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Traces of Historical earthquakes in the ancient city life at the Mediterranean region

Tarihsel depremlerin Akdeniz Bölgesi antik kent yaşamındaki izleri

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Abstract

During the historical periods, the Mediterranean region was divided in several areas, from west to east, the Carian (Menteşe), Lycian (Teke Peninsula), Pamphylia (Antalya Plain) and Cilician areas. Cilician was divided into the Mountains (Taşeli Peninsula) and Lowland Cilicia (Çukurova) regions. Further east behind the Amonos Mountains, Antiokheia (Antakya), was a completely seperate region.

All these regions were shaken by numerous earthquakes produced by main fault systems from the Aegean Sea and Mediterranean. The major geological structures are Hellenic Trench, East Anatolian Fault, Ecemiş Fault and Dead Sea Fault in the region.

Along with material destruction, earthquakes also result in tectonic rising of lands. This rising fills in ports and speeds up the process of ports getting shallow. Another negative consequence of earthquakes is the drying up of the water sources or the changing of their banks.

Key words: Mediterranean coast, historical earthquakes, ancient cities

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Introduction

The coastal areas of Turkey neighboring the Mediterranean Sea have been subject to numerous destructive earthquakes. These earthquakes have largely given direction to certain historical events urban architecture and the way of the life of inhabitants. Over the west to east stretch, Knidos (Datça), Kaunos (Dalyan), Kekova (Kale-Üçağız) settlements and cities such as Ksanthos (Kınık), Myra (Demre) and Limyra (Turunçova) situated on small plains along the steep coastline of Teke Peninsula have been badly affected by earthquakes in historical periods. Attaleia (Antalya) and Side (Selimiye) were cities on the Antalya Plain. Anazarbus in Lowland Cilicia i.e. Çukuruva was a city abandoned as result of a series of earthquakes. During the region of the Roman Empire, in Antiokheia was the political, administrative and religious center of the eastern part the country. (Erel and Adatepe, 2003).

In order to reveal the sismotectonic characteristics of eastern Mediterranean, it is necessary to fully describe the main four plates in the region, namely, Eurasia, Anatolia, Africa and Arabic plates and their movements. There are three main centers in the region which form the highest level of earthquake effectiveness. These are the Hellenic trench with subduction zone (Crete-Rhodes as center), Cyprus with surrunding regions, and Misis, Ecemiş faults in Anatolia, Death Sea fault in the East Mediterranean (Adatepe and Yüksel,1985).

Historical period earthquakes

The oldest recorded earthquake in the region is the one immediately following the volcanic eruption of Santorini in 1470 B.C. This great natural disaster has resulted in tsunami over a wide area including the South and southwest Anatolian coast. Again in 1356 (or 1365) B.C. another tsunami caused by an earthquake in the Easthern Mediterranean has devastated Ugarit (Ras Shamra).

Information on the historical period earthquakes in the examined area is taken from "Historical Earthquakes Catalogue of Turkey and Environment" (Soysal *et al.*, 1981), and after re-examining this information in the light of other historical documents and catalogues, (Ambraseys and Finkel, 1995; Aslan, 2000; Pınar Erdem and Lahn, 2001; Karagöz, 2005) the Table. 1 has been prepared.

Many of the earthquakes within the region are centered around Antakya, Samandağ and linked to the Death Sea fault. The remaining events are originated from Rhodes-Meis and Cerete.

Table 1. Historical Period Earthquakes in the Mediterranean Region

No	Date	Visual (Probable) External Center	Intensity	Explanation and Areas Affected
01	148 B.C.	Antakya	VIII	-
02	69 B.C.	Antakya, Syrian	IX	Magosa, Egypt
03	37 B.C.	Antakya	VIII	death of lot of people
04	110	Antakya, Samandağ	VIII	-
05	13.12. 115	Antakya	IX	
06	142	Rhodes,Myra(Demre)	VIII	-
07	144	Fethiye, Kalkan,	VIII	-
08	226(227)	Rhodes	VIII	Crete, SW Anatolian
09	245	Antakya	X	-
10	272	Antakya	VIII	Syria
11	334	Antakya, Magosa	IX	Salamis (Cyprus)
12	341	Antakya	VIII	-
13	344	Rhodes	IX	Rhodes destroyed
14	21.07.365	Crete, Cyprus	I X	Tsunami
15	396	Antakya	VIII	-
16	14.09.458	Antakya ve N Syria	IX	-
17	10.09.506	Antakya, Samandağ	IX	-
18	04.10.525	Kilikya (Çukurova)	IX	Tsunami
19	29.05.526	Antakya, Samandağ	IX	-
20	29.11.528	Antakya,Fethiye, Meis	IX	-
21	559	Antakya	VII	Lebanon
22	581	Antakya	VI	-
23	30.09.587	Antakya	IX	60.000 people death

Table 1 continued.

24	28.02.713	Antakya	VIII	-
25	835	Antakya	VII	Labanon
26	08.04.859	Antakya,Syrian	IX	Tsunami
27	22.07.963	N Syria, Halep	VIII	-
28	972	Antakya	VII	Lebanon
29	09.1091	Antakya, Urfa	VII	-
30	10.08.1114	Maraş	IX	Tsunami
31	29.06.1170	Antakya	IX	-
32	1268	Kilikya (Çukurova)	-	60.000 people death
33	30.12.1408	E Mediterranean	X	Tsunami
34	13.08.1822	Antakya, İskenderun	IX	20.000 death
35	28.02.1851	Fethiye, Muğla	IX	Rhodes, Tsunami.
36	19.10.1852	Fethiye, Muğla	VII	-
37	1854	Antakya, Samandağ,	VII	-
38	02.03.1855	Fethiye,Muğla, Tarsus	VIII	-
39	1858	Antalya	V	-
40	22.04.1863	Fethiye,Rhodes, Antakya	IX	-
41	02.10.1864	Meis, Fethiye	VIII	-
42	22.02.1870	Fethiye, Rhodes	VIII	20 km fault
43	07.06.1871	Marmaris, Sporat Islands	VII	-
44	02.04.1872	Antakya, Samandağ	IX	1.800 people death
45	15.05.1872	Antakya	VII	-
46	1875	Samandağ, Antakya	VI	-
47	21.08.1875	Antakya	VII	-
48	06.08.1887	Köyceğiz	VII	-
49	1894	Antakya	V	-

Table 1 continued.

50	01.1896	Adana, Mersin	VI	-
51	26.06.1896	Marmaris,Muğla, Adana	VII	.
52	05.1897	Marmaris, Köyceğiz	VII	-

Traces of earthquakes in antique cities

In this section, we will take up earthquakes in the cities located in the captioned area and the effects in urban life of these earthquakes. The first city to be mentioned in this instance is Knidos (Tekir Burnu) with two harbours, located on the tombolo at the far end of Datça Peninsula which seperates the Aegean and Mediterranean Seas. The most apparent trace of historical earthquakes in this city is born by the Aphrodite Temple which is known by the name "The Round Temple".

The foundation of the temple built in the 2nd century B.C. was damaged in the earthquake (No.13) (Figure 1) which devastated Rhodes. The same earthquake damaged also the water source of the city. Knidos was abandoned after the Abbasi raids in the 9th century.

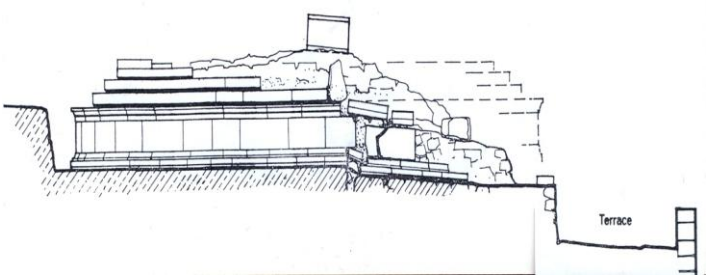

Figure 1. Situation of the Aphrodite Temple at Knidos after the earthquake

Kaunos city controlled the entrance to the old bay which is now the Köyceğiz Lake. The acropolis was constructed on the plain over the 152 meter high hill. The southern face of the hill overlooking the plan was a fault wall which naturally protected the southern side of the acropolis. Although the center of the 226 (or 227) B.C. earthquake (No.08) was at Rhodes 55 km away, part of the walls and buildings in this city were completely destroyed. Apart from these destructive earthquakes tribal raids and the fact that the ports in time were filled and could not be used due to tectonic rise caused by earthquakes resulted in this city gradually diminishing in luster and importance.

The Lycian region of the antique period was located around what is now called the Teke Peninsula. This peninsula is affected by earthquakes centered around Crete and Cyprus and produces local earthquakes as well.

Fethiye (Telmessos) in the west of this region is located along the fault just behind the bay. The earthquake (No.20) under Table 1 above for which the seismic center was in Fethiye-Meis was effective in Fethiye and Teke Peninsula. Another prominent earthquake in this region occured near our time on 1851 (No.35) in the undersea trench between Fethiye - Rhodes. It resulted in tsunami on the coasts and in land slides in the inner regions. The follow-up shocks of the earthquake continued for up to a year. The 1855 (No.38) and 1863 (No.40) earthquakes were felt in Rhodes, Tarsus, Ceyhan and Antakya. One year later in 1864 (No.41) another earthquake centered in Meis Island was strongly felt in Fethiye too. The earthquake of 1870 (No.42) resulted in coastal rises and produced a fault of over 20 km long. The traces of these earthquakes in Lycian tombs are shown in the following photographs (Figure 2).

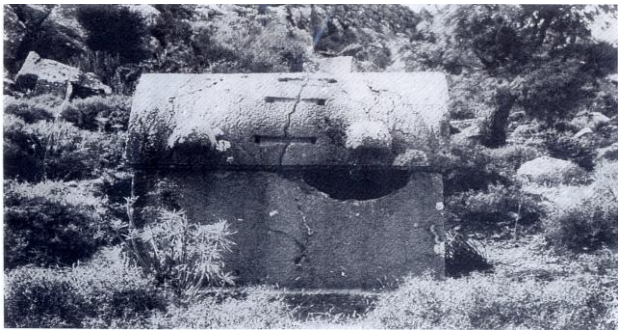

Figure 2. The lid parts of the tomb broken in the antique period earthquake are connected by metal clamps.

On the strait behind the plain formed by the alluvium of Eşen River, lies the antique city of Ksanthos (Kınık). In this city there is a temple dedicated to the sea god Poseidon, who was also an earthquake producing and therefore highly respected god. There was between Poseidon and city's legendary hero Sarpedon a dispute, following which the angered sea god sent his waves up to the walls of the city which are today 12 kms. Inland from the sea, creating a tsunami. The typical traces of the tectonic subsidence formed by the earthquakes in 142 (No..06) and 144 (No..07) over the Dalmatian type coasts of the Kaleüçağız-Kekova Island are visible even today (Figure 3).

Figure 3. Sarcophagus and antique settlements in Simena (Kaleköy), Teimiussa (Uçağız) and Kekova Island subsidence area.

The geomorphological development in the Demre coastal plain neighboring antique Myra (Demre) in the East is different. There is tectonic subsidence in this area whereas the neighboring Myras (Demre River) brings from the town plain behind, alluvions which are spread over the old delta. Recently, Santa Claus's church originally built by the seaside was excavated from 7-8 meters from earth and opened to visitors. An important city in this plain, Myra and its harbor Andriake (Cayağzı) were damaged during the earthquakes of 142 (N.06) and 528 (No.20).

Finike-Kumluca plain is the largest seaside plain of Lycia. Limyra (Turunçova) the most important city of this plain was founded over the fault surface in the side of the plain. The 1st century A.D. and the first half of the 2nd century were peaceful in the history of Lycia. The construction of artictic buildings gained speed, ceremonies games and contests were organized. Howewer the 142 (No.06) earthquakes caused great destruction throughout the area. This situation is recorded in the list of cities to which Opraomas, a philantropist from Rhodiapolis, made monetary contributions for repairs after the earthquake.

The antique period Pamphylia covered what now is the Antalya Plain. The Pamphylia plain was not itself an eartquake producing area, but was affected and damaged by earthquakes originating from Rhodes and Crete.

The Mountainous Cilicia was haven of pirates in the 1st century B.C. and urban life was affected not only by earthquakes but by pirate pillage as well. The most destructive earthquake in this region was that on 525 (No.18). The most important antique cities in Plain Cilicia are Tarsus, Misis and Anazarbus. Of these cities, Anazarbus was deserted by inhabitants following a series of earthquakes in the 6th century. Misis too was damaged by numerous earthquakes and there after repaired by emperors (Figure 4).

Figure 4. Traces of earthquake at Termessos (Güllük Dağı) theater.

Antiokheia (Antakya), a brilliant city of antique times, was founded around 300 B.C.on the Habib Neccar Mountain of 400 meters altitude. The city's port was Seleukeia Piereia (Samandağ=Suveydiye) on the Asi River delta. Both settlements were shaken and damaged by earthquakes on the Death Sea fault, Cyprus, Cilicia, Eastern Anatolian fault and Syria.

It is also known that the Amik-Antakya-Samandağ plain produces independent earthquakes. During the Roman period, the lower city where artistic buildings

were consructed in the 2nd century A.D. The oldest recorded earthquake in Antakya was in 148 B.C. (No.01) following which the destroyed city was re-consructed by Antiokhos IV. Emperor Traia, caught in one of the largest earthquakes in the history of Antakya in 115 (No.05), barely escaped death by jumping from the window of the building he was in. The city recovered from the consequences of the 526 (No.19) earthquakes by material aid from the then emperor, Justinianus.

Two years later on 29th November 528 (No.20) another earthquake was recorded by the chronic Ihoannes Malalas as follows: "On 528, the 6th of earthquake disaster caused five thousand people to die" when this event was heard in İstanbul, there was great mourning. After this earthquake, the city's name was changed to "Theoupolis" meaning "the God's city", in other words people seeked refuge in God's protection.

The city was devastated not just by earthquakes, but by Persian troops in 573 and by plague in 742. However earthquakes have always been a continuing threat for Antiokheia. Of these events, the 581 (No.22) event totally destroyed the nearby settlement of Daphne (Harbiye). Six years later, another disaster struck Antiokheia and approximately 60 thousand inhabitants were killed in the 587 (No.23) earthquake.

When the 6th century earthquakes are taken up for examination in general, it is possible to say that Antiokheia has been subjected to a serious earthquake in approximately every 30 years. After this century, for up to mid 18th century however, earthquakes resulted in fewer casualties and lesser metarial damage (Tekin, 2002).

The earthquake which occurred in the evening hours of 1822 caused (No.34) damage not just in Antiokheia, but in the whole region, resulting in tsunami and twenty thousand casualties The most destructive of these earthquakes definitely was the 1872 (No.44) earthquake, which struck at 07:45 hrs in the morning,

resulting in 1800 casualties and total destruction in of one third of the Antiokheia city. The final historical period earthquake in Antiokheia was in 1894.

Conclusions

1. In the Mediterranean region, cities were generally located within reach of water springs; therefore they were forced to choose places near earthquake faults.

2. Earthquakes have altered location of water sources, playing an undesirable role in urban life. Moreover, the sloping faults formed in river valleys have rendered communications by river impossible.

3. Tectonic rising in subsidence plains formed by faults has caused ports to be filled in with soil, hindering their function.

4. Whereas faulted steep coasts are suitable for port operations they provide restricted economic sources and their connections with mainland are weak

5. Mediterranean earthquakes, many of which are open-sea centered, have produced tsunamis, causing great danger particularly to ports along coasts.

6. Series of earthquakes which have caused destruction within certain periods of time have terrorized people, who have in many instances totally abandoned cities.

7. When the 6th century earthquakes are taken up for examination in general, it is possible to say that Antiokheia has been subjected to a serious earthquake in approximately every 30 years

8. Lowland cities in the Roman period established on alluvial plains have been subject to many casualties, particularly as result of the 6th century earthquakes.

Özet

Akdeniz bölgesinde ilk çağda batıda Karya bölgesinin bir kısmı ile doğuya doğru Likya, Pamfilya, Kilikya bölgeleri yer alıyordu. Kilikya; dağlık ve ovalık olmak üzere ikiye ayrılmıştı. En doğuda ise Amanos dağlarıyla ayrılmış Antakya ayrı bir bölüm

oluşturuyordu. Doğu Akdeniz'in deprem etkinliğini oluşturan üç ana merkez vardır. Bunlar Helenic Trench, Kıbrıs Ada Yayı ve çevresi ile doğuda Ölü Deniz, Doğu Anadolu, Ecemiş ve Misis fayları'dır. Türkiye'nin Akdeniz kıyı bölgesinda oluşan yıkıcı tarihi depremler bazı tarihi olaylara, kent mimarisine ve insanların yaşayış tarzına yön vermişlerdir.

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