Procedència i evolució dels sistemes sedimentaris de la conca de Jaca (conca d'avantpaís Sudpirinenca):

Interacció entre diverses àrees font en un context tectònic actiu

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Tesi Doctoral
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Universitat Autònoma de Barcelona

Facultat de Ciències
Departament de Geologia

Annex 1

Provenance constraints on the Tremp Formation paleogeography (southern Pyrenees): Ebro Massif VS Pyrenees sources

En l'annex 1 s'incorpora l'article publicat a la revista *Cretaceous Research* publicat l'any 2016 com a part d'un volum especial sobre els els paleoambients a finals del Cretaci.

M. Roigé ha mostrejat en totes les seccions, ha realitzat el comptatge d'algunes de les mostres, i ha sintetitzat part de les dades extretes. Ha realitzat les figures 4 i 5 i també ha redactat part del text.

Gómez-Gras, D., Roigé, M., Fondevilla, V., Oms, O., Boya, S., Remacha, E., 2016.Provenance constraints on the Tremp Formation paleogeography (southern Pyrenees): Ebro Massif VS Pyrenees sources. Cretaceous Research 57, 414-427. doi:10.1016/j.cretres.2015.09.010.

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Annex 2

Interplay of multiple sediment sources in the south-central Pyrenean Basin (Late Cretaceous – Early Eocene): the role of the Ebro Massif as a source area.

« International Meeting of Sedimentology 2017 – Toulouse, 10-12 October 2017 »

INTERPLAY OF MULTIPLE SEDIMENT SOURCES IN THE SOUTH-CENTRAL PYRENEAN BASIN (LATE CRETACEOUS-EARLY EOCENE): THE ROLE OF THE EBRO MASSIF AS A SOURCE AREA

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The south-central Pyrenean Basin constitutes a good example to tie the changes in sediment routing and composition during the evolution of the basin. The Pyrenees is an inverted Alpine chain that developeddiachronously, from east to west. Characterization of sediment provenance in the south central Pyrenees is a challenging issue as the complex tectonic setting and the interference of various systems during the filling of the basin hinder it. In addition, the lack of agreement about the correlation between systems get in the way to achieve a well-constrained plaeogeographic reconstruction. A detailed petrological study leads to identify the compositional changes of the clastic systems and therefore to better understand the evolution of the sediment sources throughout the development of the foreland basin. During Late Cretaceous to Early Eocene the Àger and Tremp basins contained deltaic and fluvial deposits that evolved to the distal time equivalents of the Ainsa-Jaca basins. Our provenance results show that the clastic systems from both Àger and Tremp basins were derived from different source areas in different times. These changes can be identified in the Garumnian facies (Late Cretaceous), which in the Tremp basin show sediment input from new uplifted sources, located to the north (i.e. Sant Corneli-Bóixols anticline). In contrast, the Garumnian deposits of the Àger basin show distinct compositional features that imply a different source, located to the south. According to the petrological composition, we find the Ebro Massif as the most likely source area for these sediments. This source area was delivering a mature detritus to the south-central Pyrenean basin at least since Santonian times. In the Àger basin, supply from the Ebro Massif can be also identified in the Eocene deltaic and fluvial systems, having implications in the final composition of the distal deposits of the Ainsa-Jaca basin. Although the Ebro Massif acted as source area only episodically during specific intervals of the basin evolution, its clear provenance signature emphasizes an important role of the cratonic margin of the South Pyrenean foreland basin which has been overlooked up to date.

Interplay of multiple sediment sources in the south-central Pyrenean Basin (Late Cretaceous-Early Eocene): the role of the Ebro Massif as a source area

Marta Roigé[1], David Gómez-Gras[1], Victor Fondevilla[1], Salvador Boya[1], Miquel Poyatos-Moré[2], Oriol Oms[1], Eduard Remacha[1], Antonio Teixell[1]

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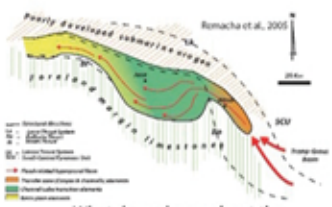
INTRODUCTION

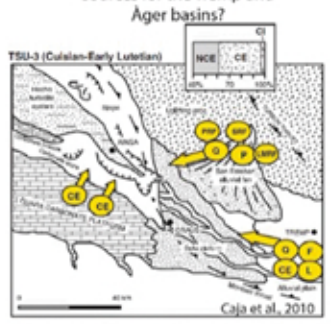
The south-central Pyrenean basin constitutes a good natural laboratory to investigate changes in sediment routing and composition.

The complex tectonic setting and the interference of various depositional systems during the infill of the basin hindered the characterization of the sediment provenance. New compositional analysis of the Eocene and Cretaceous foreland basin sequences have allowed us to resolve provenance sources.

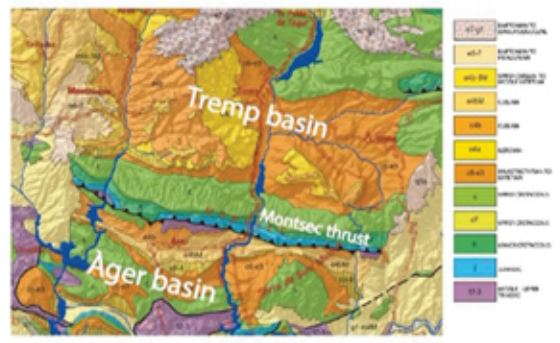
During Late Cretaceous to Mid Eocene times, the Ager and Tremp-Graus basins contained deltaic and fluvial systems that evolved to the distal time equivalents of the Ainsa-Jaca basins.



What do we know about the sources for the Tremp and Àger basins?



Correlation between the sandy systems located at both sides of the Montsec thrust has allowed to understand the evolution of the sediment sources throughout the development of the foreland basin.

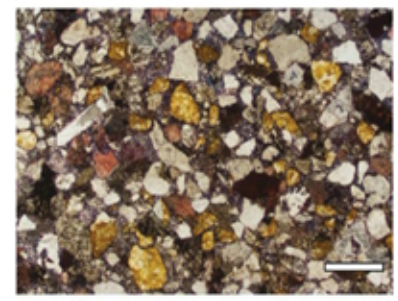


Well-constrained age correlation of syntectonic formations keep track of the Montsec High uplift, which controlled sediment connection between Tremp and Àger basins.

SAMPLES AND METHODS

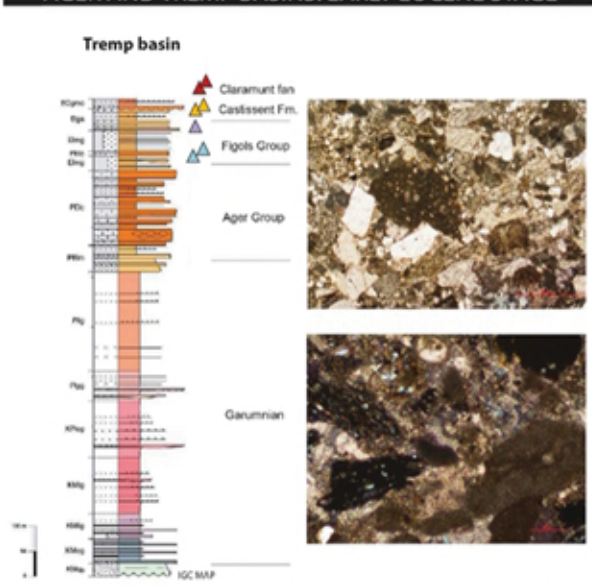
Late Cretaceous and Early Eocene formations from both Àger and Tremp basin have been sampled and studied under the polarizing microscope.

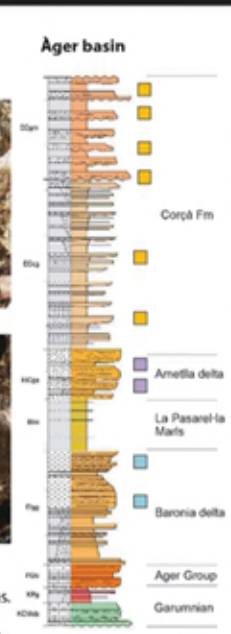
Point counting analysis (300 to 500 points) have been performed for quantification of the detrital modes.

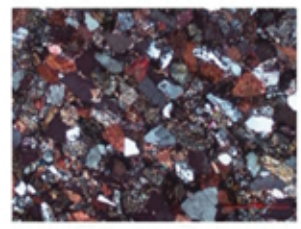


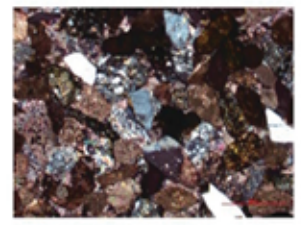
Stained thin section using Na-cobaltinitrite for suitable identification of feldspar, and Alizarine red-S staining for distinction of carbonate composition. White scale bar is 1mm.

ÀGER AND TREMP BASINS: EARLY EOCENE STAGE

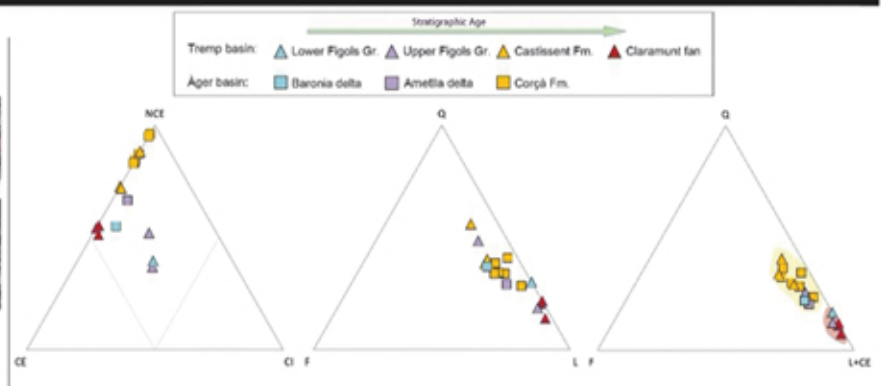








Colours of sample symbols are the same for time equivalent formations. Squares and triangles refer to the basins.
Note higher proportion of carbonate extrabasinal grains in Tremp basin when compared to the Àger basin, dominated by siliciclastic grains.

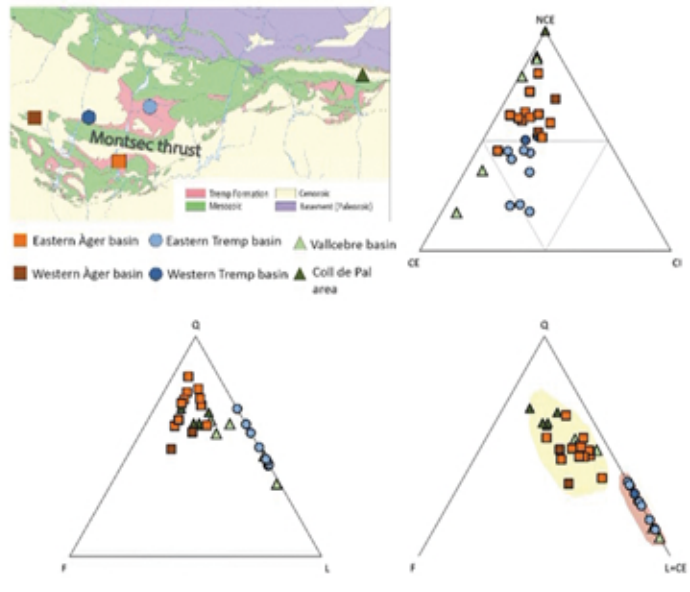


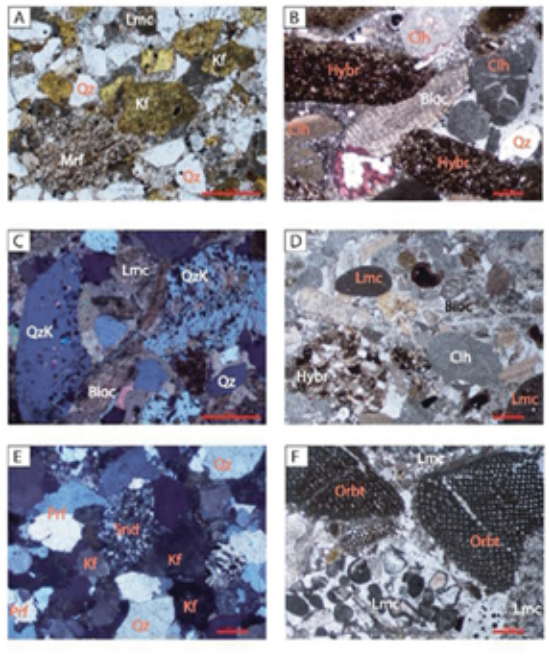
The sedimentary systems of the Àger basin show a homogenous composition across the diferent units, characterized by high amounts of lithic (schists and quartzarenites) and K-feldspar grains (Ternary plot 2 and 3).

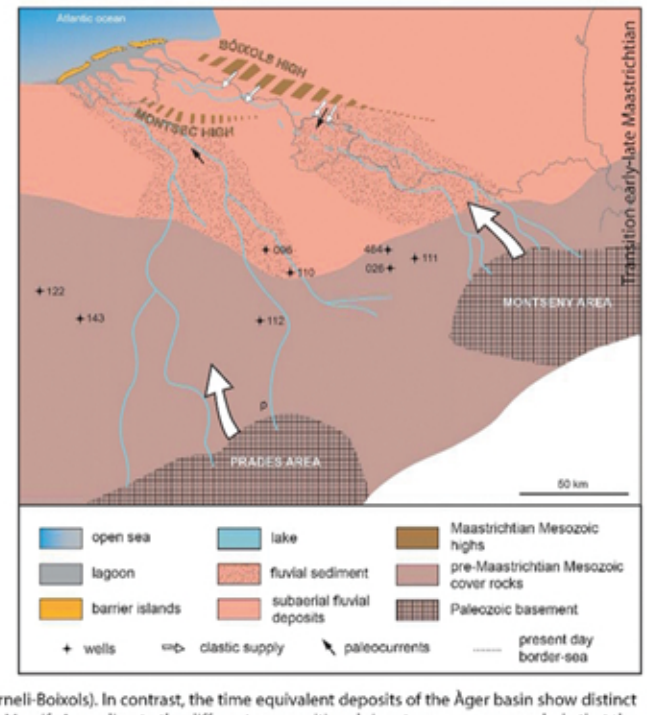
In the Tremp basin, the Figols Gr. and Claramunt conglomerates are characterized by higher proportions of carbonate extrabasinal grains. In contrast, the Castissent Fm. presents the same siliciclastic petrofacies recorded in the Àger basin.

Sedimentary and petrological data indicate that the Àger basin was fed by southeastern source areas, that could enter, in certain times the Tremp basin, due to a lowered topography of the Montsec high. Source areas that ruled the Tremp basin during Eocene times were placed in the uplifting Mesozoic cover thrusts, providing carbonatic detritus into the basin.

INFERENCES FOR THE LATE CRETACEOUS STAGE



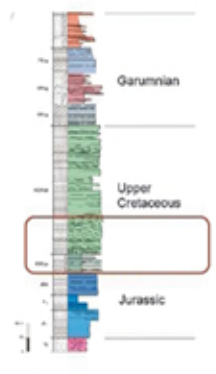


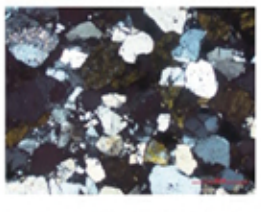


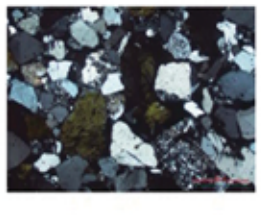
The conclusions obtained for the eocene basin can be extended to the earlier foreland basin stages. The northern and southern source fingerprints can thus be readily identified.
At this stage, the Tremp basin shows again a carbonatic dominant composition, while in the Àger basin siliciclastic grains (quartz and feldspar) prevail.

The Tremp basin shows sediment input from northern sources (i.e Sant Corneli-Boixols). In contrast, the time equivalent deposits of the Àger basin show distinct compositional features that imply a source located to the south, in the Ebro Massif. According to the different compositional signatures, we can conclude that the Tremp basin was isolated from the Àger basin due to the early growth of the Montsec anticline.

THE SANTONIAN AS A PROXY FOR THE SOUTHERN PROVENANCE







Ziegler, 1988

The Adraén sandstone (Santonian) represents the first sandy system filling the south Pyrenean foreland basin. Paleogeographic studies agree that it has a clear and single source area in the south (Ebro Massif).

Therefore, its petrofacies (quartzo-feldspathic rich) is indicative of a southern (cratonic) provenance, that in this work can be tracked in the younger deposits (Late Cretaceous and Eocene) above described.

CONCLUSIONS

1. The south Pyrenean basin records an interplay between sediment input derived from new orogenic sources (northern provenance) and from a cratonic, higly weathered sources (southern provenance). The interference of systems derived from these two distinct sources is controlled by growing structures.

2. During late Cretaceous times, the Tremp basin became isolated from the Àger basin because of the early growth of the Montsec anticline, preventing sediments derived from the Ebro Massif to reach the Tremp basin. The source area for the Àger basin was distinctive because of its quartzo-feldspathic rich composition, while the Tremp basin was supplied with high amounts of carbonate grains.

3. The early Eocene stage begins with a similar paleogeographic configuration, in which the Àger and Tremp basins show different compositional signatures. Nonetheless, this stage ends up with connection between both basins, as evidenced by the irruption of south-derived sediments in the Tremp basin. Therefore at certain times (Castissent-Corçà) the sediment routings of the Àger and Tremp basins could converge.

4. Although the Ebro Massif acted as source area only during specific intervals of the basin evolution, its clear provenance signature emphasizes an important role of the cratonic margin of the South Pyrenean foreland basin.