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TECTONICS OF THE NORTH ANATOLIAN FAULT LOCATED IN THE SEA OF MARMARA ACCORDING TO SEISMIC REFLECTION DATA

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ABSTRACT *The Sea of Marmara is cut through by the North Anatolian Fault (NAF) from east to west. A number of digital off-shore seismic reflection data acquired by TPAO during 1970, 1984 and 1991 have been interpreted. Northern branch of the North Anatolian Fault extend as an arc form approximately E-W direction in the Sea of Marmara. The Sea of Marmara has affected extensional tectonics of the Aegean Sea and strike-slip system of the North Anatolian Fault. Tectonic properties of the Sea of Marmara were studied by multi channels deep seismic reflection data. According to seismic reflection data, northern branch of the North Anatolian Fault is active, right lateral strike-slip fault zone and has negative-positive flower structures. The North Anatolian Fault is divided two faults in the Sea of Marmara as northern branch and north segment of southern branch. Northern branch of the North Anatolian Fault named main Marmara fault extend complicatedly in the north of the Kapıdağı Peninsula and of the Sea of Marmara westward. North segment of southern branch of the North Anatolian Fault extend between Gemlik and Bandırma gulfs in south of the Sea of Marmara. In addition, uplift areas arise by compression and push-up style in between the Kapıdağı Peninsula and main Marmara fault. The North Anatolian Fault is negative flower structure in basins but push-up style in uplift areas in the Sea of Marmara. Paleo-uplift area arises between north segment of southern branch of NAF and northern branch of the North Anatolian Fault. North segment of southern branch of the North Anatolian Fault is strike-slip fault and pull-apart style according to seismic reflection data.*

INTRODUCTION

North Anatolian Fault (NAF) had been developed in Late Miocene with a total length of 1500 km within Turkey. The subject compressional force, E-W trending the North Anatolian strike-slip Fault (NAF) and a NE-SW trending the East Anatolian strike-slip Fault systems have been developed. Also N-S trending pull-apart stress system was formed in NW Anatolia (Barka and Kadinsky-Cade, 1988). Le Pichon et al. (2001) first described the basins on northern branch of NAF and detailed bathymetry and shallow seismic data reveals the nature of NAF in the Marmara Sea. In addition, Şengör et al. (2005) emphasized that North Anatolian Fault has 4 km offset with age approximately 200 ka. The observed methane gas emitting shows from bore holes are the signs of active faults in the region. The assessment of past studies shows a complex structural development in the Sea of Marmara. The system is suitable for the pull-apart model on north segment of southern branch of NAF (Barka, 1997).

Northern branch of NAF

Northern branch of NAF is the most active fault zone in the Sea of Marmara. Northern branch shows a negative flower structure in the basins and a positive flower structure in the ridges when the seismic sections are interpreted. This branch exists as a zone comprised of boundary faults, normal faults and reverse faults in the Sea of Marmara. The flower structure of the northern branch of NAF is clearly seen in the NS Line seismic section taken (Figures 1a and b). In the Sea of Marmara a similar study by Sato et al. (2004) indicated that focal mechanism solutions of the earthquakes yielded identical results with the general trend of right lateral strike-slip and normal component strike-slip type features. Finally, earthquake epicenter locations are compatible with strike-slip geometry of northern branch of NAF in the region and supportive to understand the regional active tectonic regimes.

North segment of Southern branch of NAF

Northern side of this segment extends between Almacık Mountain and Geyve with a NE-SW direction then it follows an E-W path around İznik and reaches to the Sea of Marmara at Gemlik bay. North segment of southern branch of NAF is structurally different than northern branch of NAF as seen NS Line seismic section. A topographically uplift area is noticeable in the south of NS Line seismic section (Figure 1). Then, an asymmetric depression area developed as pull-apart style can be defined. The fault plane solutions of the earthquakes occurred on this segment provided normal component strike-slip fault geometry (Gürbüz et al., 2000). On the contrary, structure of the basin developed by a normal fault located in the south of NS Line seismic section. This situation is a result of pull-apart character of the north segment of southern branch of NAF. These indications proof that the depression area is tectonically active. The basins developed on this segment extending in the south coast of the Sea of Marmara in pull-apart character.

CONCLUSIONS

Extensive compressional and extensional tectonic systems along NAF as well as the E-W trending boundary faults in the Sea of Marmara constituted the recent day tectonic activities and structural phenomena of the Marmara Region during last three million years. In the present study, the compressional zones and the extensional zones inferred by sound reverse and normal fault systems, respectively, could easily be interpreted on seismic reflection data. Some significant structural elements, normal faults, boundary faults, reverse faults and flower structures have developed by the northern branch of NAF. Northern branch of NAF is a lot of negative flower structures in west of the Sea of Marmara. However, northern branch of NAF cuts a negative flower structure around Çınarcık Basin in east of the Sea of Marmara. Besides, north segment of southern branch of NAF developed pull–apart basins in the south of the Sea of Marmara. It can also be said that the tectonic activity in the southern part of the Sea of Marmara is far more intensive than that the tectonic activities in the northern part.

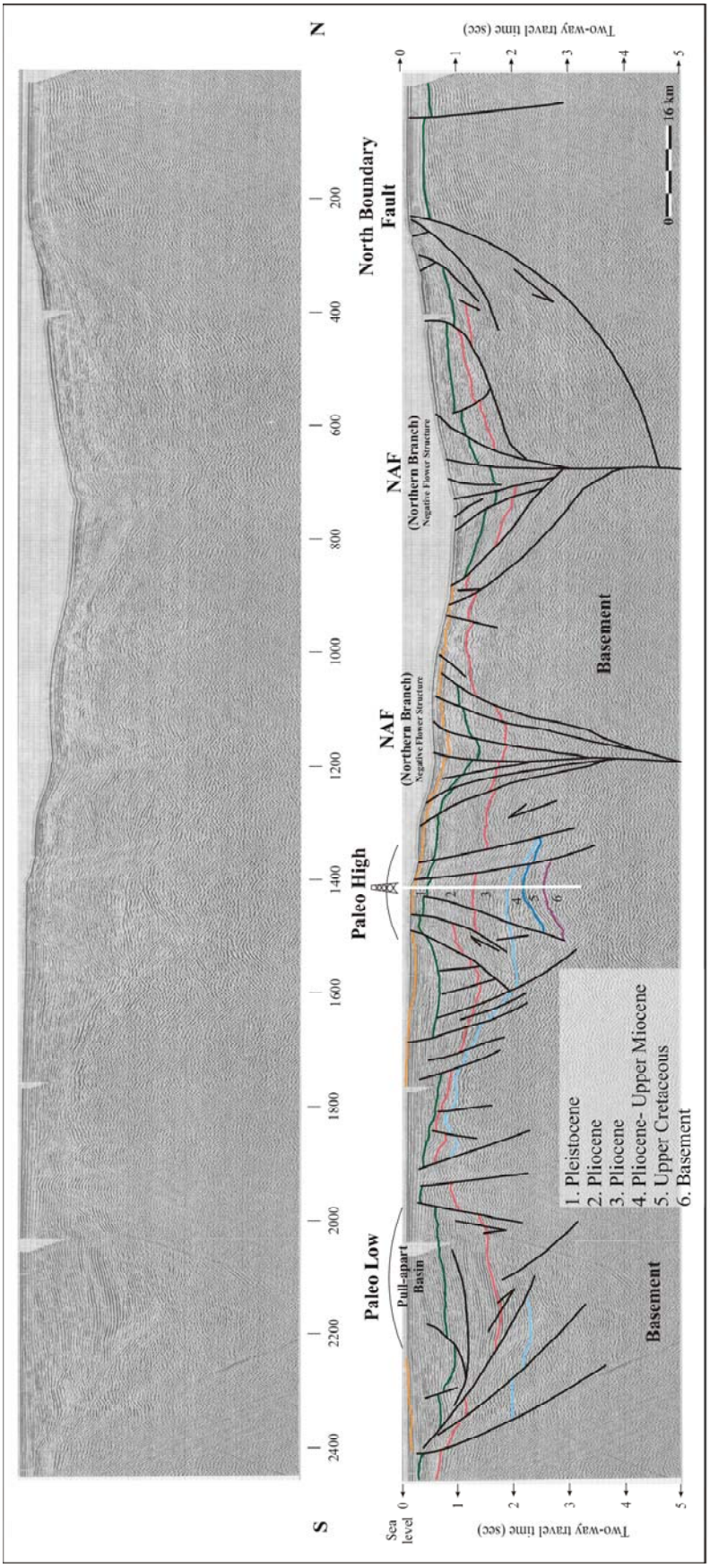

Figure-1. NS Line seismic section.

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