top levels of this unit are deposited at Late Eocene. Both of these units are composed of turbidites deposited in the marine environment despite their contrasting lithologies. A delta system named as Yenimuhacir Group started to evolve while the environment were shallowing at the end of Late Eocene - the beginning of Early Oligocene (Kasar et al., 1983, Saner, 1985, Sümengen and Terlemez, 1991, Atalık, 1992, Siyako, 2005, 2006). Mezardere (Ünal, 1967, Kasar et al., 1983), Osmancık (Ünal, 1967, Kasar et al., 1983, Siyako, 2005, 2006) and Danişmen formations (Boer, 1954, Beer and Wright, 1960, Ünal, 1967, Kasar et al., 1983, Siyako, 2005, 2006) were deposited in this system until Early Miocene. At the end of this stage, region is completely filled, uplifted and then, turned to be terrestrial, and after an erosional phase the sedimentation of younger Miocene-Pliocene aged units have taken places.

Yenimuhacir Group

Formations constituting of Yenimuhacir Group are transitional in a classic delta system laterally and vertically, and are units needed to be mapped as distinct units, i.e. prodelta, delta front and delta plain deposits, respectively.

Of these units, Mezardere Formation, representing prodelta facies is in gradual transitional with lower Keşan and Ceylan Formations and overlying Osmancık Formation. Its lithology mainly consists of shales, marls and tuffites. Tuffites, which may be distinguished as guide levels, may be traced over much longer distances. Often sandstone fragments are observed within the unit. These concentrated levels are mapped with a unit called as Teslimköy Member (Figure 2, Kasar et al., 1983). Mezardere formation has a thickness of 1540 meters at its local, type section (Kasar et al., 1983). Based on palynological studies, it is reported that its age is Late Eocene-Early Oligocene and it may extend to Late Oligocene in E of the basin (Ediger and Alişan, 1989, Batı et al., 1993, 2002).

Osmancık Formation, which is included in a delta front facies, is an upward coarsening and shallowing sequence, and is composed of sandstone and shale lithologies. The unit also contains few conglomerates, lamellibranchian shell aggregates and tuffite levels. Distribution and thicknesses of rarely observed lignite levels in the wells and in the field are not as large and great as that of Danişmen Formation (Siyako, 2005, 2006). The outcrop thickness of Osmancık Formation seems to be about 800 meter (Temel and Çiftçi, 2002) and the same value is also taken in the wells drilled in the northern and eastern Thrace. Based on palynomorphs obtained from palynological studies conducted in the field and well samples, the age of unit, ranges from Early to Late Oligocene (Ediger and Alişan, 1989, Batı et al., 1993, 2002).

Danişmen Formation, the uppermost unit of Yenimuhacir Group, represents delta plain facies in this system. Locally thin laminated claystones and shales, sandstones, conglomerates and coals deposited on lacustrine, marsh, floodplain and fluvial environments compose of the main dominant lithology. There are rare tuffite and limestone levels. Borehole data show that Danişmen Formation has 1000 meter maximum

thickness, but original thickness might have been thicker due to its upper levels' being eroded (Siyako, 2005, 2006). The parts in Danişmen Formation which is of Conglomerate-dominated and easily mappable, are named as Armutburnu Member (N.V.Turkse Shell, 1969, Saner, 1985, Siyako et al., 1989, Temel and Çiftçi, 2002, Siyako, 2005, 2006). Danişmen Formation is of Late Oligocene-Early Miocene (Batı et al., 1993) and Late Oligocene ages (Batı, 1996, Batı et al., 2002).

Lignitic sandstones

Lignitic sandstones, exposed on a vast area in the southern Thrace, comprise both of Osmancık and Danişmen Formations, as described above. Their reference sections may be seen on Keşan-Uzunköprü, Malkara-Hayrabolu, Keşan-Tekirdağ roads and on coasts of northern Marmara Sea (between Tekirdağ and İstanbul) (Figure 1). Sümengen and Terlemez (1991), studied the regions between Keşan and Tekirdağ, reported all of lignitic sandstones as Danişmen Formation and subdivided it into two facies, one as delta front and the second as delta plain, on their generalized stratigraphic sections. Atalık (1992), who has studied measurement of the detailed stratigraphic sections on all of the exposed lignitic sandstones, described the whole unit as Osmancık Formation and subdivided it into 16 characteristic lithofacies. The described facies correspond to prodelta, delta front and delta plain environments, and those of more detailed subsections.

As understood from the previous works, there are several unmapped formations on the outcrops of the lignitic sandstone. If the start of the measured sections by Atalık (1992) is accepted as Mezardere formation with prodelta facies, two more formations remain which they correspond to the real Osmancık and Danişmen Formations, described previously (Siyako, 2005, 2006).

Based on subsurface studies by the well records and seismic sections, carried out at TPAO, Danişmen, Osmancık and Mezardere Formations are separated from each other by traceable levels over long distances like an indicator layer and described as sequence boundary (Figure 3, pers. comm. with A. Kadir Yılmaz and İsmail Abalıoğlu, 2004, Siyako, 2005, 2006). Besides, the basement of the coal levels, observed as the lower part of Danişmen Formation, is described as the contact between Danişmen and Osmancık Formations by means of performed drilling exploration studies (pers. comm. with Hasan Emiroğlu, 2004, Siyako, 2005, 2006).

The separation of Osmancık and Danişmen Formations outcrops were partially done on the lignitic sandstone outcrops in a small area shown on the unpublished geological maps of F29-c and d sheets found at the archives of TPAO Exploration Department (Figure 4, Bürkan, 1992). Here, folded Oligocene units, being formed by a strike and slip fault, are seen. Although with its distinctive and resistant litjology, Armutburnu member beloging to Danişmen Formation can be mapped easily, the contact between Osmancık and Danişmen Formations was not discerned due to their unconsolidated and fragmented lithology. However, as shown on figure 3, there is a distinctive contact between the two units. As in the seismic section of figure 5, the correlations performed among the other sections reveal that the contact was discerned,

Using similar methods and detailed sedimentological-stratigraphical works in the field, it is likely that this contact is mapped on all of the exposed lignitic sandstone in southern Thrace (Siyako, 2005).

CONCLUSIONS

It is a pity that inspite of Thrace's being an oil, natural gas, and coal production territory from Oligocene clastics, there is still shortage of basic stratigraphic-sedimentological knowledge within the geological maps as well as models. In this article, not only scientific significance of the

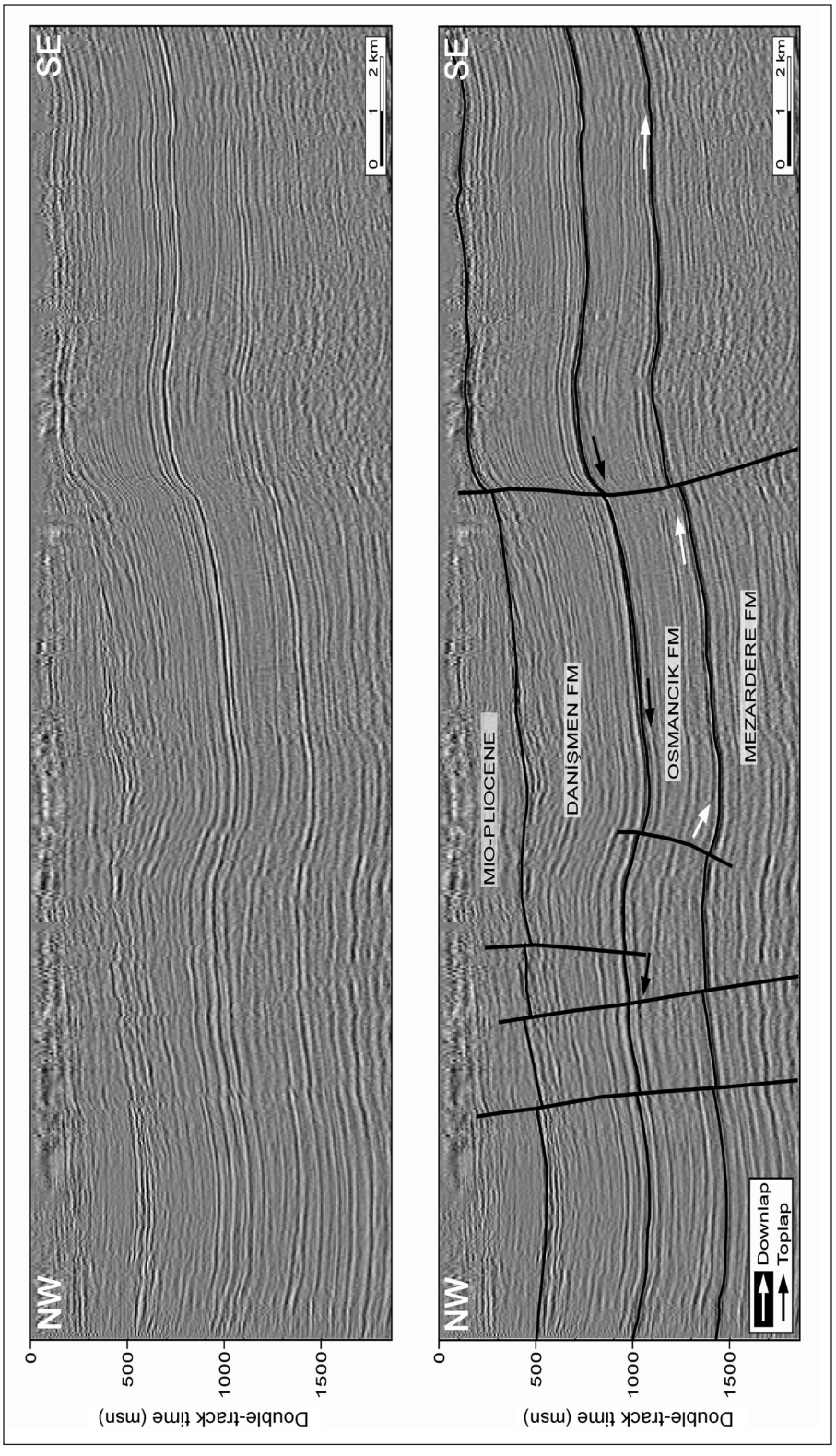

Figure 3- Sequence boundaries between Danişmen, Osmancık and Mezardere Formations and "toplap"s and "downlap"s, which are indicators of these boundaries, are seen on the interpreted and uninterpreted seismic section A. See figure 1 for the location of the section (Siyako, 2005).

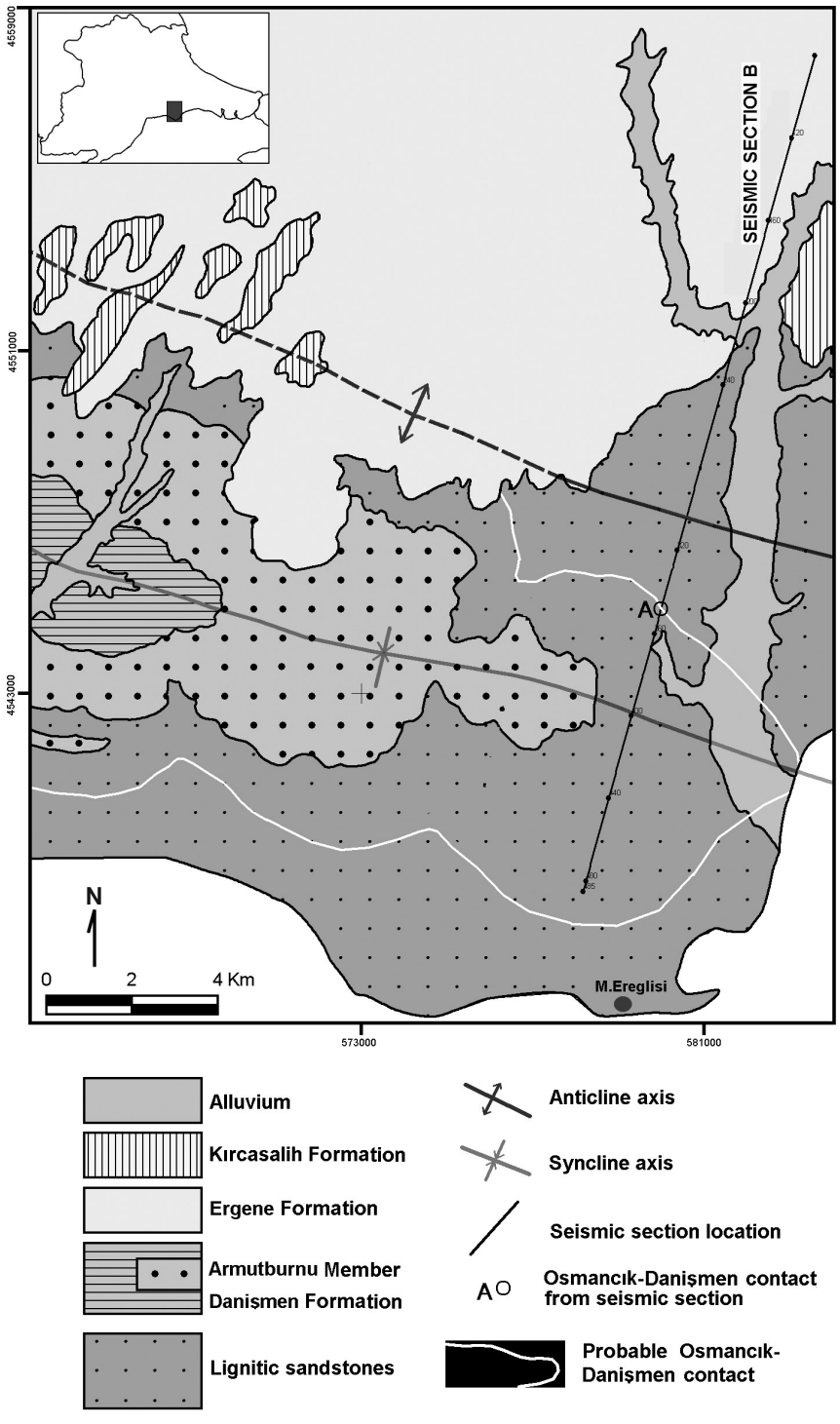

Figure 4- Geological map of northern Marmara Ereğlisi (Bürkan, 1992, Siyako, 2005)..

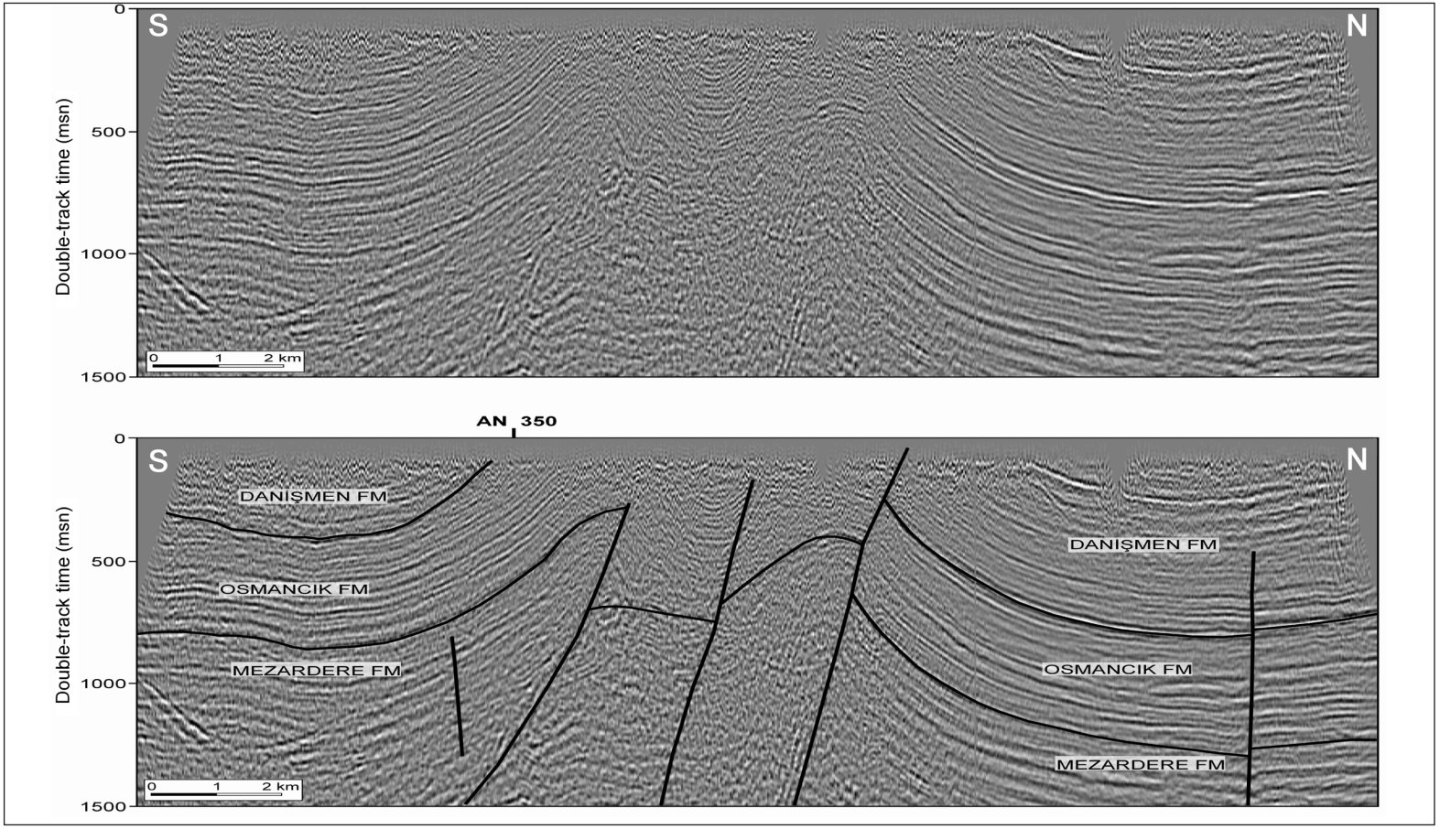

Figure 5- Seismic section B indicating separability of Osmancık and Danişmen Formations from each other in the field. See figures 1 and 3 for location of the section (Siyako, 2005).

separability of lignitic sandstones at least into two formations, an issue being not difficult to solve but ignored as well or unperceived for many years, also having their economic importances are emphasized.

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