

INTRODUCTION

western Turkey is a tectonically very active region. Therefore, rich in archaeological ruins which display the historical earthquake traces. Cibyra is also an ancient city located on the middle segment of the active Burdur-Fethiye Fault Zone (BFFZ) in southwestern Turkey (Figure 1) where was effected by earthquakes in ancient time. Especially, the stadion of the city bears the traces of a great earthquake.

Guidoboni et al. (1994) states that the ancient city of Cibyra has been struck by the earthquake of 23 A.D. and was rebuilt by the help of the Roman Emperor Tiberius. In addition, according to the historical earthquake catalogues (Guedoboni et al., 1994; Ambraseys, 2009) an earthquake in 417 A.D. caused remarkable damage in the city.



Most of the researchers that studied in this area suggests a fault (named as Cibyra Fault) cutting the stadion of the ancient city. This fault was firstly suggested by Akyüz and Altunel (1997, 2001). Researchers identified traces of historical earthquakes in Cibyra by taking into account the collapsed seat rows on the east side of the stadion as reference.

IS THERE A FAULT CUTTING THE STADION?

In the southern side of the stadion, there are 20 seat rows and the lowermost row is half-buried. It is an important contradiction that despite the marked fault direction on the southern seat rows, no offset is seen on that row (Figure 3). Also there are many collapsed rows tilted to different directions. This is because the ground of these seat rows has structurally heterogeneous properties. For instance, the seat rows on the entrance tunnel were tilted to the south and fell down inside. Briefly, a nonsystematic spread is clearly seen. When we look at the aerial photo (Figure 4), the photo taken from the northern hill (Figure 5) and the east wall of the stadion (Figure 6), there is no offset which can manifest the presence of a fault as stated by the researchers.



Figure 3. Earthquake damage on the southern side of the stadion: The yellow dashed line indicates the asserted direction of left lateral Cibyra fault (Akyuz and Altunel, 1997, 2001; Karabacak, 2011)



IS THERE REALLY AN ACTIVE FAULT (CIBYRA FAULT?) CUTTING THE STADION OF THE ANCIENT CITY OF CIBYRA? (BURDUR-FETHIYE FAULT ZONE, TURKEY)

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0°W 5°W W0°E 5°E 10°E 15°E 20°E 25°E 30°E 35°E

Figure 1. The position of the study area and seismic activity map of southwestern Turkey (Source: koeri.gov.tr)



Figure 4. The aerial photo of the stadion. The dashed red line indicates the asserted direction of the left lateral Cibyra Fault (Akyuz and Altunel, 1997, 2001; Karabacak, 2011).

GEOLOGY

imestones; Middle-Upper Miocene aged coarse-grained onalomerates, sandstones, siltstones and shales deposited in meandering and braided river environments (Gölhisar Formation) and Upper Miocene-Lower Pliocene aged beige coloured claystones, thick bedded limestones, marls and siltstones deposited in delta and lake environments (ibecik Formation) (Figure 2A). The stadion of the city is located on the east-dipping beds of a rollover anticlinal (Figure 2B).





2). Dip direction and angle of dip:126/51SE (view direction: NW)

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WHY WAS THE EASTERN SIDE OF THE ANCIENT STADION DESTROYED?



During the studies in Cibyra, three different types of ground are encountered. The first one is Miocene aged conglomerates which can be described as bedrock. This group of rocks is inclined to east and consists of hard and well-cemented conglomerates with sandy pebble levels. The others are the natural and hand-made fills which have different properties from bedrock.

The hand-made fill materials can be classified into three types. One of these is the hand-made fills which were obtained from the construction area. They were produced on the purpose of smoothing the floor and filling the voids. They are apparent on the eastern slope of the stadion. Secondly, the fills with blocks are composed of the pieces cut from bedrock and they can be reputed to be bedrock. This kind of blocks was commonly used at the eastern part of the stadion during construction(Figure 7A).









constructing a wall is comprehensible.

WHERE IS THE FAULT THAT DESTROYED THE ANCIENT CITY OF CIBYRA?

Figure 10. The northern side of the Cibyra Fault. It is located between recrystallized limestones and İbecik Formation in the northwest of the ancient city (see Figure

It is clear that the signified damage on the stadion are the result of a earthquake. However especially the evidences presented for interpretation of the fault are

There are many normal and normal oblique faults in Miocene aged units towards the upland on the way between Gölhisar Town and main fault. If the rotation and overturn novement are considered and both movements are the product of the same earthquake, we are of the opinion that the real Cibyra Fault is located in the northwest of the city (Figure 2 and 10). This is a normal fault (N36E/51SE) with left-lateral strike-slip component (rake:-70) between ophiolitic melange and Miocene units. With reference to the dip angle of the fault plane, it can be said that the epicenter of the earthquake is located near the western side of Gölhisar Lake. Thusly, that's enough to explain the fill damage on the wide area.

the same earthquake.

the ancient city of Cibyra.

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- It is clear that the signified damages on the stadion are the result of an earthquake. If the rotation and overturn movement are considered, both movements are the product of
- The reason of the destroyed seat rows is the weak ground properties.
- The characteristics of the damage (rotation and domino effect) indicate that the fault caused the earthquake is a normal fault with left lateral component.
- The only fault that can cause an earthquake is the real Cibyra Fault located in the northwest of
- All previous data for supporting "the fault cutting a stadion" idea is speculative and invalid. - In this context we are of the opinion that a left lateral active Cibyra Fault is not present and the real Cibyra Fault is located on the northwestern side of the city.
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