Unconventional Potential of the Interior Basins of Turkey, Central Anatolia*

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Abstract

The Tuzgölü Basin is composed of many sub-basins and depression areas. Those sub-basins are separated from each other according to their sedimentation history and lithological differences (Figure 1). Although they are components of a large and unique basin system (Central Anatolian Basin), each of these sub-basins is named separately according to their geographical locations such as Haymana, Tuzgolu and Eregli-Ulukisla Basin. The largest system is surrounded by Aladaglar to the SE, Nigde Massif to the east and Bolkar Mountains to the south. There are many potential unconventional reservoirs in the interior basins of Central Anatolia, Turkey. The Tuzgolu Basin, largest one in the Central Anatolia has three different source rocks that indicate potential for the shale gas and oil: U. Cretaceous Haymana Formation's geochemical properties are in the range as follows: TOC values, 0.06–1.42, S2: 10-430, HI: 1-33. The Tmax indicates its maturity degree: 431-477 °C (Illeez et al., 1993). This formation crops out around the Haymana and it consists of sandstone and shale alternations. Oil-filled channel fills with 1-6 m thickness of turbidite lithology are observed around the Haymana region. The second potential unconventional formation is the Paleocene to L. Eocene Karapinaryaylasi Fm. It is represented by relatively deep marine environment facies and generally composed of turbiditic sandstone-shale alternations. In some places, it contains olistostromes. The Karapinaryaylasi Formation indicates the highest source rock parameters and unconventional potential in comparison with the others. Its thickness ranges from 1,000 to 1,500 m. A wide range of geochemical parameters are also observed depending on its depositional environments; TOC: 0.01-12.61%; S1+S2: 10-12020; Tmax: 239-544 °C (Illeez et al., 1991). The third potential unconventional formation is the Mio-Pliocene Cihanbeyli Fm (Katrandedetepe member) deposited in a lacustrine environment. This formation contains very good to excellent source rock potential bituminous shales.

Introduction

The Tuzgölü Basin is composed of many sub-basins and depression areas. Those sub-basins are separated from each other according to their sedimentation history and lithological differences (Figure 1). Although they are components of a large and unique basin system (Central Anatolian Basin), each of these sub-basins is named separately according to their geographical locations such as Haymana, Tuzgolu and Eregli-Ulukışla Basin. The largest system is surrounded by Aladaglar to the SE, Nigde Massif to the east and Bolkar Mountains to the south.

Discussion

The Tuzgölü Basin developed during the Late Senonian - Oligocene. Over 10,000 meters of sediments, representing a complete sedimentary cycle, accumulated in the deepest part of the basin. Subsidence occurred during the Upper Senonian - Early Eocene, followed by regression that started in the Late Eocene and lasted until the end of Oligocene. During the Late Senonian - Early Eocene, the Tuzgölü Basin formed as a unique, continuous depression with the Haymana area to the northwest. After the deposition of the Middle Eocene nummulitic limestone, the Tuzgölü Basin was separated from the uplifted Haymana basin by a fault zone along the eastern side of the Karacadağ uplift to the north of the Lake Tuzgölü. It was connected with the Çankırı Basin further to the north-northeast during the Paleocene and this interrelation was followed throughout the Middle Eocene-Oligocene, at which time the Tuzgölü area became a graben bounded by major NW-SE trending fault zones. After the main deformation in late Oligocene or Miocene times, local depressions or sub-basins were formed during the Neogene allowing deposition of variable thicknesses of volcanic and continental sediments, including lacustrine limestones (Cemen et al., 1998). The Tuzgölü Basin was slightly affected by the late Alpine movements during the Pliocene. Tensional movements took place during the Neogene and continued into the Pleistocene, leading to volcanic activity that extended into very recent historical times.

Unconventional Reservoirs

There are many potential unconventional reservoirs in the interior basins of Central Anatolia, Turkey. The Tuzgolu Basin, largest one in the Central Anatolia (Figure 2) has three different source rocks that indicate potential for the shale gas and oil: U. Cretaceous Haymana Formation's geochemical properties are in the range as follows: TOC values 0.06-1.42, S2: 10-430, HI: 1-33. The Tmax indicates its maturity degree: 431-477 °C (Illeez et al., 1993). This formation crops out around the Haymana (Figure 2) and it consists of sandstone and shale alternations. Oil-filled channel fills with 1-6 m thickness of turbidite lithology are observed around the Haymana region (Figure 3). The second potential unconventional formation is Paleocene to L. Eocene Karapinaryaylasi Fm (Figure 2). It is represented by relatively deep marine environment facies and generally composed of turbiditic sandstone-shale alternations (Figure 4). In some places, it contains olistostromes. The Karapinaryaylasi Formation indicates highest source rock parameters and unconventional potential in comparison with the others. Its thickness is about 1000 - 1500 m. All geochemical parameters are also observed in a wide variety depending on its depositional environments; TOC: 0.01 - 12.61%; S1+S2: 10 - 12020; Tmax: 239 – 544 °C (Illeez et al., 1991). The third potential unconventional formation is the Mio-Pliocene Cihanbeyli Formation (Katrandedetepe member) deposited in the lacustrine environment (Figure 5). This formation contains very good to excellent source rock potential bituminous shales.

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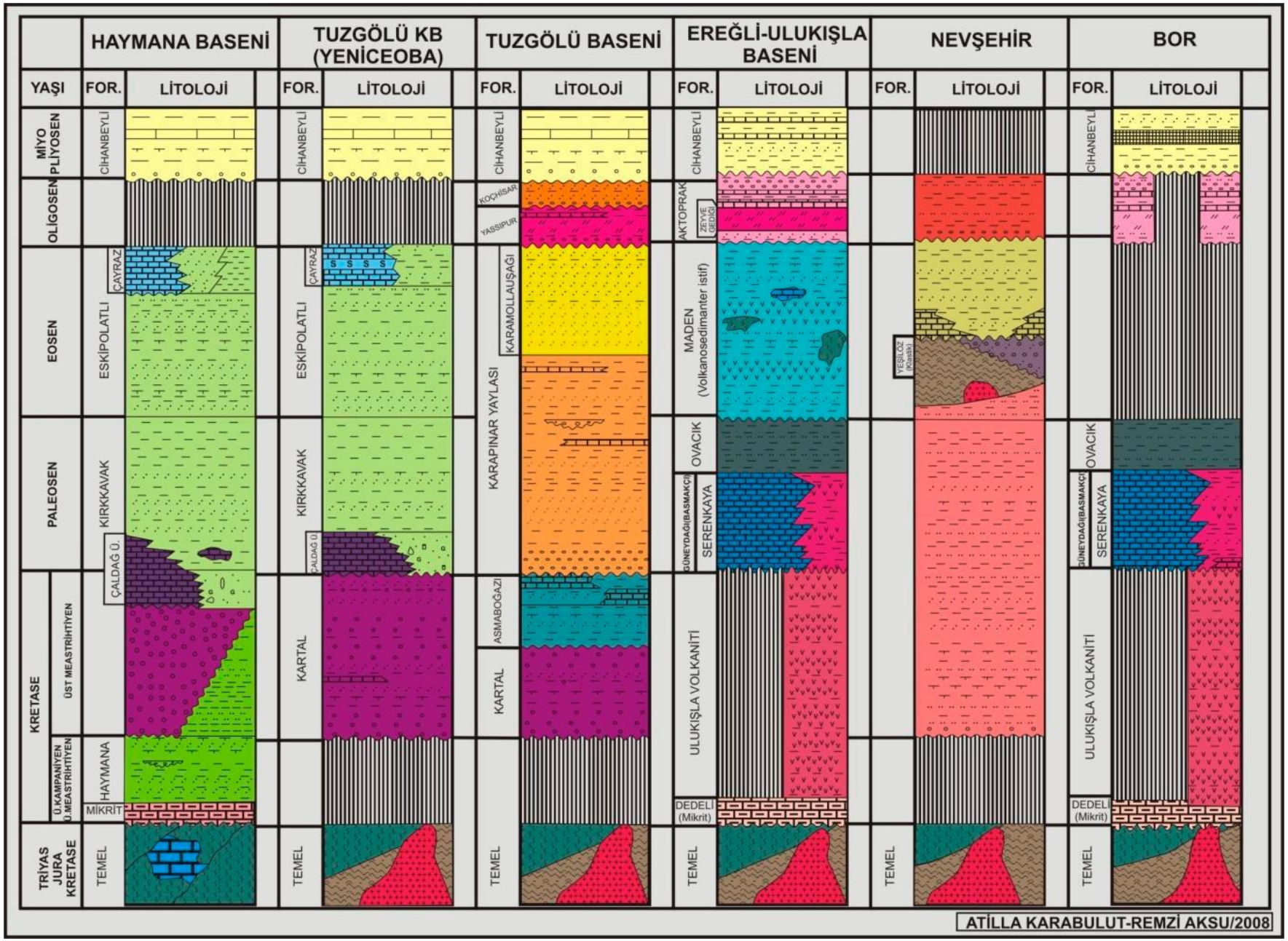

Figure 1. Generalized horizontal geological cross-sections of Tuzgölü and adjacent basins.

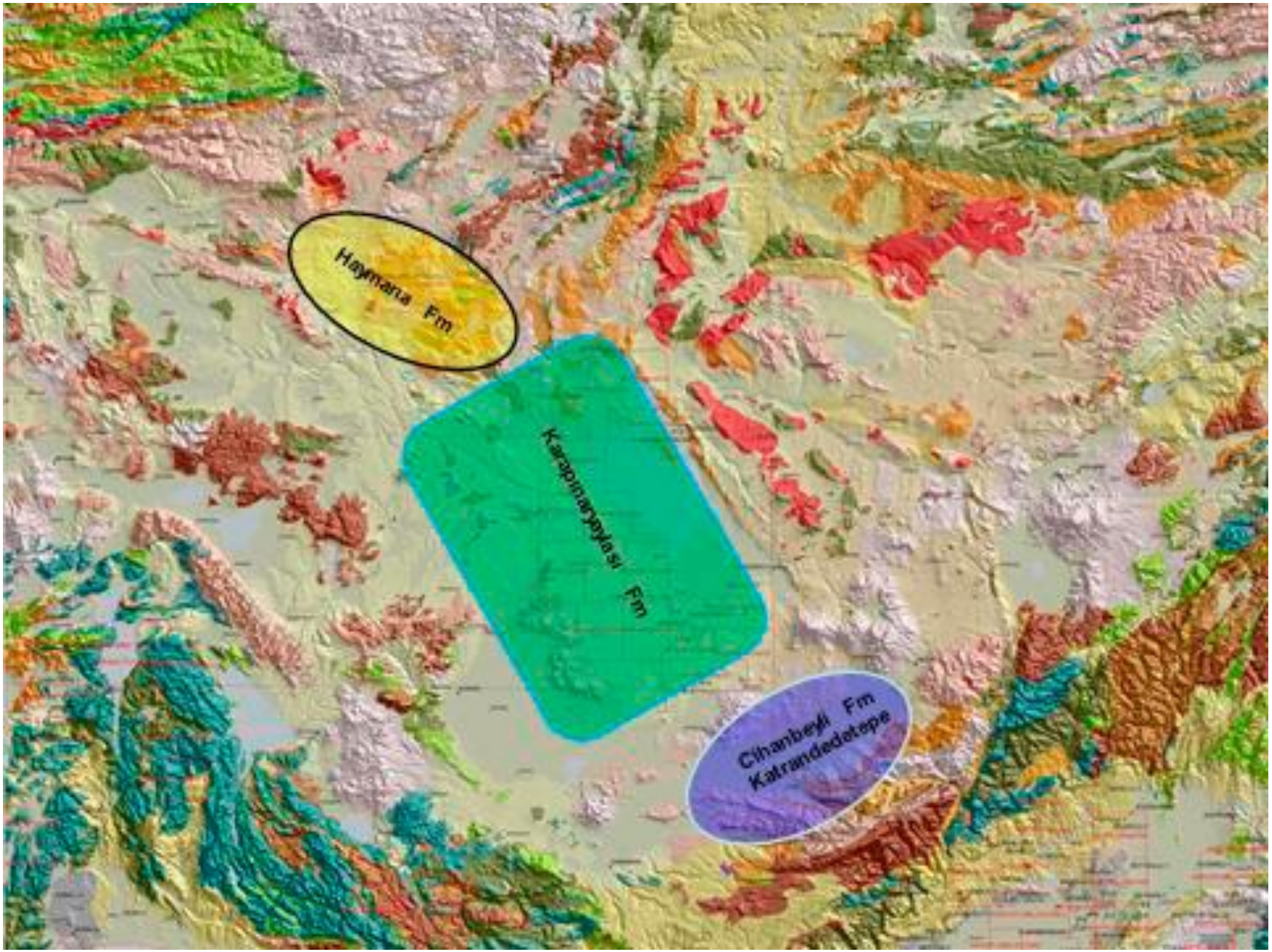

Figure 2. Topographical and geological map of Interior Basin.

Figure 3. General view of the oil-filled sandstones of U. Cretaceous Haymana Fm.

Figure 4. General view of the relatively deep marine deposits that are composed of turbiditic sandstones and shales of Paleocene to L. Eocene Karapinaryaylasi Fm.

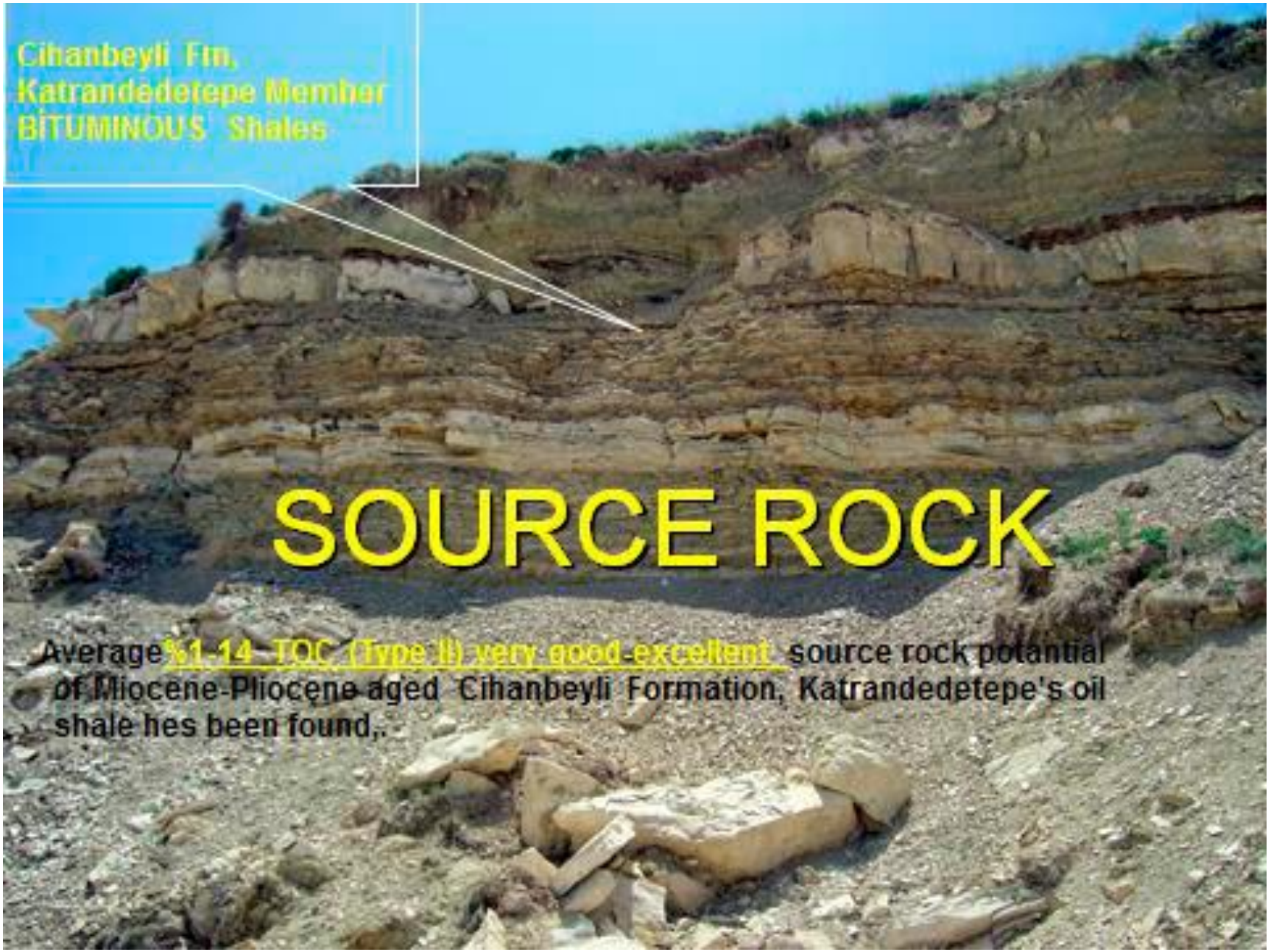

Figure 5. General view of the bituminous shales of Mio-Pliocene Cihanbeyli Fm (Katrandedetepe Member).