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Inquiry based learning during the Zumaia fieldwork

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ABSTRACT

Even though innovation in IT applications and computational modelling becomes more important in the teaching environment for Earth Scientists, fieldwork remains a key aspect of undergraduate degrees. At Utrecht University we recently developed a new two week long field course in the region around Zumaia in the Basque country, which follows on the traditional sedimentology fieldwork in Tremp.

The Zumaia rock cliffs are well-known not for a single reason, but because there are multiple geologic features to be admired in beautifully exposed outcrops along the shoreline. The Zumaia sequence shows a deepening and subsequent shoaling trend in essentially continuously deposited sediments from lower Santonian to lower Eocene. The students work on sedimentary beds that show astronomical forcing and boundaries such as the K/P and PETM, and two GSSP's that have been defined at Zumaia.

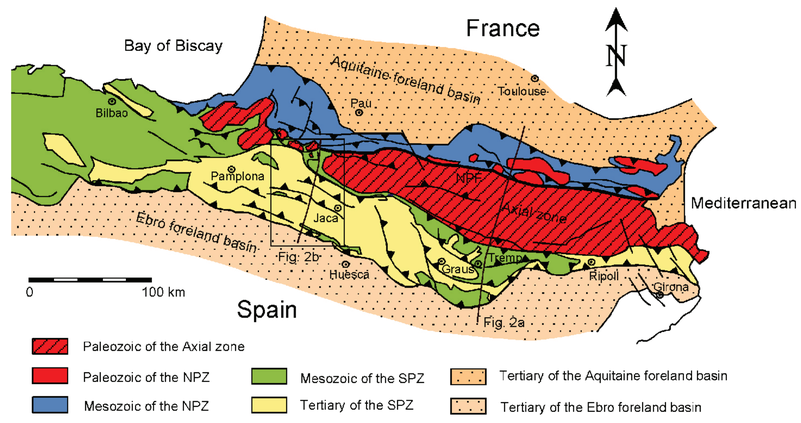
The excellent quality of the outrcops allowed us to define several research subjects, among which the students can choose from and subsequently propose their own research questions. They investigate the area than independently with modern field techniques, such has handheld XRF and colour scanning. In this inquiry based approach students build on previous knowledge and generate unprecedented datasets to get a real hands-on research experience, instead of working towards established knowledge or answer models.



Part I:

focus on the sedimentary history of the SPFB by visiting and studying six key successions of late Cretaceous (Maastrichtian) to Eocene age in an EW transect from a locality named Esplugafreda to Zumaia, where students describe the sediments and log them, and understand their origin

- **application of previous knowledge (Tremp sedimentology fieldwork) to define characteristics of formations and separate units**
- **study depositional environmental change through time and space along the EW transect**
- **apply sequence stratgraphic principles**



As part of the GEO3-1217 second year field exercise, the El Pont du Suert–Zumaia field trip aims to study the lateral paleo-environmental changes in the sedimentary basin setting of the South Pyrenean Foreland Basin (SPFB) that occurred during the Pyrenean phase of the Alpine orogeny (Late Cretaceous to Miocene). For this purpose students have to log and describe the facies variations (including sedimentary structures and fossil content) of five key successions in the SPFB, and link their main observations to the tectonic framework of the Pyrenees and global climate change.

During this field trip students study a huge variety of sedimentary rocks and features associated with a broad range of depositional environments. Students will also gain knowledge on the various internal and external forcing mechanisms that determine sedimentation, such as Pyrenean tectonics, global climate change, sealevel variability, and autogenic sedimentary processes.

didactic approach / **research- and inquiry-based education** in an authentic context

Part II:

Key element: Workpackages
students are given research topics and analytical tools (e.g handheld XRF scanners):



1. Danian Cycles 2. PETM 3. K-T boundary 4. Flysch 5. Trace Fossils

This part of the fieldwork puts students into an authentic research context.



Small groups make this part highly flexible and allow different levels:
confirmation inquiry
structured inquiry
guided requiry
open/true inquiry

Depending on the level, students develop own research question, design their study and paln the procedure. At a lower level, the question is provided by the teacher and the procedure is given and a known result is confirmed by newly aquired data.



References:

Baceta, J., Pujalte, V., Wright, V.P. and Schmitz, B. (2011): Carbonate platform models, sea-level changes and extreme climatic events during the Paleocene-early Eocene greenhouse interval: a basin-platform-coastal plain transect across the southern Pyrenean basin. In: Pree-Meeting Field trips Guidebook, 28th IAS Meeting. Zaragoza (C. Arenas, L. Pomar and F. Colombo, Eds.). Sociedad Geológica de España, Geo-Guías, 7:151-198

Bernaola G., Baceta J.I., Payros A., Orue-Etxebarria X. and Apellaniz E. (eds.) 2006. The Paleocene and lower Eocene of the Zumaia section (Basque Basin). Climate and

