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Education and Qualifications

- >2015** **PhD Candidate, University of Leeds, School of Earth and Environment, UK**
Ongoing development of a research project that comprises the evaluation of the relative influence of tectonics, climate and eustasy in the preserved architecture of fluvial successions. Supervisors: Dr Nigel Mountney & Dr Luca Colombera
- 2012** **Diploma in Mining Exploration, Camiper & Mining Society of South Africa**
On-line Diploma (7 months) on geological and geophysical techniques implemented in mining prospecting and exploration. GPA: 18.67/20.00.
- 1995 – 2003** **BSc Geology, National University of Colombia. GPA: 4.0/5.0**
The final project comprised geological mapping, stratigraphic surveying and petrographic description of Early Cretaceous marine sedimentary rocks in the Western Andes of Colombia.

Employment History

- 2006 – 2014** **Geologist - Petrographer (Colombia)**
Petrographic description and acquisition of mineralogical and textural data from thin sections of sedimentary and crystalline rocks and preparation of written reports.
- 2007 – 2014** **Exploration geologist (Colombia)**
Geological mapping, sedimentological descriptions, mining sampling, interpretation of seismic data and wireline logs and preparation of stratigraphic sections and written reports.
- 2002 / 2005 / 2009** **Data Management (Colombia)**
Compilation, review and classification of technical information from the documental and lithological collections of different Colombian state companies.
- 1999 – 2000** **Teaching assistant (Colombia)**
Assistant in laboratory practices and organisation of thin sections and rock samples collections in the Petrography Laboratory of the National University of Colombia (Bogotá).

Short Courses

- 2015** Safety and leadership in fieldwork, British Sedimentological Research Group (UK)
- 2014** Petrel Fundamentals, Schlumberger (Colombia)
- 2012** ArcGIS Desktop, Prosis (Colombia)
- 2009** Wireline log interpretation, National Hydrocarbons Agency (Colombia)

Awards & Funding Sources

- 2015 – 2016** Beneficiary of Colfuturo's academic loan to best Colombian professionals (USD 50,000)
This loan covers the tuition fees at the University of Leeds.
- 2015** Fluvial Research Group – Support used for 2015 fieldwork (GBP 2,500)
- 2015** AAPG Foundation – Support used for 2015 fieldwork (USD 1,500)
- 2015** IAS Grant – Support used for 2015 fieldwork (EUR 1,000)

Recent Publications & Presentations

- Colombera L., Mountney N. P., Plink-Björklund P., Arévalo O. J. (submitted) Climate change and the response of river landscapes: insights from the sedimentary architecture of fluvial systems at the Paleocene-Eocene Thermal Maximum. *Earth-Science Reviews*, in review
- Arévalo, O. J., Mountney, N. P. & Colombera, L., (2015): Stratigraphic heterogeneity induced by allogenic and autogenic factors in a Paleogene low net-to-gross fluvial succession, Tremp-Graus Basin, southern Pyrenees, Spain. BSRG 54th Annual Meeting, Keele, UK.
- Colombera L., Mountney N. P., Arévalo O.J. (2015) Climate change and the response of river landscapes: insights from the sedimentary architecture of fluvial systems across the Paleocene-Eocene boundary. BSRG 54th Annual Meeting, Keele, UK.
- Colombera L., Mountney N. P., Plink-Björklund P., Arévalo O. J., McCaffrey W. D. (2015) Climate change and geomorphic evolution: insights from meta-analysis of the sedimentary architecture of fluvial systems across the Paleocene-Eocene boundary. IAS International Meeting of Sedimentology 2015, Krakow (Poland), 22-25 June 2015.

Stratigraphic heterogeneity induced by allogenic factors in a Paleogene low net-to-gross fluvial succession, Tremp-Graus Basin, Spain

Introduction

The preserved sedimentary record of fluvial successions is governed by the interaction of one or more principal allogenic factors: tectonics, climate and eustasy (Catuneanu, 2006; Miall, 2013 and references therein). These factors are interdependent and their effects, in many cases, can be superimposed; consequently, discriminating their relative roles is not straightforward. For recent deposits, implementation of different radiometric, isotopic and palaeontological tools to constrain climatic, sea-level and tectonic changes can assist in evaluation of the relative roles of allogenic factors. However, in ancient deposits, where the accessible information is more limited, this task is more complex (Shanley and McCabe, 1998).

The approach of this project involves the acquisition of quantitative and qualitative sedimentological data from synorogenic Paleogene fluvial deposits of the Tremp-Graus basin, in the Arén-Esplugafreda sector, located in the central southern Pyrenees (Spain). The study of these deposits, informally known as 'upper red Garumnian', represents an ideal opportunity to evaluate the role of tectonics, climate and eustasy in controlling preserved fluvial architecture. Excellent time constraints exist for both the syn-sedimentary tectonic activity and the occurrence of climatic changes. Additionally, the regional and temporal context of the basin serves to constrain the extent and timing of eustatic influence. This improved understanding of extrinsic sedimentation factors, that will be the principal outcome of this research, will facilitate the interpretation of signatures present in the preserved lithological record of an ancient fluvial system in relation to these precursor allogenic drivers.

Geological setting

The central southern Pyrenees comprise an imbricate sequence of three east-west-trending thrust sheets (Ardevol, et al., 2000) which are, from top to bottom, the Bóixols-Cotiella thrust sheet (Late Cretaceous), the Montsec-Peña Montañesa thrust sheet (Early Eocene) and the Sierras Exteriores thrust sheet (Middle Eocene to Early Miocene) (Fernández et al., 2012). The Bóixols-Cotiella thrust sheet itself comprises several imbricate thrust splays that are largely buried and become younger toward the foreland (Ardevol, et al., 2000). The Tremp-Graus Basin developed as a piggy-back basin in the footwall of this thrust sheet. However, during the time of deposition of most of the 'upper red Garumnian' in this basin, a very low shortening rate (< 0.5 mm/year) predominated (Verges et al., 2002). Consequently, accumulated fluvial deposits and coeval marine limestones (Ardevol et al., 2000) exhibit only mild deformation. Notwithstanding this, an increase in sediment supply and the occurrence of stratigraphic hiatuses in the uppermost part of the 'upper red Garumnian' succession can be associated with the precursory stage of emplacement of the Montsec-Peña Montañesa thrust sheet which commenced in the Late Paleocene (Fernández et al., 2012).

During the Paleocene, the Tremp-Graus Basin was mostly occupied by an orogen-parallel routing system (Whitchurch et al., 2011). However, some parts of the basin developed transverse drainage systems, a notable example being in the Arén-Esplugafreda sector where local uplift was related to growth of the Bóixols-Cotiella thrust sheet. Interfingering limestones in the Serraduy area (15 km west of Arén-Esplugafreda) record two episodes of marine transgressions which are dated as Early Thanetian and Late Thanetian (Pujalte et al., 2014). A stratigraphic discontinuity of regional extension between these limestones is described by Serra-Kiel, et al. (1994). The hiatus associated with this discontinuity corresponds to a sea-level fall, which is thought to equate to Chron C25 according to the Paleogene time scale of Ogg & Ogg, 2008). The occurrence of only reverse palaeomagnetic directions in the Esplugafreda section (López-Martínez et al., 2006) implies that non-deposition (associated with this sea-level fall) extended over much of the Tremp-Graus Basin, including areas of transverse drainage associated with tectonic uplift.

Isotopic analyses of samples from the 'upper red Garumnian' indicate the occurrence of a negative carbon isotopic excursion (CIE) corresponding to the Paleocene-Eocene Thermal Maximum (PETM) in the upper part of this unit (Domingo et al., 2009; Manners et al., 2013; Pujalte et al., 2014; Dawson et al., 2014). Palynological, lithological and geochemical analyses from different worldwide locations indicate that this thermal event coincided with a global transgression (Sluijs et al., 2008). Due to differences in the techniques implemented, and the occurrence of hiatuses in the sampled sections, there is no consensus about the specific stratigraphic position of the PETM in different localities of the Tremp-Graus Basin. In contrast to the underlying succession where channelised elements have restricted width, the stratigraphic interval corresponding to the PETM is characterised by a conglomeratic body several kilometres in width, named Claret Conglomerate (Pujalte & Schmitz, 2005). Observations from this project show that changes in palaeohydrological conditions interpreted from palaeosols in stratigraphic intervals correlative with the Claret Conglomerate. Such changes are interpreted as the result of an increase in precipitation related to the PETM.

Aim and objectives

The main aims of this study is to document the heterogeneity of a low net-to-gross fluvial succession by means of acquisition of quantitative and qualitative sedimentological data, and to explain these lateral and vertical changes in terms of well constrained allogenic drivers. Specific research objectives are as follows:

- Detailed sedimentological characterisation of the ‘upper red Garumnian’ in the Arén-Esplugafreda sector in order to interpret the sedimentary processes and depositional sub-environments that prevailed during the time of accumulation of this unit.
- Quantitative characterisation of the channelised-elements (apparent width, thickness, lithofacies and vertical separation) as a tool to identify stratigraphic trends in the preserved record that could be associated with particular allogenic events identified from the literature review.
- Identification of the relative roles of different allogenic drivers in the uppermost part of the ‘upper red Garumnian’, which records not only the onset of the PETM, but also a globally recognised transgression and possibly some incipient tectonic activity associated with the emplacement of the Montsec-Peña Montañesa thrust sheet.

Advanced work

During the first year of this project (2015) 130 channelised bodies were mapped by combined analysis of high-resolution orthophotographs and LiDAR DEM's, with field data comprising graphic logs and panels, photomosaics and GPS measurements. In excess of 300 m of stratigraphic sections have been measured (cm scale), and detailed thickness, lithofacies and palaeocurrent data for 33 channel bodies have been collected. Four channelised architectural-element types have been defined. In increasing order of width-to-thickness ratio, these have been termed: ribbon bodies, poorly channelised sheet-like bodies, compound bodies and amalgamated complexes. Preliminary results of this project were presented in the 2015 BSRG annual meeting. Additionally, abstracts have been submitted and accepted for posters presentations at the forthcoming AAPG/SEG International Conference and Exhibition (Barcelona) and AAPG Annual Convention and Exhibition (Calgary).

Award use

Funding is here sought specifically for a fieldwork season in the Arén–Esplugafreda sector with the objectives of acquiring additional quantitative data for the entire set of channelised elements and measuring additional continuous stratigraphic sections to constrain the vertical spacing of these bodies. This new field season is planned for May to June 2016 and the budget presented with this proposal would partially cover the travel and maintenance expenses during this fieldwork season. I am a self-funding student and therefore I am responsible for covering my tuition fees at the University of Leeds (paid by means of a loan granted by a Colombian institution) and of my own maintenance costs. During the first year of the project (2015), the fieldwork expenses were covered by the Fluvial Research Group (FRG) of the University of Leeds, (though no formal budget is provided by FRG for my project) and by grants awarded by the AAPG Foundation and the International Association of Sedimentologists (IAS). For this second year I have to find additional sources of funding to cover the remaining fieldwork. For the development of the project I make use of the educational and research resources available to me via the University of Leeds and academic support provided by the experienced geologists of the Fluvial Research Group.

Cited references

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Budget

Based on the experience from a previous fieldwork season in the Arén-Esplugafreda sector, the following table specifies the anticipated expenses during the forthcoming fieldwork in May-June 2016. These expenses correspond to the maintenance (accommodation and food) and travel costs (air tickets and local transportation) associated with this planned fieldwork season. The amount requested from BSRG is GBP 300. The balance will be covered by the applicant from his own funds.

Item	Item description	Unit cost (GBP)	Unit	Unit description	Total (GBP)
Air tickets	Total cost of tickets	75	2	tickets	150
Accommodation	Cost per night	45	30	nights	1,350
Food	Cost per day	20	30	days	600
Local transportation	-	-	-	-	150
TOTAL EXPENSES FIELDWORK MAY-JUNE 2016					2,250
<u>AMOUNT REQUESTED TO BSRG</u>					<u>300</u>