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# DETECTION OF MAJOR RIVER BED CHANGES IN THE RIVER EBRO (NORTH-EASTERN SPAIN)

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## ABSTRACT

The River Ebro is the most important water course in Spain crossing the Iberian Peninsula in a south-eastern direction from Central North to the Mediterranean Sea.

A study has been undertaken to evaluate major river bed changes over a distance of 30 Km. either side of the city of Zaragoza. Data, as far back as 1890 have been used showing that meanders are fairly active thus causing a noticeable repercussion on the use of nearby agricultural lands.

Results make it possible to estimate future trends in meander evolution.

## 1. INTRODUCTION

The River Ebro is the most important water course in Spain Along its 927 km. path from the Central-Northern part of the Iberian Peninsula to the Mediterranean Sea it collects the waters of the southern slopes of the Pyrenees and ends in a large delta of about 400 sq. km.. Mean discharge at its mouth is about 600 c.m./sec. For many centuries the delta has been building up at a quick rate thanks to an abundant supply of sediments wich have been caused by intense anthropic erosion.

The zone of the present study corresponds to the middle part of the course and and centers around the city of Zaragoza (Fig. 1). An approximate length of 60 km. has been selected leaving the city

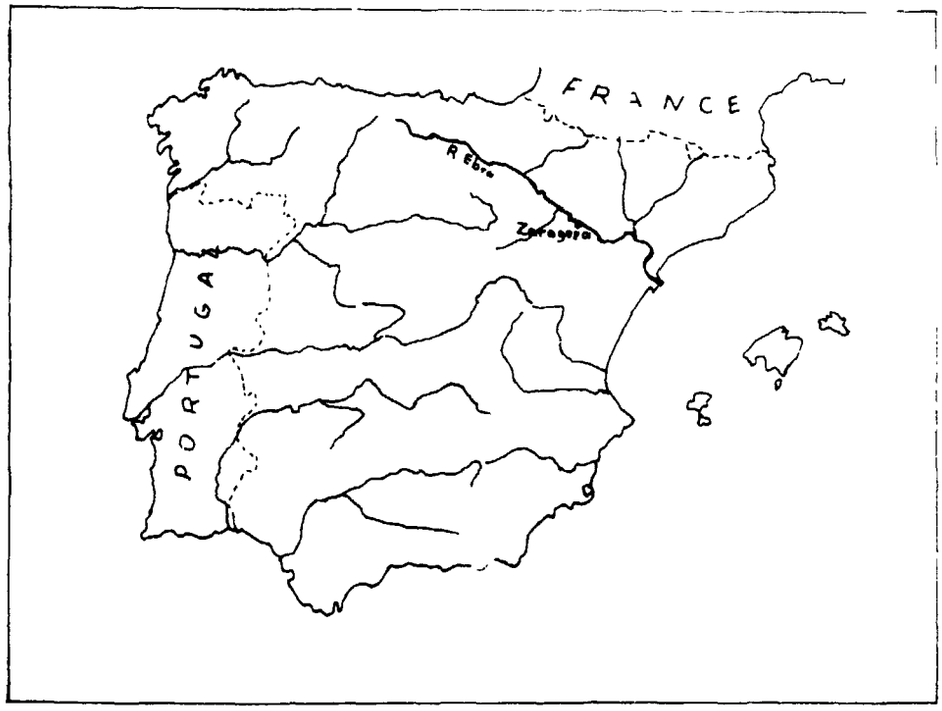


Fig. 1. Map of situation

at its center. In this area the river flows cutting a complex sequence of terraces, usually limited by Miocene sediments (gypsiferous marls)

## 2. MATERIALS

Selected areas that had historically showed meander activity were examined by means of topographic maps scale 1:50.000 correspondig to the years 1.892 and 1.920 (1) and aerial photographs at scales 1: 45,000 ( USAF - A, 1946 ) and 1: 32,000 ( USAF - B, 1956 ). Thus a clue was obtained as to the direction of river changes. Then the available ERTS-1 imagery ( MSS 4, 5, 6, 7, 25th September, 1972 ) was used to see the evolution in the last 15 years.

Image quality was good enough to permit a clear identification of the river course and bands MSS 5 and 7 proved to be the most useful for this purpose. Reflectance for band 5 was high due to the high sediment content of the water and sufficed to identify the river. However other features like bodies of water related to old channels and depressions were only apparent in band 7.

## 3. MEANDER EVOLUTION

Eventual floods were a constant danger in the history of the River Ebro, but hazard has been gradually reduced thanks to a series of dams built during the last 50 years. River activity remains nevertheless intense and continuous action can be seen in meander dynamics.

Several zones of the study area have river channels that have been abandoned in the last 15 years. Figure 2 shows a typical case in which a major variation in the course of the river is observed. Mean yearly desplacements are as high as 30m., the greater activity obviously related to minor floods and seasonal peaks.

## 4. THE IMPACT OF RIVER DYNAMICS

Fluvial deposits are the best agricultural lands of the area as surrounding Miocene sediments have given place to soils characterized by high salinity and shallowness. As a consequence of this, irrigation schemes were established in the area long ago and have, since then, undergone changes due to river channel displacements. These changes go, to our knowledge, as far back as the fourteenth century.

Demographic pressure adds to the good quality of alluvial deposits to cause the intense cultivation of not only terraces but recent alluvium. It has been estimated that, due to river activity, 1500 Ha. have disappeared for agricultural purposes and 900 Ha. brought under cultivation in the last 80 years.

It is expected that repetitive coverage by means of satellite can help monitoring river changes in the future thus supplying valuable information to local authorities, which will be able to take primary decisions about defence works, irrigation schemes etc. Characteristics of ERTS-1 imagery will also be useful to geographers and geomorphologists so as to appraise the overall variations over a long distance of the river course.

Another point of interest arises from the possibility that band MSS 7 also shows small bodies of water. Therefore it will be feasible to detect, after flooding especially, the repartition of areas that are depressed or have a slow drainage. An example of this has been included in Figure 3 which shows small water-filled depressions in an old river channel.

FIG. 2 . AN EXAMPLE OF MEANDER EVOLUTION

a) In 1946

b) In 1956

c) In 1972 ( ERTS-1, MSS 5 )

ERTS-1 imagery is also intended to serve as a source for the detection and selection of areas of newly deposited alluvial materials. These will be taken as pilot zones for the study of initial soil forming processes, and compared to analogous cases in other rivers were research in soil age has been undertaken.

REFERENCES

(1) Mapa Agronómico Nacional. Comarca de Zaragoza. Memoria ( Tomo I ). Ministerio de Agricultura, Madrid, 1.950.

FIG 3. DETECTION OF A WATER-FILLED OLD RIVER CHANNEL

a) Aerial photograph

b) ERTS-1, MSS 7



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