

IV. INTERNATIONAL HALICH CONGRESS  
ON MULTIDISCIPLINARY SCIENTIFIC  
RESEARCH

August 4-5, 2022 / Istanbul, Turkey

# THE PROCEEDINGS BOOK

Edited by

Dr. Mustafa Sarper ALAP

Gulnaz GAFUROVA

---

ISBN: 978-625-8323-92-4

**ALADAĞ (KONYA) YÜKSELTİSİNİN JEOLJİK ÖZELLİKLERİ**  
THE GEOLOGICAL FEATURES OF THE ALADAĞ MOUNTAINS (KONYA)

**Berkant COŞKUNER**

Arş. Grv., Konya Teknik Üniversitesi, Mühendislik ve Doğa Bilimleri Fakültesi, Jeoloji  
Mühendisliği Bölümü, KONYA

**Yaşar EREN**

Prof. Dr., Konya Teknik Üniversitesi, Mühendislik ve Doğa Bilimleri Fakültesi, Jeoloji  
Mühendisliği Bölümü, KONYA

**ÖZET**

Bu çalışmada Aladağ (Konya) çevresinde yüzeyleyen Geç Paleozoyik - Mezozoyik yaşlı kayaçların jeolojik özelliklerinin incelenmesi amaçlanmıştır. İnceleme alanında Permian'den günümüze kadar oluşmuş değişik kökenli kayaçlar yüzeylemektedir. Orta - Geç Permian yaşlı düşük dereceli metamorfizmaya uğramış mermer – dolomit mermer, fillit, grafit fillit ve beyaz renkli metakuvarsit ardalanmasından oluşan Derbent Formasyonu inceleme alanı içerisindeki en yaşlı birimi oluşturmaktadır. Birim üzerine uyumlu olarak Triyas yaşlı düşük dereceli metamorfizmaya uğramış kireçtaşı, şeyl, kuvarsit ve kumtaşı ardalanmasından oluşan Aladağ Formasyonu gelmektedir. Aladağ Formasyonu üstte, koyu gri renkli düşük dereceli metamorfizmaya uğramış dolomit, dolomitik kireçtaşından oluşan Geç Triyas - Erken Jura yaşlı Kızılören Formasyonu tarafından uyumlu bir şekilde örtülmektedir. Kızılören Formasyonu gri, açık gri, beyaz renkli kristalize kireçtaşından oluşan Triyas – Kretase yaşlı Lorasdağ Formasyonu ile yanall düşey geçişe sahiptir. Yukarıda değinilen tüm birimler Miyosen yaşlı birimler ve Kuvaterner yaşlı alüvyonlar tarafından uyumsuz olarak örtülmektedir. İnceleme alanındaki Paleozoyik - Mezozoyik yaşlı kayaçlar Miyosen öncesindeki orojenik hareketlerle deformasyona uğrayarak kıvrımlı ve klivajlı yapılar kazanmışlardır. Ayrıntılı mesoskopik yapısal analizlere dayanan incelemelerde Paleozoyik – Mezozoyik yaşlı birimlerin çokevrelili deformasyona uğrayarak Tip 1 ve Tip 3 türü kıvrımlanmış kıvrım yapıları kazandıkları tespit edilmiştir. Yine Alpin olaylarla, bölgesel ölçekli klivajlar gelişmiş ve inceleme alanındaki birimler düşük dereceli metamorfizmaya uğramıştır.

**Anahtar Kelimeler:** Derbent, Aladağ, Çok Evrelili Deformasyon, Alpin Orojenezisi.

**ABSTRACT**

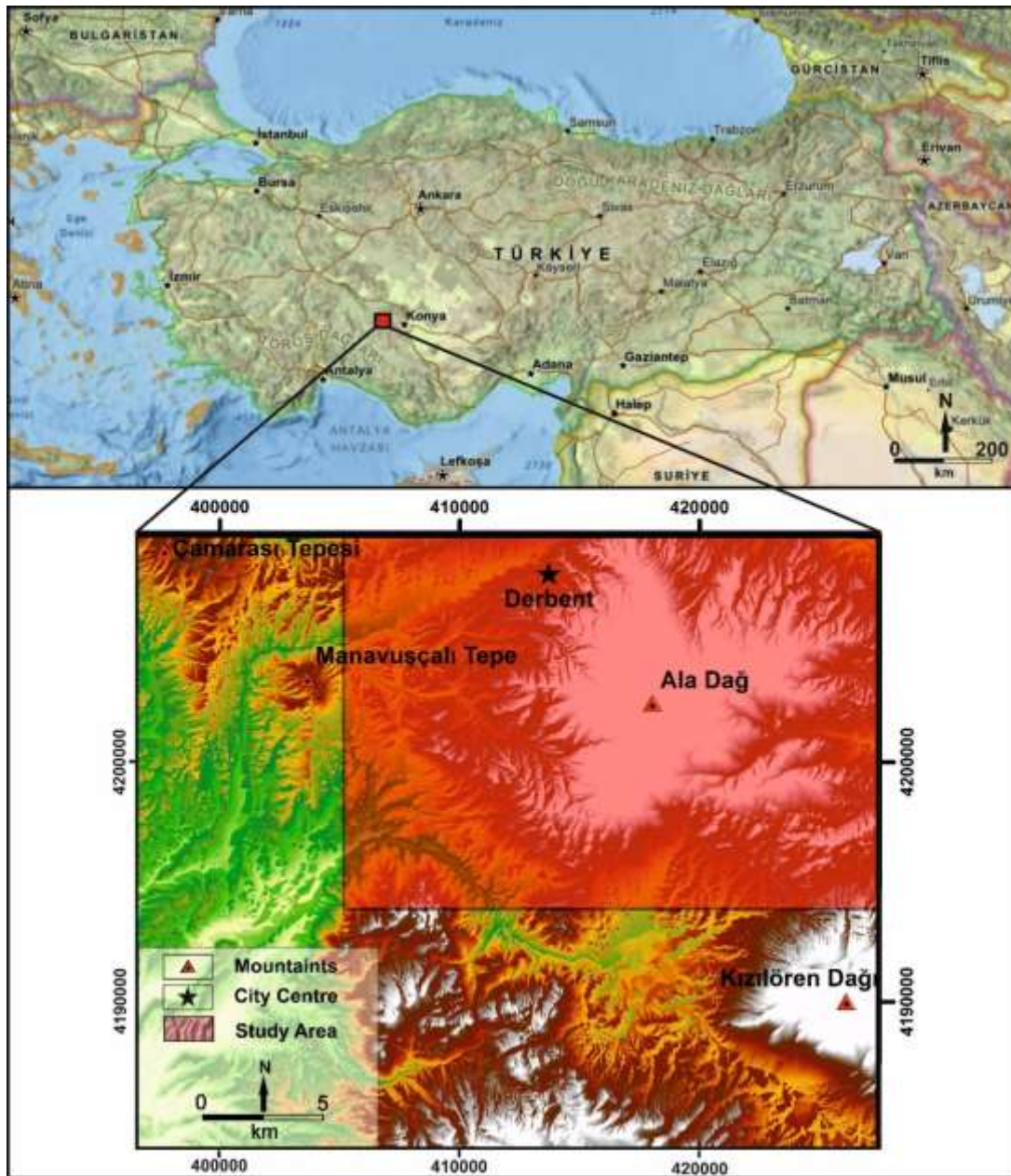
This study aimed to explain the geological features of late Paleozoic–Mesozoic aged rocks around the Aladağ (Konya) area. In the study area, rocks of different origin, ranging in age from Permian to the present, crop out. The oldest rock outcropping in the area is the middle – late Permian Derbent Formation that is low-grade metamorphosed marble-dolomite marble, phyllite, graphite phyllite, and quartzite intercalation. The Derbent Formation is unconformably overlain by Triassic Aladağ Formation consisting of low grade metamorphosed limestone, shale, quartzite and sandstone. The late Triassic, early Jurassic low grade metamorphosed dark grey coloured dolomite and dolomitic limestone of the Kızılören Formation conformably overlies Aladağ Formation. The Kızılören Formation has a lateral and vertical transition with the Triassic – Cretaceous Lorasdağ Formation consisting of gray, light gray and white colored crystallized limestone and marble. The above mentioned units are

overlain unconformably by the Miocen units and Quaternary alluvium. Upper Paleozoic-Mesozoic rocks of the study area have experienced deformation by pre-Miocene Alpine Orogenic movements. These orogenic events gave rise to folds and cleavage structures. The detailed mesoscopic structural analyzes show that both Paleozoic and Mesozoic aged units underwent polyphase deformation and acquired Type 1 and Type 3 superposed fold structure. These Alpine Orogenic events caused regional scale cleavage formation and low grade metamorphism in the region.

**Keywords:** Derbent, Aladağ, Polyphase Deformation. Alpine Orogeny.

## 1. INTRODUCTION

Study area is located about 40 km northwest of the Konya (Figure 1.1.). According to the tectonic classification of Turkey, the studied area is located in, “Anatolides” (Ketin, 1966), “Bolkardağı” unit in “Taurides” (Özgül, 1976), “Afyon-Bolkardağı zone” (Okay, 1986), and “Kütahya-Bolkardağı Belt” (Özcan et. al., 1988). Numerous regional and local studies have been carried out by many researchers (Brennich, 1954; Wiesner, 1968; Göğler and Kırıl, 1969; Görmüş, 1984; Özcan et. al., 1988; Eren 1993, 1996) in the study area since 1950. This study, aim to determine the stratigraphic and structural features of the units in the region.



Şekil 1.1. Location map of the study area.

## 2. STRATIGRAPHY

The oldest rock outcropping in the area is the middle – late Permian aged Derbent Formation that is low-grade metamorphosed limestone, phyllite, graphite phyllite, and white quartzite alternation. The Derbent Formation is unconformably overlain by Triassic aged Aladağ Formation which is consisting of low grade metamorphosed limestone, shale, quartzite and sandstone. The Aladağ Formation divided into two members namely the Mekeçal and Kırankaya. The Kırankaya member forms the lower part of the Aladağ Formation which is consisting of low grade metamorphic massive limestone while Mekeçal member is located in upper part of the formation and contain low grade metamorphic limestone and sandstone alternation. The late Triassic - early Jurassic low grade metamorphosed dark grey coloured dolomite and dolomitic limestone of the Kızılören Formation conformably overlie Aladağ Formation. The Kızılören Formation has a lateral and vertical transition with the overlying Triassic – Cretaceous Lorasdağ Formation consisting of gray, light gray and white colored

crystallized limestone and marble. The above mentioned units are overlain unconformably by the Miocene units and Quaternary alluvium. Description of these stratigraphic units and their characteristics will be given below.

Age	Formation	Symbol	Litology
Quaternary	Alluvium		Poorly cemented clay, silt, sand and gravel
Neogene			White, yellow colored claystone and marl
Cretaceous Triassic	Lorasdağ		Grey colored crystallized limestone
Early Jurassic Late Triassic	Kızılören		Dark grey, black colored metadolomite
Triassic	Mekeçal		Yellow colored sand stone and crystallized limestone alternation.
	Aladağ		Purple, yellow, grey metalimestone, metasandstone and metaconglomerate alternation.
	Kırankaya		Grey, light grey colored metacarbonate
Permian	Derbent		Grey, dark grey colored, metacarbonate, metasandstone and graphite phyllite alternation

Şekil 2.1. The stratigraphic columnar section of the study area (not scale).

### 2.1. DERBENT FORMATION (Pd)

Derbent Formation was named by Göğer and Kırıl (1969). It consist of low grade metamorphic, medium – thick bedded fossiliferous limestone, thick bedded to massive, mostly deformed quartzite, phyllite and graphite phyllite alternation. The bottom of the Derbent Formation is not exposed in the area. It is unconformably overlain by the Triassic age Aladağ Formation. According to the microfossils identified in previous studies (Eren, 1993), the age of the unit was determined as middle - late Permian.

### 2.2. ALADAĞ FORMATION (TRa)

Aladağ Formasyonu was named by Göğer and Kırıl (1969). It clearly distinguished from the surrounding units due to its typically purple and red colours. The Aladağ Formation represented by purple, red and pink coloured, thin - medium bedded, phyllite, red, yellow and brown coloured metasandstone, deformed metaconglomerate, medium - thick bedded, grey and dark grey coloured metacarbonate and medium thick bedded, brown, dark brown and white coloured quartzite alternation. Aladağ Formation divided into two members. The Mekeçal member (Eren, 1993) consist of low grade metamorphic limestone and sandstone alternation and the Kırankaya member (Eren, 1993) consist of massive metacarbonate. The base of the formation is discondart with the Derbent Formation while at the top is concordant with the late Triassic – early Jurassic Kızılören and Triassic – Cretaceous Lorasdağ formations. According to the identified microfossils in previous studies (Eren, 1993), the age of the unit was determined as Triassic.

### 2.2.1. KIRANKAYA MEMBER (TRak)

The name of the member was first used by Eren., (1993). Kırankaya member is composed of low grade metamorphic, medium - thick bedded to massive, grey and light grey coloured limestone and dolomite which is located in lower part of the Aladağ Formation. The most distinctive feature of the Kırankaya member is that it contains oolitic surfaces (Eren 1993). According to the microfossils identified by Eren, (1993), the age of the unit was determined as Triassic.

### 2.2.2. MEKEÇAL MEMBER (TRam)

Mekeçal member was named by Eren, (1993). Mekeçal member consist of low grade metamorphic, medium – thick bedded, light grey and white coloured limestone, medium bedded, light yellow, and brown coloured sandstone alternation. The Mekeçal member is clearly separated from the Kırankaya Member due to this alternation. No fossils were found in the unit. However, considering the stratigraphic position of the unit, Triassic age is accepted.

### 2.3.KIZILÖREN FORMASYONU (TRJk)

Kızılören Formation was named by Göğ̈er and Kır̈al, (1969). It is distinguished from the surrounding units with its typically black and grey colours. The Kızılören formation represented by low grade metamorphic thick bedded to massive dolomite and dolomitic limestone. The base of the formation is concordant with the Triassic Aladağ Formation while the top is transitional laterally and vertically with the Triassic – Cretaceous Lorasdağ Formation. According to the algs and foraminifers fossils identified by Görmüş, (1984), the age of the unit was determined as late Triassic – early Jurassic.

### 2.4.LORASDAĞI FORMATION (TRKl)

The name of Lorasdağ Formation was first used from Göğ̈er and Kır̈al, (1969). It consist of low grade metamorphic white, grey and light grey, bedded to massive, limestone, dolomitic limestone and brown, dark brown coloured chert nodules. The base of the formation lateral and vertical transition with the late Triassic – early Jurassic age Kızılören formation while the top is unconformably overlain by Miocene, Quaternary aged sediments. According to the identified microfossils in previous studies (Eren, 1993; Turan et. al., 1997), the age of the unit was determined as Triassic - Cretaceous.

### 2.5. MİOCENE - QUATERNARY UNITS

The basement units which are mentioned above is unconformably overlain from Miocene aged lacustrine sediments and Quaternary aged alluvium which is contain unconsolidated gravels, sands, silts and clays.

## 3.STRUCTURAL GEOLOGY

Late Paleozoic-Mesozoic rocks of the study area have experienced polyphase deformation by pre-Miocene orogenic movements. These orogenic events gave rise to folds, cleavages, nappe-thrust structures and low grade metamorphosed. The different aged basins and wide spread normal faults produced by the block faultings in the neotectonic period during upper Miocene - Quaternary time.

In the studied area wide spread and various types folds are observed in the region (Figure 3.1.). These folds are mostly found in Permian Derbent and Triassic Aladağ formations. Due to regional-scale deformation, cleaved structures developed throughout the study area. At the outcrop scales the cleavage planes cut the beddings at an angle. These cleavages defined as

axial plane cleavages which developed parallel to the fold axial planes (Figure 3.2.). The cleavages planes have different spacing according to the lithological variations of the units.



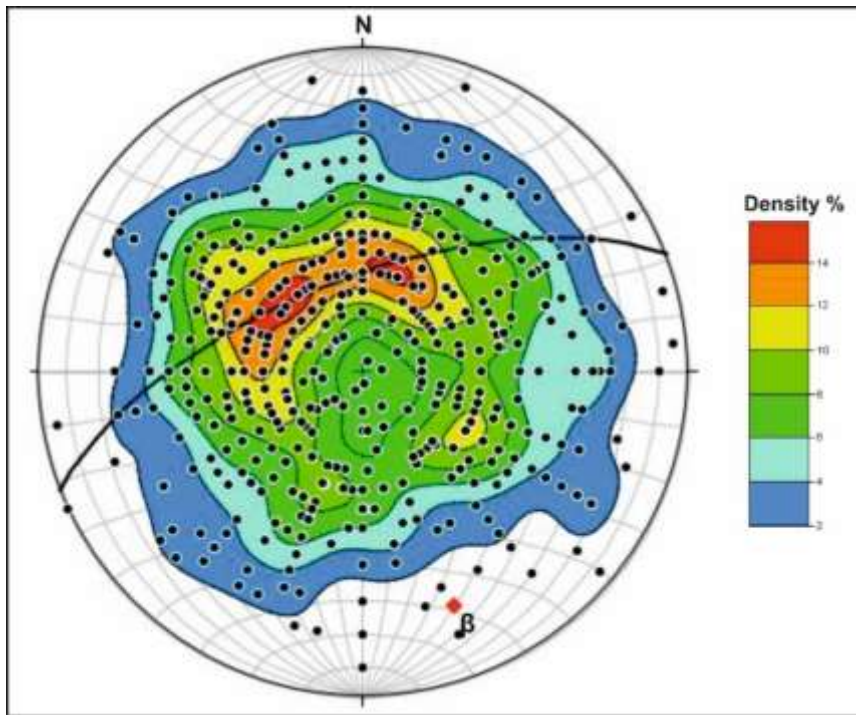
**Figure 3.1.** Different type of folds in the study area.



**Figure 3.2.** Cleavage structures in the metamorphosed rocks of the study area.

In the study area, bedding, cleavage and fold axis data were measured from the Permian - Cretaceous aged units. In order to interpret these data more accurately, stereographic projection used and contour diagrams prepared. According to 600 bedding data measured in the region, it seems that the attitude of the bedding planes differ greatly in orientation. This pattern shows that the study area has a dome-fold structure and has undergone polyphase

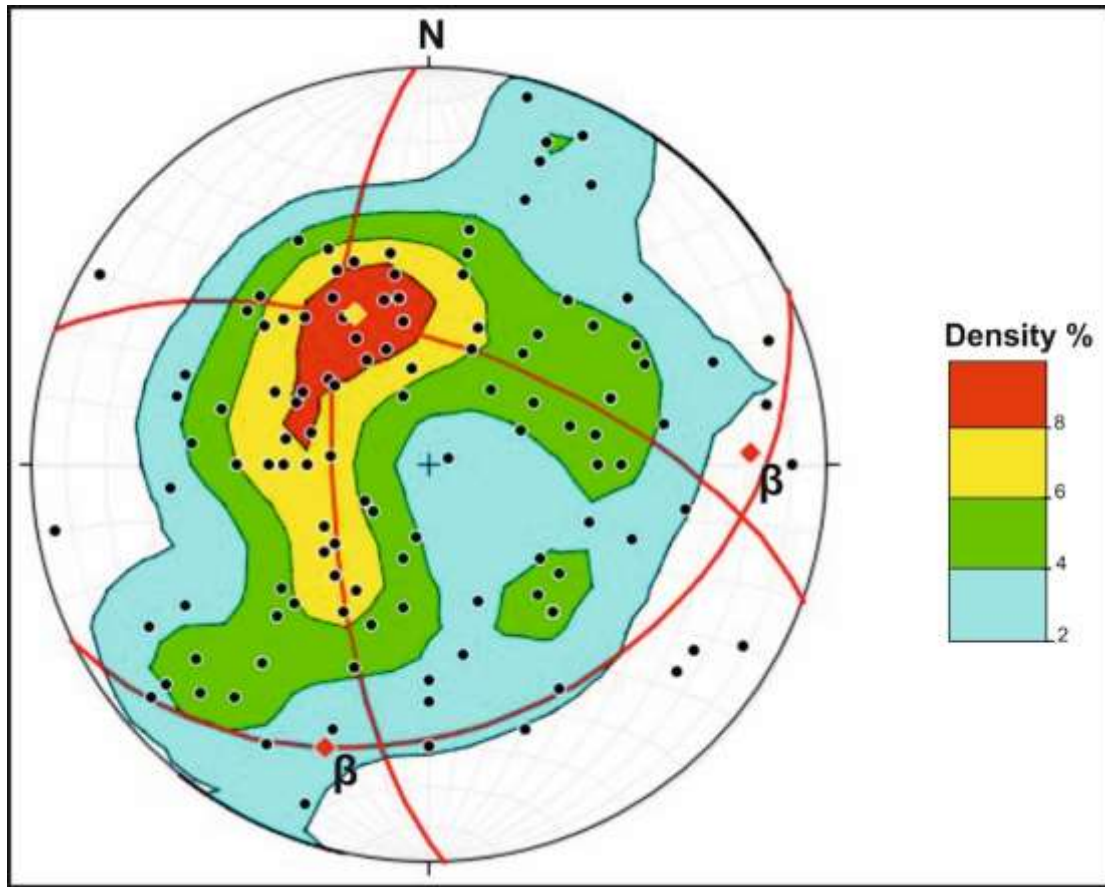
deformation. The density of bedding at point - contour diagram show that the main fold hinge is  $N20^{\circ}W/23^{\circ}SE$  in the study area (Figure 3.3).



**Figure 3.3.** Point-contour diagram of bedding data in the study area, the mean orientation of the fold hinge is  $N20^{\circ}W/23^{\circ}SE$ .

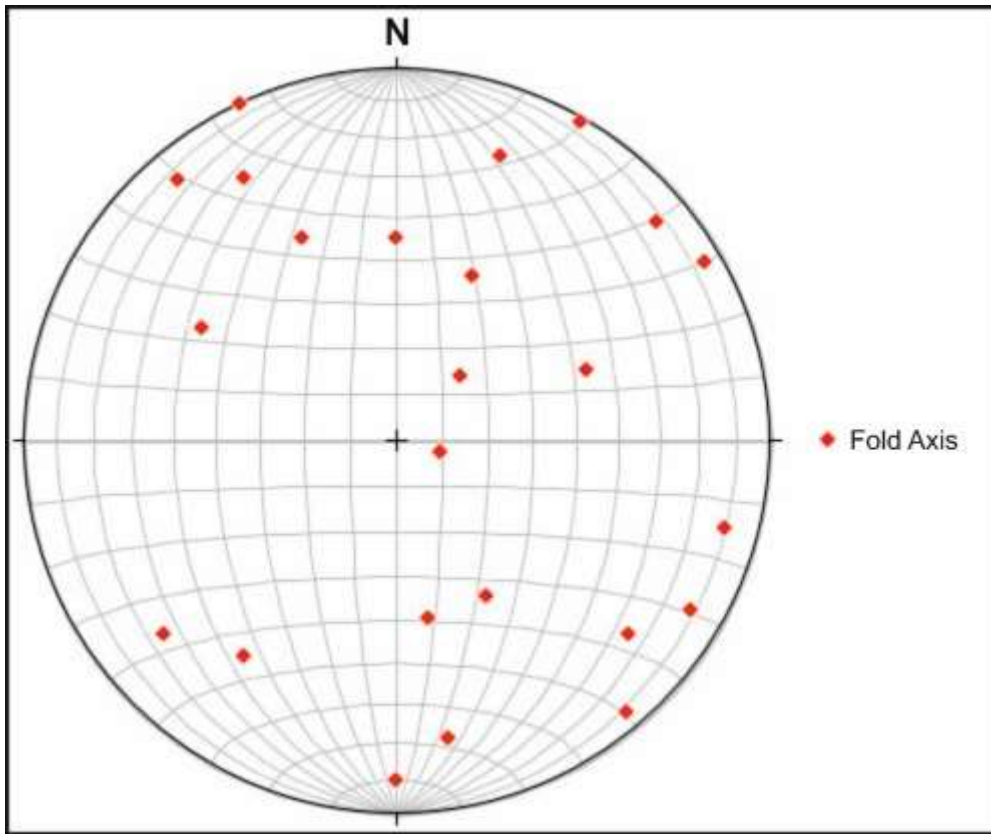
In order to interpret the cleavages in the Derbent region, 131 cleavage data measured and evaluated in the stereonet diagram. According to this diagram, the dominant cleavage attitude in the study area is  $N65^{\circ}W/35^{\circ}SE$ . Also the diagram indicate that the cleavage planes are folded in (B2)  $N20^{\circ}E/25^{\circ}SW$  and (B3)  $N88^{\circ}E/20^{\circ}SW$  directions (Figure 3.4.). This diagram shows us the basement units in the study area underwent polyphase deformation.





**Figure 3.4.** Point-contour diagram of 131 cleavage planes. The mean cleavage orientation is  $N65^{\circ}E/35^{\circ}SE$ . The cleavages are twice folded with the  $N20^{\circ}E/25^{\circ}SW$  and  $N88^{\circ}E/20^{\circ}SW$  fold axes.

The mesoscopic folds which are measured in the field were plotted on the stereonet diagrams. According to the diagram the mesoscopic fold axes don't have a homogeneous distribution. They show NE - SW, NW - SE and E - W orientations (Figure 3.5.).



**Figure 3.5.** Point diagram of mesoscopic fold axes in the study area.

#### 4. CONCLUSIONS

In the study, it was determined that the oldest unit outcropping in the region is the Permian aged Derbent Formation. The Derbent Formation is unconformably overlain by Triassic aged Aladağ Formation. Jurassic and Cretaceous Kızılören and Lorasdağ formations conformably overlie Aladağ Formation. The above mentioned basement units are unconformably overlain by the Miocene lacustrine sediments and Quaternary alluvium.

The evaluation of the point - contour diagrams of bedding planes demonstrate that upper Paleozoic – Mesozoic rock units have a dome – fold structure. The cleavages, which developed due to pre Miocene deformation were folded later. The mesoscopic scale fold axes which are measured in the field show a wide variation in orientation. All these results show us that the region has a polyphase deformation history.

#### 5. REFERENCES

1. Brennich, G., 1954, 1/100 000 ölçekli genel jeolojik harita izahnamesi. Akşehir (90-1, 2, 3, 4) ve Iğın (91/1 ve 91/3) paftaları, MTA Derleme Rapor, 2515.
2. Eren, Y., 1993, Konya kuzeybatısında Bozdağlar masifinin otokton ve örtü birimlerinin stratigrafisi, *Türkiye Jeol. Kur. Bül.*, 36, 7-23.
3. Eren, Y., 1996 a, Iğın-Sarayönü (Konya) güneyinde Bozdağlar masifinin stratigrafisi ve jeoloji evrimi, *30. Yıl Sempozyumu*, Trabzon, 694-707.
4. Göger, E., Kırıl, K., 1969, Kızılören dolayının jeolojisi. MTA rapor, 5204.
5. Görmüş, M., 1984, Kızılören (Konya) dolayının jeoloji incelemesi, *SÜ Fen Bil. Enst.*, Yüksek Lisans Tezi, Konya.

6. Ketin, I., 1966, Turkiyenin tektonik birlikleri, *Bulletin of MTA*, 66, 23-4.
7. Okay, A., 1986, High-pressure/low-temperature metamorphic rocks of Turkey. In: Blueschists and eclogites, *Eds: Geological Society of America Memoir*, 164, 333-48.
8. Özcan, A., Göncüoğlu, M., Turhan, N., Uysal, S., Şentürk, K., Işık, A., 1988, Late Paleozoic evolution of the Kütahya-Bolkardağ belt, *METU Journal of Pure and Applied Science*, 21 (1/3), 211-20.
9. Özcan, A., Göncüoğlu, M., Turhan, N., Uysal, S., Şentürk, K., Işık, A., 1988, Late Paleozoic evolution of the Kütahya-Bolkardağ belt, *METU Journal of Pure and Applied Science*, 21 (1/3), 211-20.
10. Özgül, N., 1976, Toroslar'm bazı temel jeoloji özellikleri, *Bulletin of the Geological Society of Turkey*, 19, 65-78.
11. Turan, A., Küpeli, Ş. ve Karakoç, İ., 1997, “Lorasdağı–Çaldağı ile Hatunsaray (Konya batısı) Arasında Kalan Bölgenin Stratigrafisi Ve Bazı Tektonik Özellikleri”, *Geosound Yerbilimleri Derg.*, 30, 305–318
12. Wiesner, K., 1968, Konya civa yatakları ve bunlar üzerindeki etüdler, *Maden Tetkik ve Arama Dergisi*, 70, 178-213.