

**LATE PALEOZOIC EVOLUTION OF THE
KÜTAHYA - BOLKARDAĞ BELT**

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INTRODUCTION

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Abstract. In the Kütahya-Bolkardağ belt, the lowermost visible unit is Silurian-Devonian Bozdağ Limestones. These carbonates, which reflect shelf environment are cut by diabase dykes. The Halıcı Group, which overlies these rocks with angular unconformity, is composed of a sheared matrix of chert, shale, siltstone, graywacke, pebblestone and limestone alternation in which the Silurian, Devonian and Carboniferous blocks and the volcanic and volcanoclastic rocks such as trachyte, trachydacite and rhyodacite are involved. The Halıcı Group is of Carboniferous age and due to its structural setting and content of the volcanics, blocks and turbidites it has back-arc basin character. The Upper Permian Eldeş Formation rests paraconformably on the Halıcı Group. The post-tectonic cover units, which are composed mainly of shelf carbonate start with Scythian Clastics on the Hercinian basement with an angular unconformity and continue up to Maastrichtian. In the Late Maastrichtian-Early Paleocene period, the units reflecting the closure of Neo-Tethys are observed.

I. INTRODUCTION

The belt situated in between west of Kütahya and Bolkar Mountains displays different stratigraphic and metamorphic features than the surrounding tectono-stratigraphic units (Fig. 1). As a result of the field studies between 1982-1986, a detailed map of the belt has been prepared, the structural features and the stratigraphy of the region have been brought under discussion by Özcan et al. [1, 2].

In this paper, mainly the lithology of the Upper Paleozoic units exposed along the belt here will be described, and their geological evolution will be discussed.

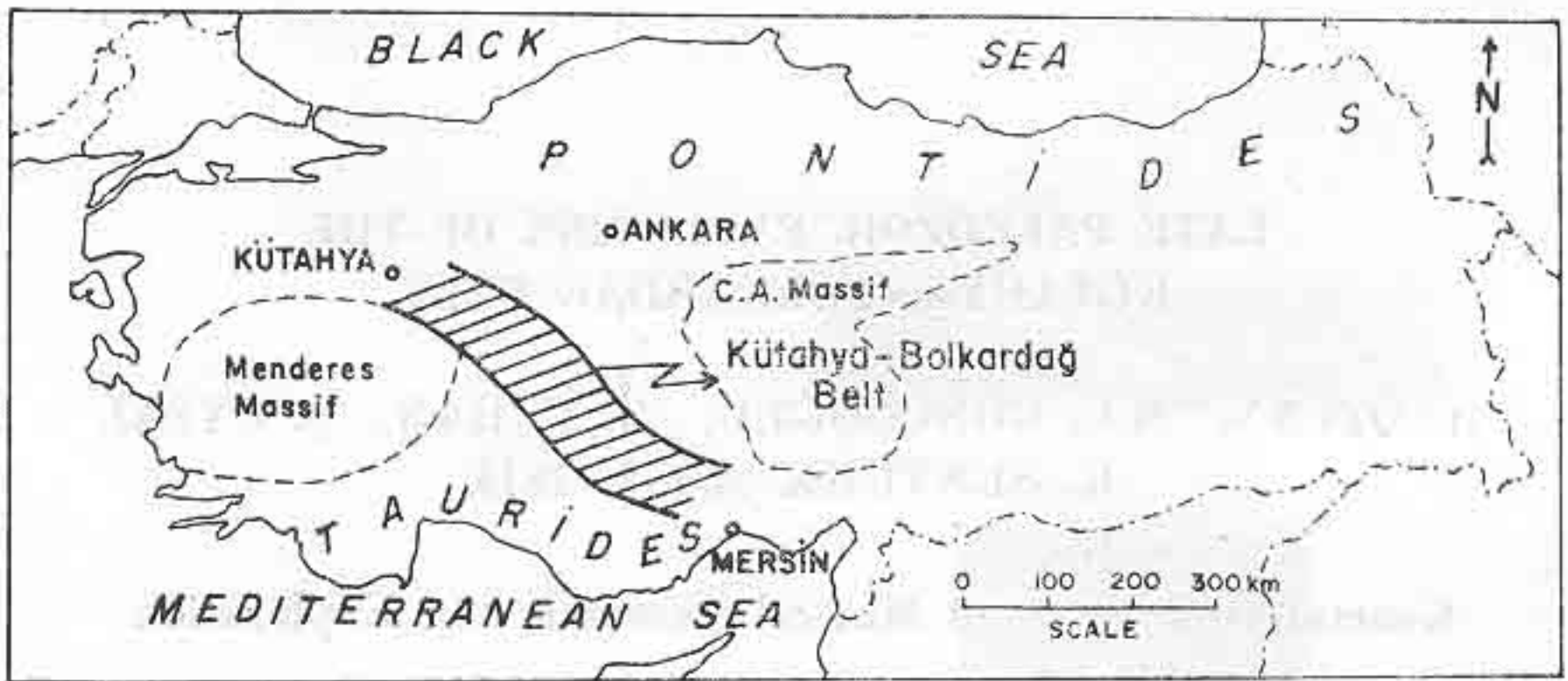


Figure 1. Location map of the investigated area

Niehoff [3], in one of the earliest mapping studies in the region, states that the lowest unit, which consists of metaclastic rocks including submarine lavas, is Devonian in age. He adds that these rocks, which he describes as the Na-keratophyre-spilite and quartz porphyry, are "Paleozoic ophiolite" overlain by the Upper Carboniferous-Lower Permian calcschists and marbles. Kaaden [4] suggests that the Paleozoic units in the north of Konya represents the geosynclinal sediments undergone glaucophanic greenschist metamorphism.

Wiesner [5] who studied around Sızma region, states that the extrusive rocks in the region must be post-Permian andesiteporphyrite. The same rocks were described as the metatrachyte (metaporphyrite) by Bayiç [6].

According to Pehlivan [7], the sequence, exposed around Konya, start with the schist and carbonates of Middle-Upper Devonian age, at the top, these units are unconformably overlain by the Lower-Middle Carboniferous metaclastics and carbonates.

In regional studies, Kütahya-Bolkardağ belt is shown to have situated between Anatolides and Taurides [8]. Özgül [9] assumes it is included in the Bolkardağ unit. On the other hand, Okay [10] calls it Afyon-Bolkardağ zone and refers to the stratigraphy identified by previous researchers.

Şengör and Yılmaz [11] and Şengör et al. [12, 13] suggest that some important events took place in the study region and its neighbourhood during Late Paleozoic-Early Mesozoic period. These are the

closure of a Hercynian ocean whose remnants can be seen to the north of Menderes Massif, opening of the Karakaya marginal basin, initial opening of the Pamphilia basin and opening of the various branches of Neotethys. Studying and dating the records of these events in different tectonic units exposed in the Kütahya-Bolkardağ zone of 300 km, will shed light and contribute to the regional geodynamic synthesis.

II. STRATIGRAPHY

In the Kütahya-Bolkardağ belt, there is a sequence which has undergone an intense polyphase deformation and metamorphism (Fig. 2). The lowest visible section of this sequence is the Bozdağ Limestone of late Silurian-Devonian age which exposes to the north of Konya. The Carboniferous Halıcı Group overlies the Bozdağ Limestone with an angular unconformity, and is overlain by the Eldeş Formation of Permian age with paraconformity.

Post-tectonic Ardıçlı Formation is of Scythian age and overlies the above mentioned units with angular unconformity. The Loras Formation of Anisian-Upper Jurassic age is represented by a regular carbonate sedimentation. Lower Cretaceous-Campanian Midos Formation indicates a pelagic environment. The Hatip mélange of Maastrichtian-Early Paleocene age forms the uppermost section of the same sequence.

Bozdağ Limestone

The lower sections of the Bozdağ Limestone is recrystallized, massive in appearance, beige-light gray in color. Rare algae, gastropoda and coral fossils can be seen in its lower levels. Medium bedded, light gray-pinkish, fine grained, locally banded recrystallized limestone is widespread towards the upper sections of the formation. The uppermost section of the unit is medium to thick bedded, dark gray-bluish, locally brecciated dolomitic limestone. Around Konya, it is cut by diabase dykes.

To the north of Konya, Wiesner [5], depending on the *Orthoceras* sp., *Murchisonia* sp. and conodont findings, stated that the age of the Bozdağ Limestone is Silurian-Early Devonian. Pehlivan [7] proposes that, depending on the conodont findings, it is Middle-Late Silurian in age. Fossil content of the unit shows that it was sedimented in a restricted shelf.

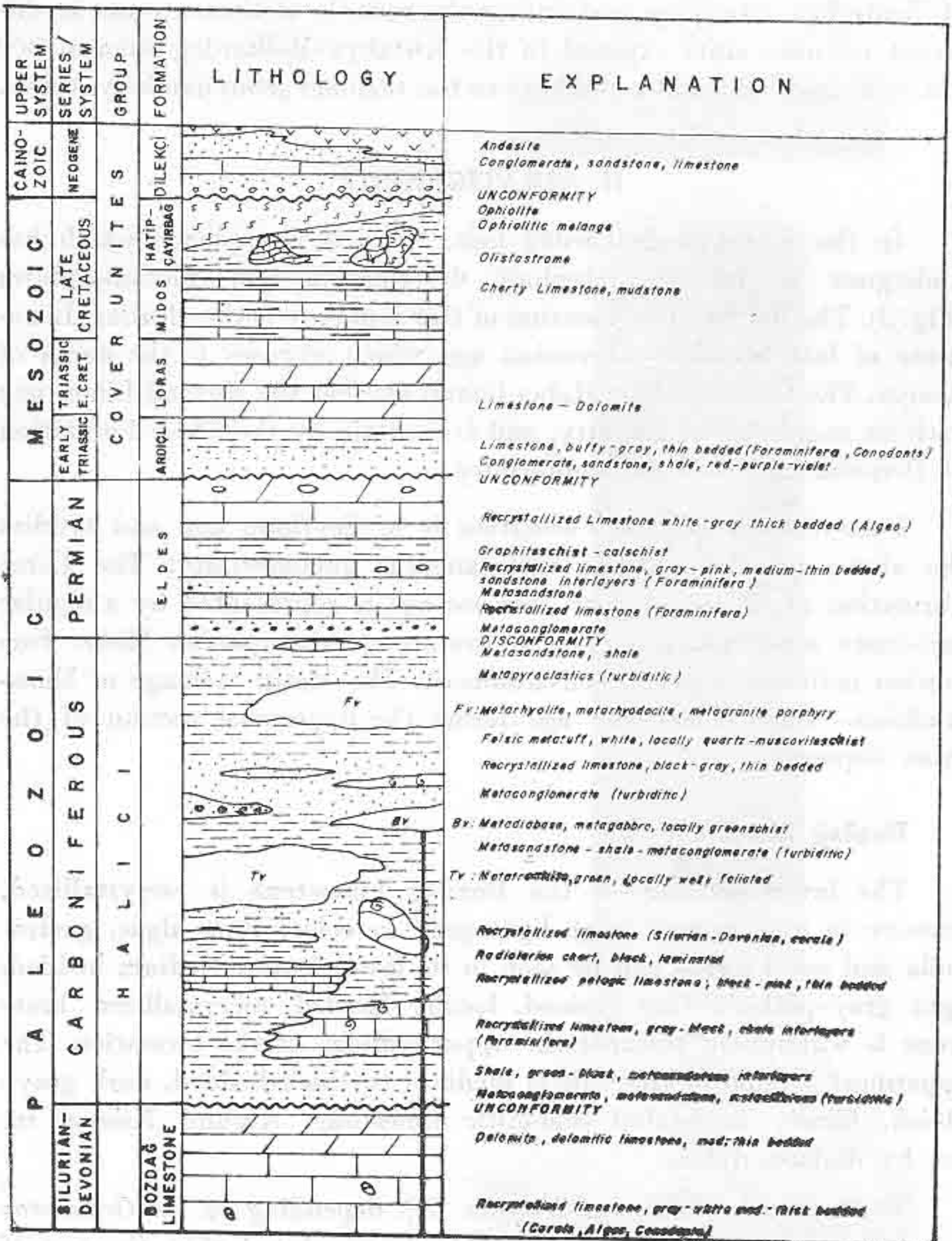


Figure 2. Sketch columnar section of the Kütahya - Bolkardağ belt.

Halıcı Group

The Carboniferous metaclastics, metavolcanics and their blocks are called Halıcı Group, which extends from the north of Kütahya to the south of Konya. Sedimentary rocks of the unit are metasandstone, metasiltstone, metapebblestone, metaclaystone, black chert with rare radiolaria and recrystallized limestone. It is generally thick to medium bedded, dark gray and greenish gray in color. In coarse-grained clastics turbiditic feature is clearly seen. Also, they include locally dense, synchronous acid volcanic grains.

Volcanic rocks are acidic rocks such as metarhyolite, metarhyodacite and metagranite porphyry and basic rocks such as metatrachytic rocks, metadiabase and metagabbro. Acidic rocks mostly occur as tuff, pyroclastics and quartz porphyry dykes. Trachytic rocks are green in color, containing coarse feldspar crystals and foliated. They are composed of tuff and lavas. Basic ones are formed by diabasic, micro-gabbroic sill and dykes. They are green in color, unfoliated and mostly silicified. Basic volcanic rocks cut up to Permian rocks. Especially, in the Lower Paleozoic carbonate rocks the dyke system is clearly seen.

In volcanic rocks, in which deformation is high, new mineral occurrences and schistosity are observable according to the rock types. Metaacidic ones have transformed into chloritoid schists, trachytic ones have transformed into stilpnomelane-riebeckite schists and basic ones have transformed into riebeckite-bearing greenschists.

Blocks are made up of different types of limestone. Some of them are Silurian-Devonian but some other are of the same age with the matrix. The last group is easily identified by the presence of abundant crinoid. Some blocks, which may be considered Early Paleozoic, are in massive appearance, devoid of fossil, and are sucrose-textured. The fine-grained, medium bedded limestone blocks, which contain abundant corals such as *Thamnopora reticulata* (De Blainville) and *Amphipora ramosa* (Phillips), are of Devonian age. On the other hand the blocks of Bozdağ limestone can frequently be seen in the unit.

The Halıcı Group overlies Bozdağ Limestone with an angular unconformity, which can be seen near Ardıçlı and Yükselen Villages to the north of Konya. Halıcı Group is overlain by Permian coarse-clastics with paraconformity. Also Scythian red sandstones overlie the unit with angular unconformity.

In the samples, taken from the thin bedded limestones interbedded with metaclastic, the following fossils are identified, and therefore it is dated as Viscaen: *Endothyra* sp., *Pseudostafella* sp. and *Mediocris* sp.

Eldes Formation

This formation is widespread all along the Kütahya–Konya belt and contains abundant fossils. It is clearly observed to the north of Ilgın and to the south of Eldes Village. Also, it resembles the Carboniferous rocks all along the belt.

It, generally, is a succession of quartzite, sandstone, limestone and shale. In the lower sections clastics, whereas in the upper sections carbonates are dominant. Quartzites are the most widespread element of the unit. They are laminated, cross laminated, thin to medium bedded, reddish–brown and dark gray in color. Sandstones are medium bedded, reddish in color and are intercalated with siltstone, sandstone and pebblestone. Clasts are volcanic in the origin. Worm traces and flow structures can be seen. Shales are thin bedded, purple–reddish in color and flaky.

Limestones are thin to medium and thick bedded, recrystallized, black, light gray, yellowish and greenish in color. In the upper levels, the dolomitic limestones and dolomitization are laterally and vertically transitive.

This formation has undergone low grade metamorphism, and overlies the Carboniferous units with paraconformity. It contains abundant fossils, such as *Kahlarina* sp., *Glomospira* sp., *Globivalvulina* sp., *Hemigordius* sp., *Nankinella* sp., *Stafella* sp., *Pseudofusulina* sp., *Parafusulina* sp., and *Pseudoschwagerina* sp., According to these rich fossil content, early Permian and early Upper Permian ages were assigned to the Eldes Formation.

Mesozoic Rocks

In the following paragraphs, the units, which present a continuous sequence from Scythian to Maastrichtian and overlie the Hercynian basement as a post–tectonic formation, will be discussed. They have undergone intense deformation and metamorphism of the alpine events. The Mesozoic rocks are divided into four formations: [1] Ardıçlı Formation; [2] Loras Formation; [3] Midos Formation, and [4] Hatip ophiolitic mélange.

Ardıçlı Formation

It is generally made of clastics. In the upper levels, it contains limestone intercalations and lenses. Clastics are mostly reddish, purplish metasandstones and metapebblestones. Pebblestones are mostly quartzitic. This formation is of Scythian age and is gradually transitive to the Loras Formation in the upper contact.

Loras Formation

It is made up of recrystallized limestones, which are laterally transitive with dolomitic limestones and dolostones. It is of Anisian–Upper Jurassic age and gradually transitive to the overlying Midos Formation.

Midos Formation

It is made up of cherty limestone, turbiditic sandstone, limestone and semi pelagic limestone. The Lower Cretaceous–Campanian formation is gradually transitive to the overlying unit.

Hatip Ophiolitic Melange

Its lower sections displays a regular sequence character. Upwards, it gains olistostome and melange character. It is of Maastrichtian–Early Paleocene age and overlain by the peridotite nappe.

III. CONCLUSIONS

As a result of the studies carried out along the Kütahya–Bolkardağ belt, the following conclusions are obtained: (1) In the stratigraphic column, depending on the fossil findings, it is shown that the lowermost unit of the sequence is Silurian–Devonian Bozdağ Limestone, which characterizes the Early Paleozoic shelf sediments; (2) The Carboniferous Halıcı Group overlies Bozdağ Limestone with an angular conformity. It is the product of a Carboniferous basin and made up of the alkaline volcanics, turbiditic sequences and shelf-derived carbonate blocks. Considering both the above data, lack of the ophiolitic material and its position to Paleozoic Toros platform, it is proposed that a back-arc basin was developed in the Kütahya–Bolkardağ belt during Carboniferous. The opening of this basin is characterized by the basic volcanics, which intruded the Bozdağ Limestone; (3) This assumption

indicates that the Hercynide area of Şengör [14], extends further to the east; (4) The late tectonic Eldeş Formation (Permian) characterized by carbonates and clastics, paraconformably overlies the Halıcı Group; (5) The Scythian Ardıçlı Formation overlies the Hercynian basement with an angular unconformity. All along the belt, during the Anisian–Maastrichtian period, a continuous carbonate sequence was deposited; (6) The lack of major stratigraphic breaks, and the sedimentological data indicate that the Kütahya–Bolkardağ Belt was not effected by the Cimmerian Orogeny during the Early Mesozoic period [14] (7) It is further determined that the region, which had a platform character between Scythian and Upper Jurassic, started to be broken up and collapsed since Early Cretaceous, and later on, it became a deep marine basin filled by the Upper Maastrichtian–Paleocene olistostrome [1].

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ÖZET

KÜTAHYA - BOLKARDAĞ KUŞAĞININ GEÇ PALEOZOYİK EVRİMİ

İçbatı Anadolu'da Kütahyadan Bolkardağı doğusuna kadar uzanan kesimde yer alan kayalar gerek istiflenme gerekse metamorfizmaları açısından çevredeki ana jeolojik birimlerden farklı özellikler sunmaktadır. Bu farklılığa dayanarak sözkonusu alan Kütahya–Bolkardağı Kuşağı olarak adlandırılmış ve 1/25 000 ölçeğinde haritalanmıştır.

Haritalanan alanda yüzeyleyen en alt birim Siluriyen–Devoniyen yaşlı Bozdağ Kireçtaşıdır. Alg, mercan ve gastropod içeren, orta–kalın tabakalı ve yer yer dolomitleşmiş olan kireçtaşı çalışma alanı güneyinde ileri derecede rekristalizasyon gösterir ve yoğun biçimde diyabaz daykları ile kesilmiştir. Fosil kapsamı ve çökelim koşulları gözönüne alınarak birimin şelf ortamını karakterize ettiği düşünülmelidir.

Karbonifer yaşlı Halıcı Grubu Bozdağ kireçtaşı üzerinde aşıl uyumsuzlukla yer alır. Bu birim; makaslanmış, pelajik aratabakalı türbiditik çökeller ve olistostromal bölümler yanında Paleozoyik yaşlı

neritik ve pelajik kireçtaşı blokları ile bazik ve felsik volkanitleri içerir. Makaslanmanın yoğun olduğu kesimlerde kloritoyit şist ve stilpnomelan-ribekit şist gelişimine rastlanır.

Eldes Formasyonu Halıcı Grubu üzerinde uyumsuzlukla yer alır. Alt bölümü kırıntılılarla, üst bölümü ise kireçtaşı ve dolomitik kireçtaşı ile temsil edilen birime fosil içeriği dikkate alınarak Alt Permiyen ve erken Üst Permiyen yaşı verilmiştir.

Bozdağ kireçtaşı, Halıcı Grubu ve Eldes Formasyonundan oluşan bölüm Kütahya-Bolkardağı Kuşağının Hersiniyen temeli olarak tanımlanmış ve Üst Paleozoyikteki evrimini yayardı bir havzada tamamladığı öne sürülmüştür.

Olasılı Permiyen sonunda sıkışarak kıvrımlı ve dilimli bir yapı kazanan Hersiniyen temel üzerinde Sikitiyen gel-git ortamı çökelleri (Ardıçlı Formasyonu) açısız uyumsuz olarak yer alır. Anisiyen-Üst Jura karbonatları ve dolomitleri (Loras Formasyonu) bu kırıntılı istif ile geçişlidir ve stratigrafik boşluk içermiyen bir şelf ortamını yansıtır. Çörtlü kireçtaşı, pelajik kireçtaşı ve türbidit çökellerinden oluşan en üst birim (Midos Formasyonu) Alt Kretase-Kampaniyen arasında çalışma alanının derinleştiğine işaret eder. Çalışma alanında Maastrihtiyen-Alt Paleosen dönemi olistostromal nitelikli Hatip ofiyolitik melanji ile temsil edilmektedir.

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