# SEISMIC REFLECTION STUDIES IN POLATLI REGION, TURKEY

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ABSTRACT.— Seismic reflection work was carried out in the southwest of Ankara around Polatlı-Haymana region as part of "Haymana Oil Exploration Project" The project area is located in Polatlı Basin extending in NW-SE direction and covering Triassic to Quaternary sediments. Seismic reflection data were recorded along profiles of 426 kilometers located in the area by Ünalan's work (Ünalan et al., 1979) in which the stratigraphy of the Upper Cretaceous-Lower Tertiary are described in detail. The upper boundary of Beyobası formation is the best reflector level in the data. This Maestrichtian Formation has been considered as the reservoir formation because of its fossileferous sandstone and limestone content. The contour map of the Beyobası formation was prepared and interpreted. The transition bands in the stratigraphic layers are generally not identified sufficiently. As the result of interpretation a NW-SE directional fault zone and two highs at both sides of this zone in the east part of the project area were obtained. The highs in the north and south of this zone are considered as parts of Kızılcakışla and Eski Polatlı anticlines. However, the north closing of the high located in the north and the south closing of the high located in the south could not be seen in the seismic data. In the west part of the project area two synclines were observed. The closing of one which is placed in the south is observable and the closing of the other one located in the north is not clearly observable.

## INTRODUCTION

Seismic reflection work was carried out by General Directorate of Mineral Research and Exploration of Turkey (MTA), as part of "Haymana Oil Exploration" project in order to characterize the seismic stratigraphy in the field on the southwest of Ankara including Temelli, Polatlı, Haymana and Yenice regions (Fig. 1, 3).

The basement of the stratigraphic accumulation in the surveyed field was not described satisfactorily, however; the stratigraphic form of the Beyobası formation considered as a reservoir unit was defined and its upper boundary was contoured (Fig. 3).

## GENERAL GEOLOGY

The detailed; stratigraphic study in the NW-SE directional Haymana-Polatlı basin was done by Ünalan (Ünalan et al., 1979). According to their study, the Upper Cretaceous-Lower Tertiary sediments a good prospect for oil are placed above Dereköy formation composed of serpentinitic limestone, radiolarit and volcanic blocks; which intern is underlain by Mollaresul formation of Upper Jurassic-Lower Cretaceous age lying discordantly over Temirözü formation consisting grey, wackes and metagreywackes including Permian limestones pebbles.

The thickness of the Upper Cretaceous-Lower Tertiary sediment is 5800 meters. The Haymana flysch formation occure as a result of invasion of the Maestrichtian sea over the land and has a thickness of 1850 meters in block-section, Beyobası formation consisting of sandstone with fossiliferous limestone has a thickness of 125 meters in the block-section. These two formations cover the basement reflections mentioned previously. These formations are followed by Kartal, Çaldağ and Yeşilyurt formations deposited during lower Paleocene.

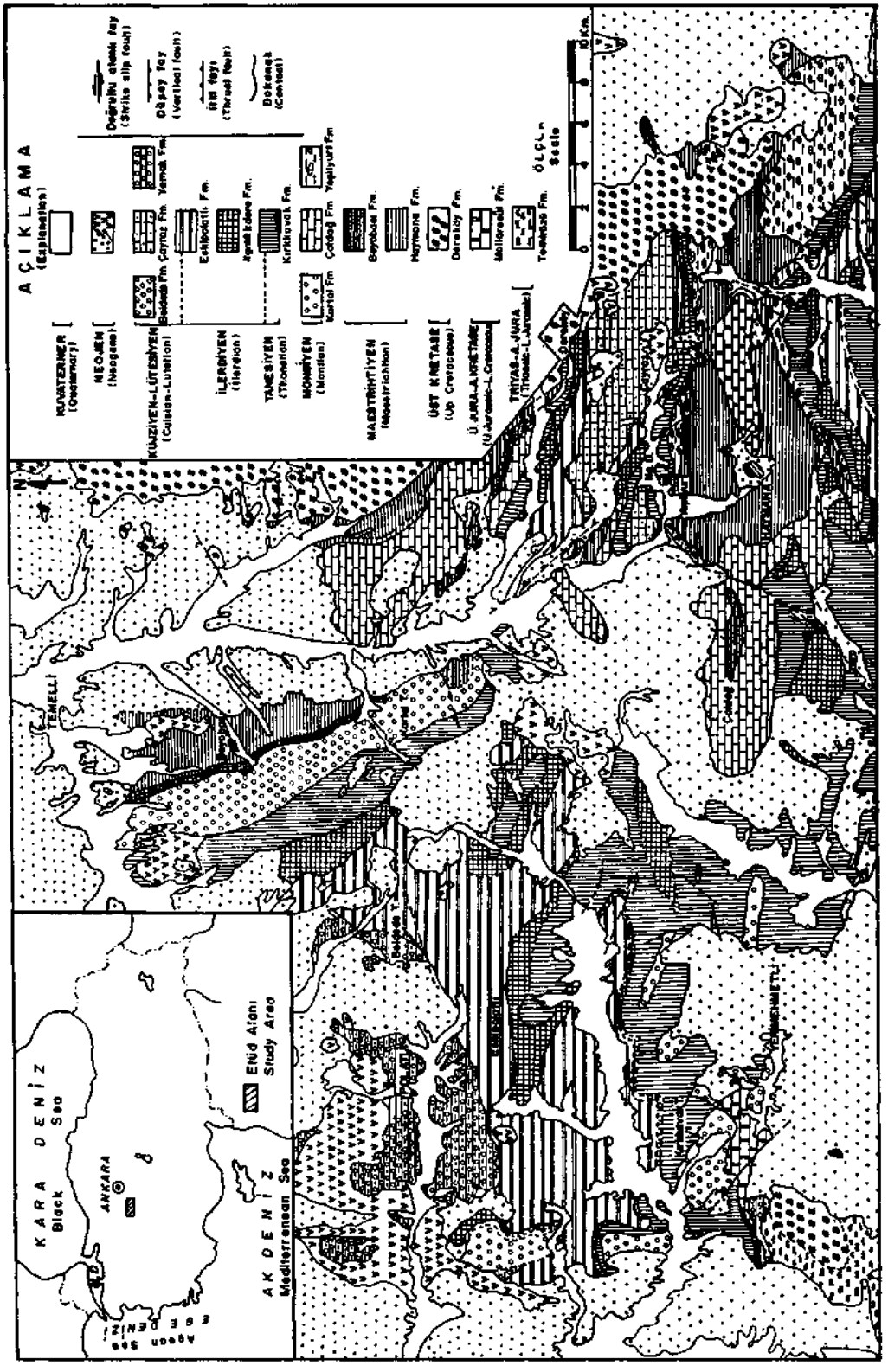


Fig. 1 - Geological map of the Haymana-Polatlı area (G. Ünalan et al., 1976).

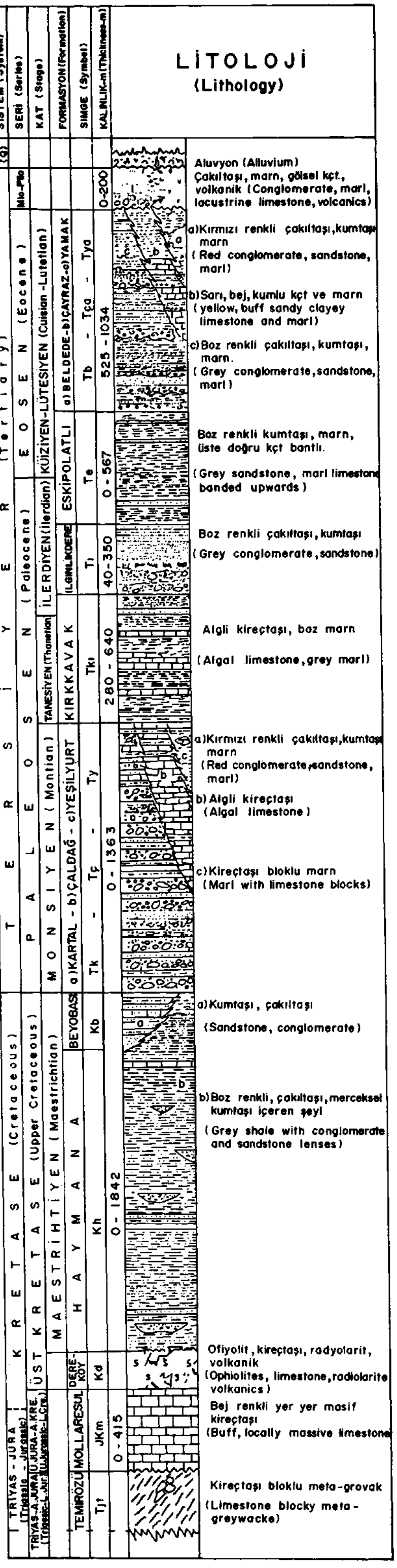


Fig. 2– Generalized columnar section of the Haymana - Polatlı area (G. Ünalan et al. 1976).

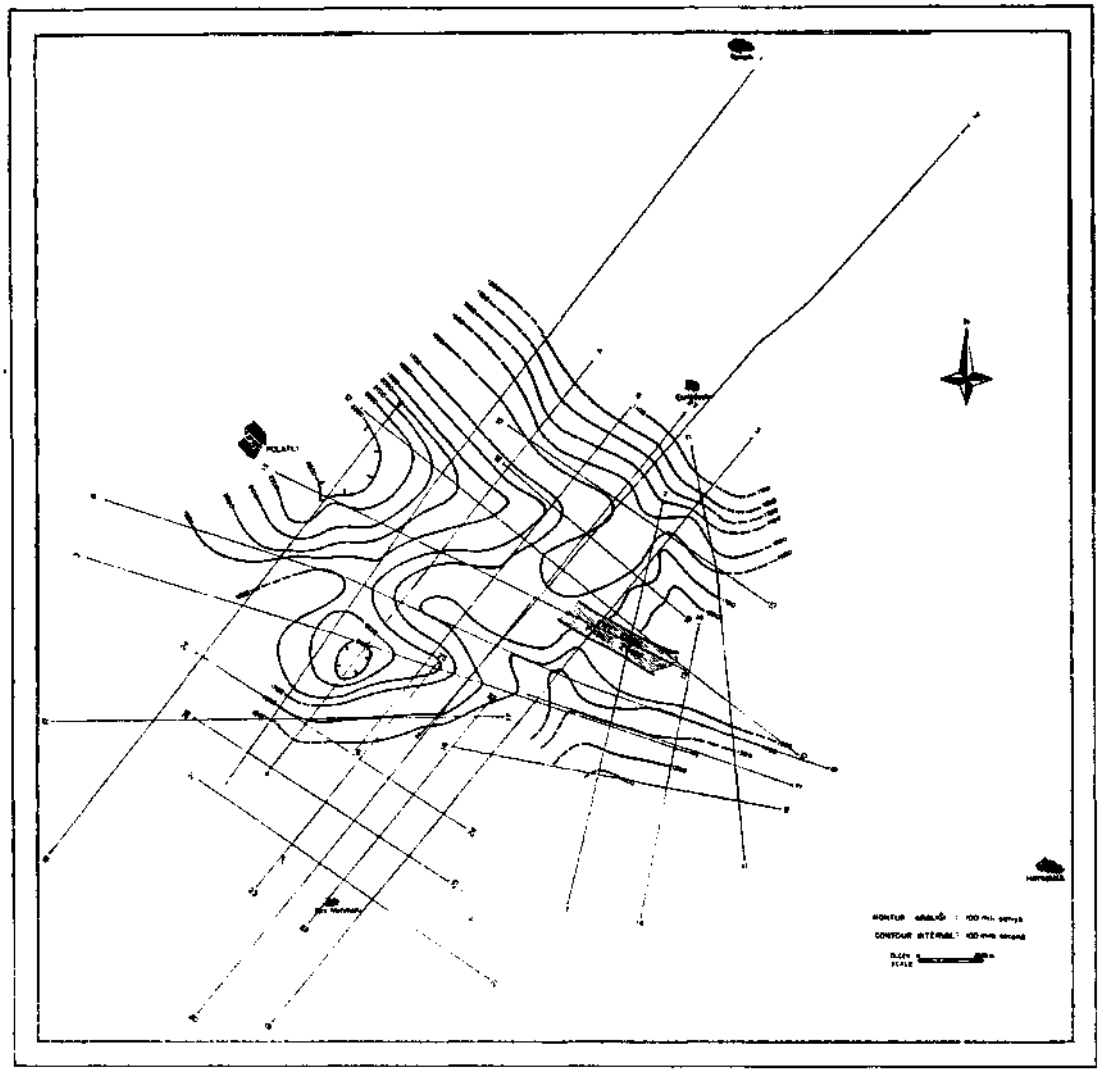

Fig. 3 - Time countour map of Beyobası formation.

The Kartal formation which has 1362 meters thickness was formed with red terrestrial fragments deposited in the margin of the basin and it passes laterally to the Çaldağ formation in the basin direction, Çaldağ formation originates with algae limestone and enters laterally in the basin direction to Yeşilyurt formation which is turbidity limestone facies and has a thickness of 945 meters.

In the Middle Paleocene Kırkkavak formation composed of fossiliferous limestone with thickness of 640 meters in the block-section takes its place in the series and is overlain by Ilgınlıkdere formation (350 m) in flysch facies and Eski Polatlı formation (562 m) composed of sandstones with marl and gray mudstones. Beldede formation, consisting of conglomerate, marl and sandstone is placed at the top, of these series and is covered by Neogene continental sediments concordantly.

It has been concluded from the interpretation of the facies studies that there has been a shelf around Haymana, a shelf back in the north, west and south and a shelf front on the southwest of this area. It is also believed that during the Upper Cfetaceous and Lower Tertiary deposition period the Haymana-Polatlı basin emerged with salt lake towards south and made a connection with it and there has been a flysch deposition (Arıkan, 1975). That occurrence is interpreted as emergence of northern and western parts of the region as a result of being filled by sediments.

## DATA ACQUISITION AND PROCESSING

The data acquisition has been done by using split-spread geophone arrengement along the lines total of 426 kilometers long. The data were recorded along these lines by using TI DFS IV recording instrument at 12 fold CDP coverege and are processed at the processing center of MTA by using TIMAP data processor.

Standart normal move out (NMO), constant velocity stack, TV filtering and spike deconvolution have been applied to the data in the processing steps.

The resolution of the data obtained in the middle and on the north side of the project area is good enough for the interpratation, but it is not good in the data obtained on the east, south and southwest sides of the project area as seen on the time-contour map (Fig. 3).

The information obtained from the well, drilled around Eski Polatlı, of 3500 meters depth (Özbudak and Yılmaz, 1980) and velocity determination studied in this well (Eres, 1978) were utilized in the interpretation stage.

## SEISMIC LEVELS

The seismic levels are described below based on stratigraphic correlations as basement reflections, Cretaceous reflections, Eosen reflections and Neogen reflections.

The best seismic reflections correlated in all cross-sections were recorded from Beyobası formations and belongs to Cretaceous reflections. Other reflections decribed are not all continuous and can only be seen on certain seismic sections, in some cases they may be poor quality reflections. Description of seismic levels are as follows:

### Basement reflections

No reflection level was accepted and correlated as a basement reflection in the whole cross-sections. However; some of the strong reflections groups, diveded by faults and suffered of diffractions beneath 2500 m. sec., have been considered as basement reflections. It is possible to correlate the basement with limestone of Upper Jurassic-Lower Cretaceous.

### Cretaceous reflections

The seismic reflections correlated in all cross-sections were recorded from the top of the Beyobası formation. The velocity of the Beyobası formation, considered as a resorvoir formation, (5400 m. sec.) is the same as the velocity obtained for limestone and sandstone in the velocity determination studied in the well drilled in the working area (Eres, 1978).

The velocity of limestone placed at the top of the sequence (about 7000 m. sec.) is greater than that of Kartal formation (5057 m. sec.) as can be seen from sonic log. For this reason, the upper boundary of the Beyobası formation was obtained satisfactorily and time-contour map could be prepared (Fig. 3).

The reflections between the Beyobası formation and Haymana formation underlying under it are not clear because of a transition zone between them. The upper boundary of the Beyobası formation show an ondulation and is divided by faults as it is seen in the cross-sections (Fig. 4, 5, 6). It was concluded that the thickness of this formation does not change very much because the thickness of this formation is 174 meters in the well and is maximum 130 meters in the autcrops (Özbudak and Yılmaz, 1980). An additional work has been done in the south of the working area, in order to search the continuity of the Beyobası formation to the south (Fig. 3). However this was not possible as the quality of the data was not sufficient for the interpretation.

The reflections were seen time to time at the depth of seismic sections where the Haymana formation was to take place were considered as coming from consecutive layers of shale and sandstone (Fig. 4,5,6).

The upper boundary of the Kartal formation overlying the Beyobası formation concordantly has not been observed in some of the seismic sections since it was divided by faults and suffered by diffractions. However; it has been well observed between 180-390 CDP points of 2T line (Fig. 4).

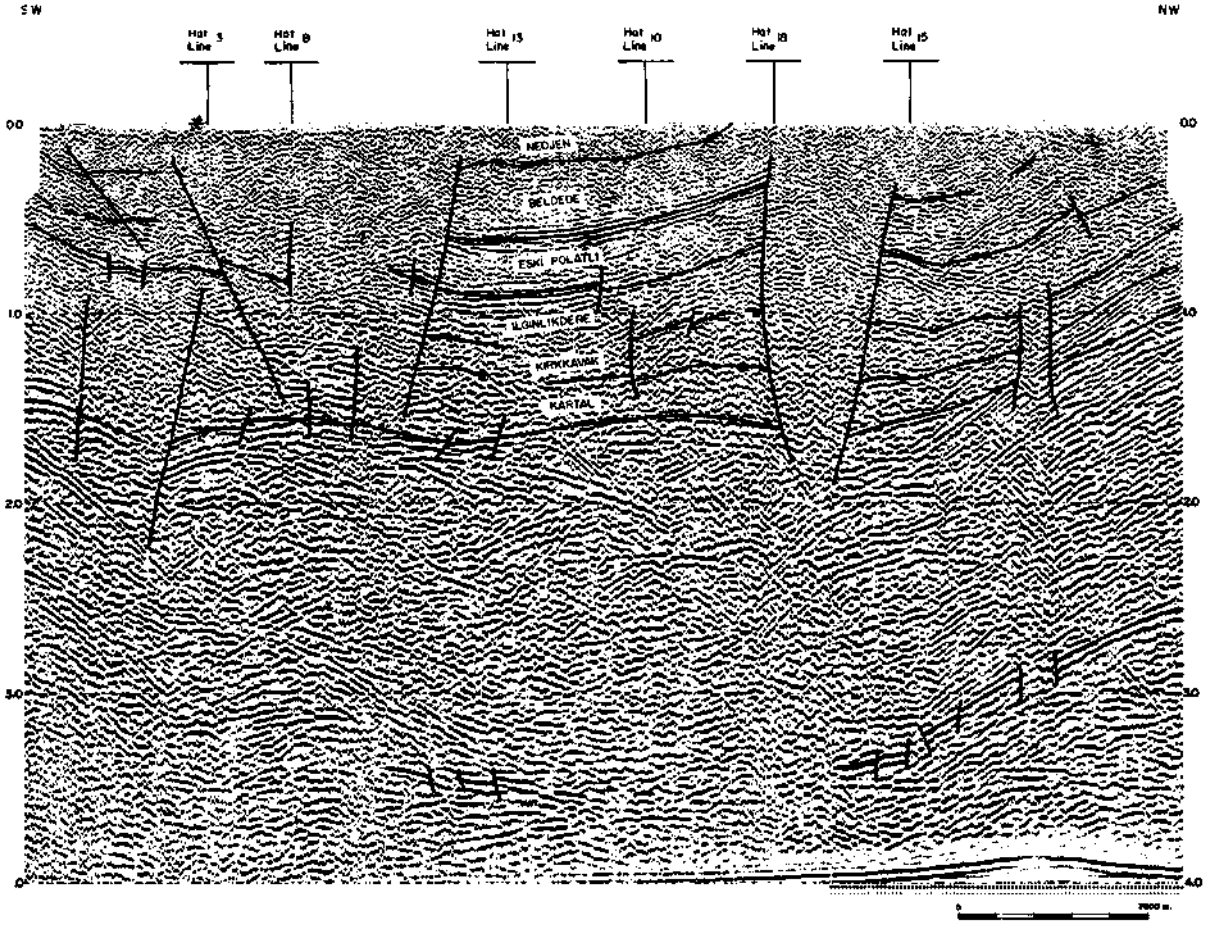


**Fig. 4 - Interpretation of seismic line 2T.**

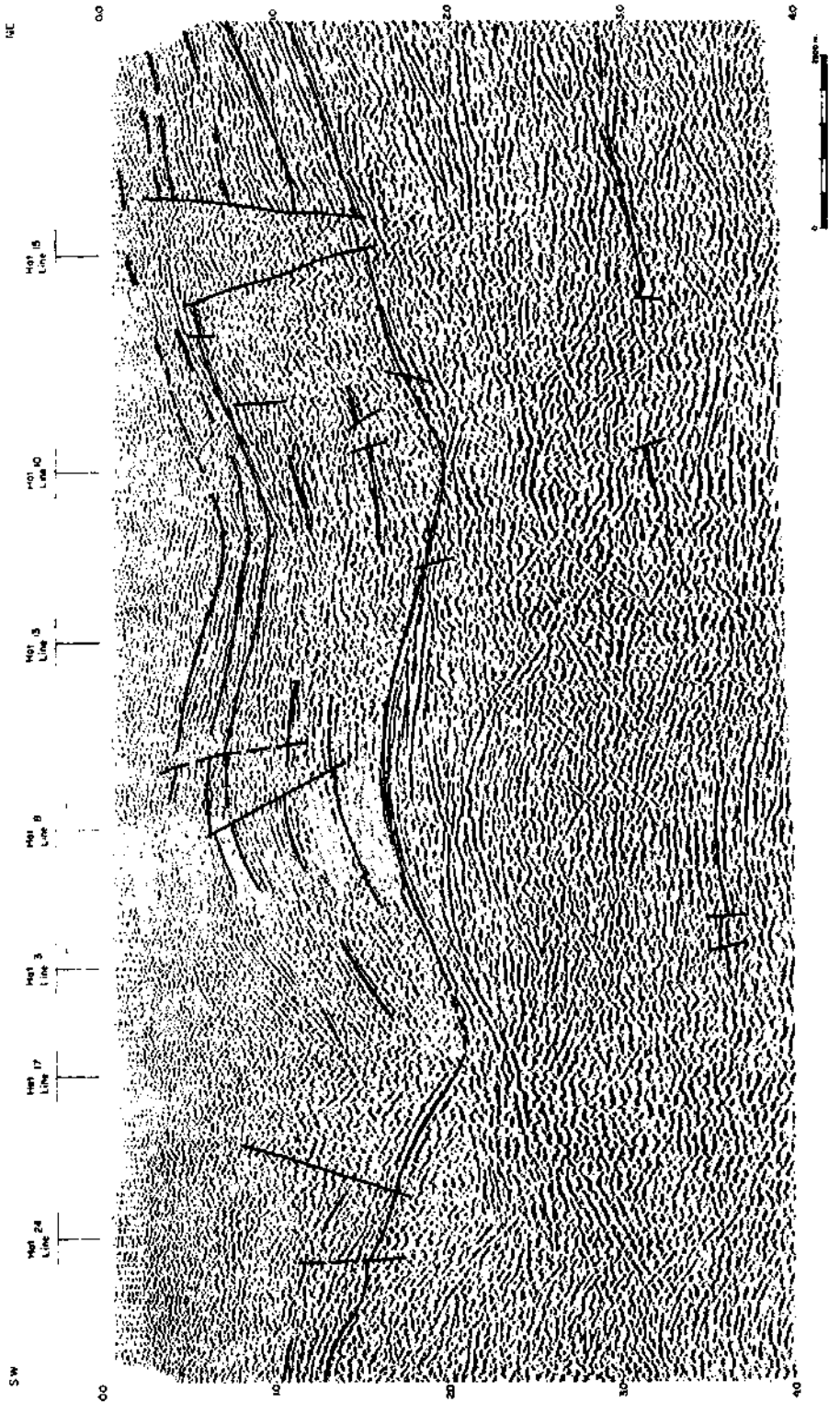


Fig. 5 - Interpretation of seismic line 4.

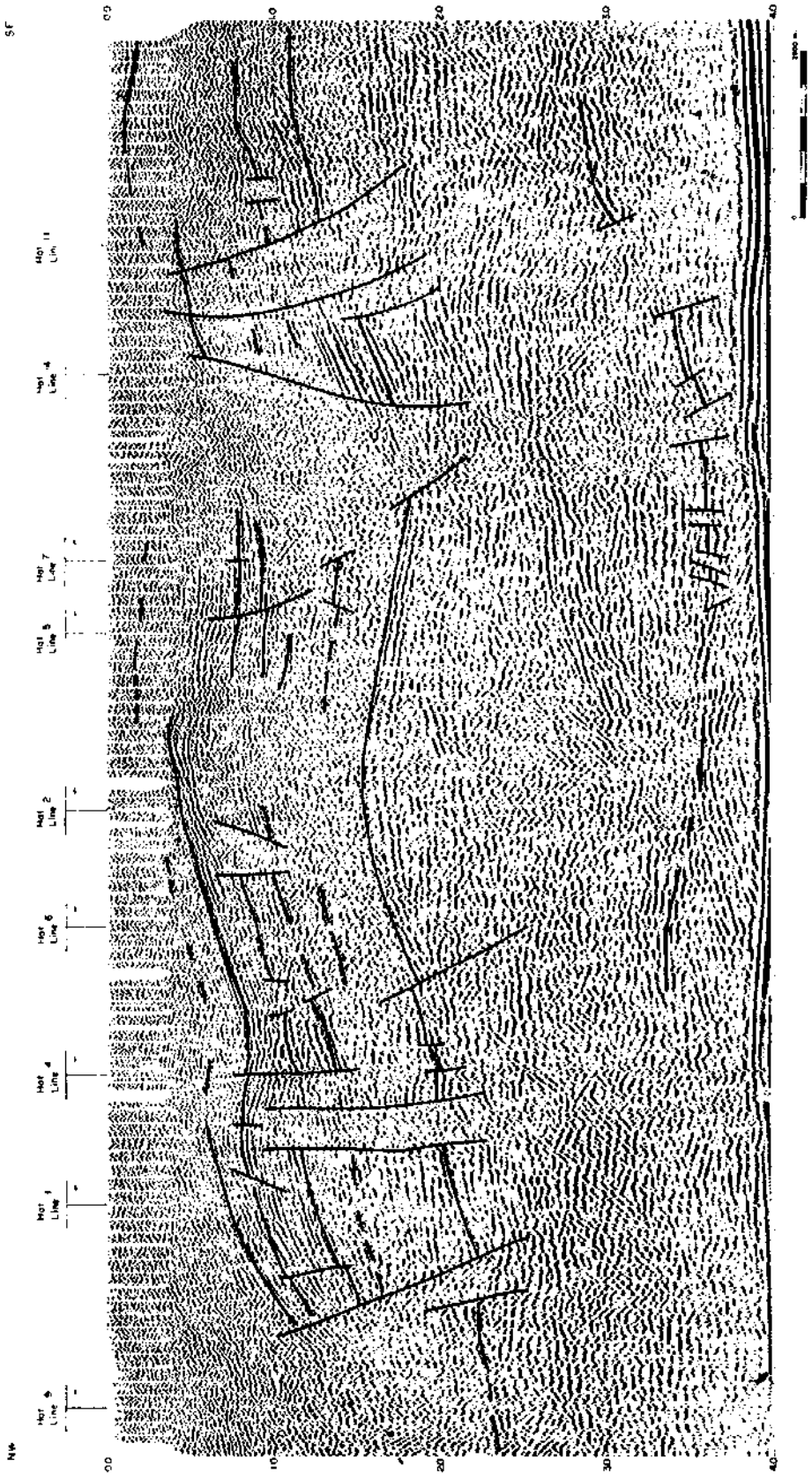


Fig. 6 - Interpretation of seismic line 10.

The seismic reflections which could characterize the lateral transition zones of the Kartal, the Çaldağ and the Yeşildağ formations have not been observed clearly in the sections (Fig. 2).

Although the reflections from the lower boundary of the Kırkkavak formation overlying the Kartal formation are not observed clearly, it is possible to observe them between 240-400 CDP points of line 4 (Fig. 5).

The upper boundary of Ilgınlıkdere formation overlying Kırkkavak formation concordantly gives more prominent reflections (Fig. 4, 5, 6). These rather strong reflections were considered as coming from shale and sandstone bands.

### Eosen reflection

Eski Polatlı and Beldede formations can be distinguished continually in some seismic sections like 4, 10, 27 (Fig. 4, 5, 6). These reflections have the some character with the Ilgınlıkdere reflections but they are more prominent than that of the Ilgınlıkdere reflections.

### Neogen reflections

There is no prominent reflection to identify the Neogen formations with angular disconformitywith the formations beneath it (Fig. 5).

## THE INTERPRETATION OF THE SEISMIC STUDY AND ITS GEOLOGIC RESULTS

The quality of the basement reflections is not good enough for the interpretation and does not allow their correlation in the whole project area. However; the top of some reflection groups at 2400-3600 m. sec., as seen in the seismic sections 2T, 4, 10 lines (Fig. 4, 5, 6) have been accepted as seismic basement.

The seismic basement shows rise towards east in the seismic sections 2T and 4 (Fig. 4, 5) and towards southwest in the seismic section 10 (Fig. 6). No information could be obtained for the south part of the project area because of the poor quality data.

The Beyobası formation, considered as a reservoir formation for its fossilereous sandstone and limestone content, has been observed at most parts of the project area (Fig. 3). As it is seen on the time-contour map, the Beyobası formation is rising towards NW regularly. This rise can be thought to point out to the Kızılcakışla anticline having a strike from the east of Eskiköseler to the 300 th shot point of the line 10 (Fig. 3, 6).

The upper boundary of the Beyobası formation in this anticline takes place at about 1550 m. sec. around the intersection of lines 10, 2T, at 1000 m. sec. in the south of Eski Köseler and makes no closure (Fig. 3).

The rise further to the north can not be followed due to the poor quality of reflections and the absence of seismic lines at this part.

The fault zone located on the east side of this rise seperates the Kızılcakışla anticline from the Eski Polatlı anticline whose strike is in the northeast-northwest direction. The upper boundary of the Beyobası formation rises from 1600 m. sec. to 1100 m. sec. at the Eski Polatlı anticline, and is located in a syncline whose strike is in the east-west direction, in the southwest reaching to 2100 m. sec. with a closure as seen on the time-contour map (Fig. 3). This boundary reaches to 2400 m.see. in the syncline, located in the west-northwest of the working area without closure.

It is necessary to conduct additional seismic studies both for determining the structures mentioned above and for better interpreting the basin located in a very interesting geological setting.

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