THE SEDIMENT YIELD OF THE SOME RIVERS OF TURKEY

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This article has been prepared in order to point out the sediment yields or sediment discharge of some rivers or streams of Turkey.

Turkey covers an area of 780 000 km sq; nearly 12 per cent of the total land is closed basins.

There has been no publication appeared on the sediment yield in Turkey, though the early data were began to be recorded since 1939. On the other hand, we do not have any records about some of the streams and rivers. In addition, the validity of some of the data may be questionable, because of short records and variability of the sediment sampling methods.

The sediment load transported by rivers is shown in table 1, and locations of the river basins and sediment stations are also presented in Fig. 1. As shown in table 1, the rivers are listed according to descending order of drainage area. The amount of the sediment transported by the Euphrates was measured as 73 358 937 tons at the Birecik station. But, the sediment load of the Euphrates varies in a great extent. For example, its sediment transport at the Dutluca which is situated 100 km. north of Birecik, is 108 178 882 tons, whereas at the Tabqa, Syria, this amount descends to 4 750 000 tons.

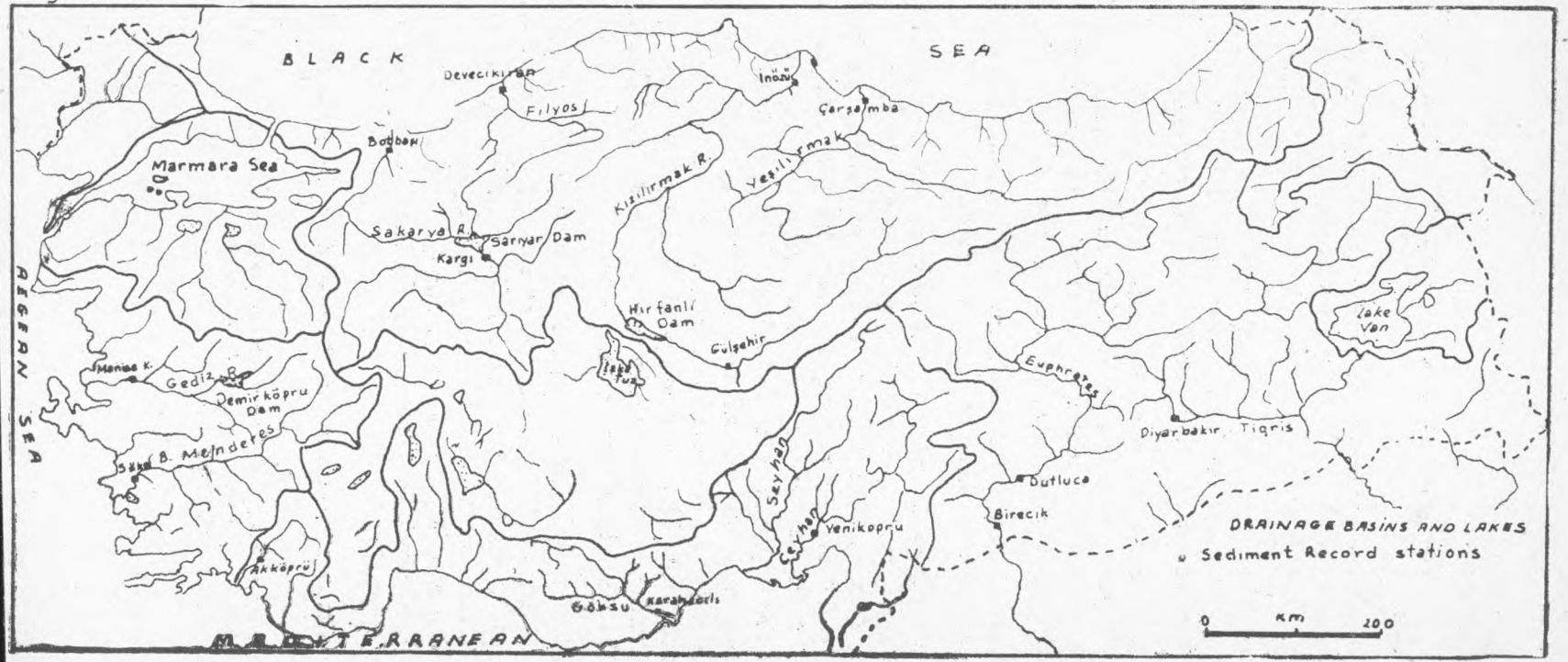
The Yeşilırmak is the second largest carriers of sediment, discharging more than 54 million tons in to the Black Sea, each

TABLE : 1 — Annual total sediment yields of the some rivers of Turkey

River Location	Period of sediment record	Total drainage area at the sediment record station		Average annual water discharge at the sediment station ton	Average annual total sediment load ton	Average sediment yield	
		km²	mil²			ton/year/sq km.	ton/year/sq mi
Euphrates, Birecik	1963—69	100 915	38 845	39 620 332 800	73 358 937	612	1.884
Euph. Tabqua, Syria	1962—64	73 994	46 570	1 800 300	4 750 000	63	100x
Tigris, Diyarbakır	1946—69	6 298	2 422	3 417 789 240	6 833 289	1.085	2821
Tigris, Bagdad, Iraq	1918—19	79 736	30 800	1 800 300	57 600 000	722	1870x
Kızılırmak, İnönü	1962—69	48 408	18 618	7 841 426 400	44 960 700	929	2408
Kızılırmak, Gülşehir	1962—69	15 581	5 992	3 006 957 600	11 884 765	763	1973
Sakarya, Botbaşı	1961—69	13 126	5 046	6 568 633 440	8 540 405	651	1693
Sakarya, Kargı	1961—69	33 847	13 018	2 191 436 640	1 579 455	47	121
Yeşilırmak, Çarşamba	1964—69	33 958	13 060	8 933 202 720	54 692 677	1.521	4187
B. Menderes, Söke	1963—68	22 889	8 803	4 507 755 840	12 394 122	519	1408
Ceyhan, Yeniköprü	1954—69	19 727	7 587	8 829 449 280	19 579 311	992	2579
Filyos, Devecikıran	1964—69	13 300	5 115	4 627 492 640	8 121 323	610	1589
Gediz, Manisa Köp.	1963—69	9 941	3 823	3 276 275 040	5 787 075	582	1514
Göksu, Karahacılı	1961—69	10 043	3 865	4 132 792 800	6 874 139	684	1798
Dalaman, Akköprü	1964—69	4 510	1 734	1 561 032 000	1 615 417	358	931

x) Source : Holeman, 1968, p. 744.

Figure 1


BLACK SEA
Devecikırı
Filyos
İnöz
Çarşamba
Bolbası
Marmara Sea
Kızılırmak R.
Yeşilırmak
Sakarya R.
Sarıyar Dam
Kargı
Hırfanlı Dam
Gülşehir
Lake Tuz
Lake Van
Euphrates
Diyarbakır
Tigris
Menias K.
Gediz R.
Demirköpru Dam
AEGEAN SEA
Büyük Menderes
Seyhan
Dutluca
Birecik
Yenikopru
Akköprü
Gölsu
Karaisalı
MEDITERRANEAN
DRAINAGE BASINS AND LAKES
Sediment Record stations
0 km 200

years. The Kızılırmak transport nearly 45 million tons into the Black Sea.

The sediment yields of the rivers of Ceyhan, Büyük Menderes, Sakarya, and Filyos are: 19.5, 12.3, 8.5 and 8.1 million tons, respectively.

Generally, the total sediment load of the rivers which flow into Black Sea, are very high; whilst the total sediment yield of the Mediterranean rivers which drain on the kartic region, are low.

According to the sediment data, the Euphrates transports almost as much sediment as the Nile, and the Yeşilırmak carries nearly as much sediment as the Caroni, Venezuella, the Tigris, Bagdad, Iraq, and the Chenab, West Pakistan (1).

Generally, the total sediment yield of the major rivers of Turkey more than those of Europe's rivers.

The average annual sediment yield of the land of Turkey, is more than 1500 tons sq mi. This yield varies from 4187 to 931 tons/year/sq mi. The highest producer of sediment is Yeşilırmak basin, with 4187 tons per sequare mile. In this basin, severe sheet and gully erosion is being prevailed, especially the flysch formation of the Upper Cratecous and less cohesive deposits of Neogene, are dissected by gullies and rills. The sediments such as sand, silt which derived from the these deposits, caused an increase in the river sediment. The sediment yield of the karstic and the dense forest lands, are low. The average of the lowest sediment yield more than 300 tons/year/sq mi.

The measured and estimated sediment yeld of the continents such as Africa, Europe and Australia appears to by very low, averaging 70, 90, and 115 tons per square mile each year, respectively. South America has the low with 160 tons per square mile; North America is a moderate sediment producer with 245; and the highest producer of sediment is Asia, with 1530 tons per square miles (2).

In addition, according to the classification made by Holeman,

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(1) Holeman, J.N., 1968, The sediment yield of major rivers of the World: Water Resources Research, 4 (4), p. 744.

(2) Holeman, J.H., 1968, Op. cit., p. 745.

on ton/year/sq mi basis, 500 tons are considered as high, between 200 and 500 as moderate and under 200 as low (3).

According to these values, the sediment production of Turkey is very high with more than 1000 tons sq mi. The amount of the sediment transported by rivers, streams and creeks into the seas is over 300 million tons, and is nearly 400 million tons.

This value shows that natural equilibrium of Turkey is being deteriorated because of misuse of the land, over-grazing and the destruction of the natural vegetation.

As it is known, the main sediment sources are soil erosion, erosion of land or parent material and mass movement that occur on the valley slopes.

Turkey is subjected to severe soil erosion. According to soil erosion researches, at the least more than 50 per cent of the total area of Turkey is being prevailed to the soil erosion of the several types. Some part of the forest and pasture land has been ploughed and converted into agricultural land. So, the soil cover of these areas are carried away from original surface, and especially in the steep slopes, parent materials are exposed. The unconsolidated deposits of the Neogene and Quaternary and colluvial deposits were eroded and dissected by runoff. And such deposits give much more sediment to the floods and the rivers. This situation can be clearly seen in the watershed of Yeşilırmak, Kızılırmak, Filyos and Euphrates and in the southern part of the Gediz. For this reason, the sediment loads of such rivers are very high.

As a result, intense modern sedimantation is being prevailed; the accumulation of the sediments in the resorvoirs, natural and artificial channels flood plains, and an agricultural lands couses different types of damage which are the common problems in Turkey.

Generally, the sediments which derived from soil erosion are less than those of other sources (4).

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(3) Holeman, J.H., 1968, Op. cit., p. 738.

(4) Atalay, İ., 1973, Türkiye'de aktüel sedimantasyon promleri hakkında bazı gözlemler - Some obsarvations about modern sedimantation problems in Turkey - (Summary in inglisch) : Prospektör Derg., Yıl 2, Sayı 2, p 105-119, Ankara.