DRAINAGE ARCHITECTURE AND SEDIMENT ROUTING IN DRAINAGE BASINS OF THE EASTERN MARGIN OF THE EBRO BASIN

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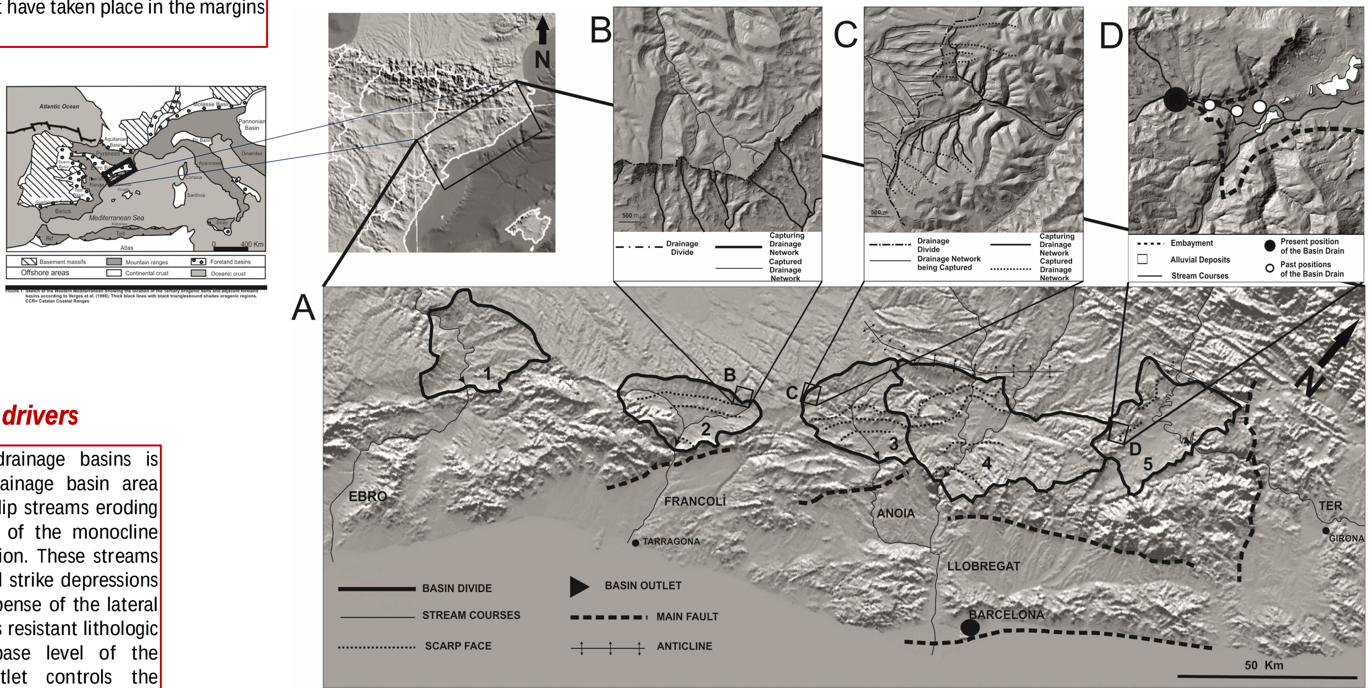
Geological setting

The Ebro Basin (EB) is the result of filling a foreland basin located between the Pyrenees, the Iberian Range and the Catalan Coastal Ranges (CCR), active in the Paleogene, and affected by distention in the Neogene. The Paleogene sequence is characterized by a succession of lithologies that have different degrees of resistance. Filling deposits have monocline structure in the eastern margin of EB. This structure determines both the emptying model of the neogene drainage basins bordering the EB and the changes in the drainage networks that have taken place in the margins of the original basin.

River captures and drainage network reorganization

The process of generation and development of the drainage basins bordering the EB has been produced through the mechanism of river capture. Stream courses that flowed to the Mediterranean from the CCR moved backwards into the EB by headward erosion through the flank of the CCR (Verges et al., 1996). The river capture process has integrated older drainage networks that flowed in opposite directions. Hence, the capturing network has rerouted tributaries of the older network in the basins divide. This rerouting has usually been gradual, occurring streams with arches of rotation of 180° in the divide (Fig. C).

Occasionally, headward erosion has progressed at a rate high enough to not allow adjustment of small tributaries that integrates. Alternatively, capturing network has already captured the low-order tributaries of the older network leaving on the escarpment beheaded sections of a valley (Fig B).



Drainage basin drivers

The emptying of drainage basins is driven by: A) A drainage basin area growth due to anti-dip streams eroding into resistant layers of the monocline stratigraphic succession. These streams empty and link small strike depressions generated at the expense of the lateral extension on the less resistant lithologic member. B) The base level of the drainage basin outlet controls the drainage network incision. Besides, gradients created by neogene distension faults from the Valencia Trough control the basin outlet.

The drainage basins

Monocline structure in the eastern margin of the Ebro Basin, and a succession of lithologies that have different degrees of resistance has led to the formation of several drainage basins throughout the contact with the CCR. These basins are the result of headward erosion towards the center of the EB generated by rivers draining the CCR to the Valencia Trough. At the time, transforming the EB from its initial condition of endorheism to exorheism was made through a drainage basin of this type. It can be distinguished five large drainage basins (Fig. A). From SW to NE they are “Conca de la Ribera d'Ebre” (1), “Conca de Barberà” (2), “Conca de l'Anoia” (3), “Conca del Bages” (4) and “la Plana Plana de Vic” (5).

Drainage basins evolution

Strike valleys are one of the first landforms formed after anti-dip incision. At the same time, the emptying of strike valleys creates new escarpments on the overlying resistant bed, providing feedback. The whole process consist of a connexion of strike valleys through headward erosion pulses of an anti-dip streams. Dimensions of new strike valleys are determined by hillslope erosion rates, and the lateral extension of the less resistant lithologic member. Thickness and dip angle of this member control valley width. Nevertheless, incision rate of the drainage network is proportional to the rate of incision of the main channel on the resistant underlying member. The incision of the main channel over the resistant layer creates a bottleneck. This is the outlet point of the drainage basin (Fig. D). It can be called the basin drain. It is the intersection between the dip slope and the main channel. In the drain, it can be observed the basin drain effect. This consists of a bottleneck where the radial drainage network concentrates. Floods reaching this point can generate a backwater effect.

As the main channel incises on the resistant layer and the drainage network expands, the strike valley migrates laterally by homoclinal shifting. This process causes a dip-slope migration of the basin drain. After each phase of incision, those streams that concentrated in the former basin drain remain in the same place. Channel entrenchment of these lateral streams grows as it does the embayment on the resistant layer. These lateral incised valleys on the canyon show the older points of confluence of the radial network (basin drain). This information allows reconstructing, using a relative dating method, the history of a homoclinal shifting process.

Entrenchment on the resistant layers by anti-dip streams causes embayment into the escarpment. Confined discharges just downstream to the basin drain are very energetic and transport high sediment loads. Flow loses its competence in the alluvial bay and deposits entrained material. Deposited sediments are structured in terraces. Because of stream incision and escarpment evolution, younger terraces are located in a lower position and in the inner part of the entrenchment.

As headward erosion progress upstream inland to the EB the older escarpments and associated basin drains are progressively lowered, remaining only a relict of a formerly active system. However, ancient and denuded strings of escarpments can be mapped.

REFERENCES

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