THE FIRST LATEST PIACENZIAN-GELASIAN FLUVIAL RECORD IN NORTHERN ITALY: INSIGHTS FROM THE ALESSANDRIA BASIN

ANDREA IRACE[1], GIOVANNI MONEGATO[1], EVDOKIA TEMA[2], EDOARDO MARTINETTO[2], DANIELE GIANOLLA[3], ELENA VASSIO[2], LAURA BELLINO[4], DONATA VIOLANTI[2]

[1] *Istituto di Geoscienze e Georisorse, CNR, via Valperga Caluso 35, 10125 Torino, Italy*
[2] *Dipartimento di Scienze della Terra, Università di Torino, Via Valperga Caluso 35, 10125 Torino, Italy*
[3] *Dipartimento di Scienze della Terra, Sapienza Università di Roma - Piazzale Aldo Moro 5, 00185 Roma, Italy*
[4] *Strada Carignano 25/2, 10024 Moncalieri (Torino), Italy*

The continental record of the late Piacenzian-Gelasian in northern Italy is poorly documented by field-based studies, mainly because of the incompleteness and/or coarseness of the studied sections [e.g., Carraro, 1996; Boano and Forno, 1999; Vigna *et al.*, 2010]. New integrated stratigraphic analyses (i.e.: sedimentary facies, gravel petrography, palaeomagnetic record, plant and fresh-water molluscs assemblages) in the southern margin of the Alessandria Basin, a large scale satellite syn-orogenic basin, located at the junction between the Alps and the Apennines, offer first insights into a late Piacenzian - Gelasian fluvial record, which appeared virtually undatable for the coarseness of most of the succession. In order to overcome this difficulty, we took the chance of the exceptional exposure of the lower part of fluvial succession in a gravel pit and for the first time in northern Italy we relied on detailed bio-magnetostratigraphic analyses of fine-grained abandoned channel fills, included in the fluvial deposits.

During the Pliocene-Pleistocene transition the Alessandria Basin experienced N-S shortening and was overthrusted to the north onto the Po Foreland Basin along the Apennine/Padane thrust front [Biella *et al.*, 1997; Piana, 2000]. In this contractional scenario, the sedimentary evolution of the basin was controlled by progressive tilting of the margins, related to the Alps and Apennine uplift, and ongoing subsidence in the depocenter. The sinsedimentary deformation produced an overall growth-syncline basin architecture, and progressive unconformities, punctuated by onlap terminations, at the basin margins [Bertotti and Mosca, 2009; Irace et al., 2010].

In the southern margin of the basin, the studied fluvial succession is gently inclined toward the N-NE. It is 25-30 m thick and is split by smooth basal angular unconformities (S1, S2 and S3) into three units (MRZ1, 2 and 3), which show internal decreasing dip values from the bottom (5°) to the top (1-2°), consistent with the growth strata geometry depicted by subsurface interpretations. MRZ1 and MRZ2 (shallow to confined braided systems) are restricted between 2.8 and 2.6 Ma from bio-magnetostratigraphic analyses. The overall stratigraphic framework indicates syntectonic deposition and erosion during the progressive uplift of the Alps and Apennines. However, the frequency of unconformities and sedimentary changes suggest the superposition of orbitally forced glacio-eustatic cycles to the tectonic deformation, which has its climax in the Gelasian, as revealed by the 450 ka to 600 ka long hiatus associated to S3. The subsequent deposition of MRZ3 (meandering systems), including a Gelasian magnetic reversal, points to the fading of tectonic activity.

In conclusion:

- multidisciplinary analyses document for the first time that in the Alessandria Basin coarse fluvial sedimentation started in the latest Piacenzian, after the climatic deterioration recorded at ca. 2.80 Ma [G10 in Lisiecki and Raymo, 2005].
- the late Piacenzian-Gelasian time bracket was interested by a long-lasting regional deformation phase related to the Alps-Apennine tectonics, that shaped an unconformity-bounded stratigraphy in the interposed Alessandria basin. The contribution of the contemporary global climate change can be even detected within the mainly coarse grained fluvial stack of this basin, but only in the late Piacenzian, while the tectonic climax had been overwhelming during the Gelasian. In this perspective, the tectono-sedimentary framework depicted for the Alessandria Basin shares good similarities with those of other synorogenic basins of the northern Apennine system: the hinterland Valdarno [Ghinassi et al., 2013] and Valdelsa Basin [Benvenuti et al., 2014] and the piggy-back Castell'Arquato Basin [Roveri and Taviani, 2003].
- the stratigraphic reconstruction marks important improvements on the knowledge of European continental biota: the carpoflora assemblage reflects the cooling after 2.8 Ma with persistent lack of humid thermophilous plant taxa of East Asian affinity and occurrence of several cool-tolerant extra-European taxa

(e.g. *Ampelopsis* cf. *ludwigii*, *Boehmeria lithuanica*, *Cryptomeria rhenana*); the fresh-water mollusc assemblage shows the occurrence of *Pomatias elegans* and *Tournouerina belnensis,* identified for the first time in the Pliocene of northern Italy.
- the present work provides a case study for the palaeoenvironmental reconstruction of the margins of continental basins, which correspond to highly dynamic belts connecting the drainage networks of orogenic systems to the depocenters.

Benvenuti, M., Del Conte, S., Scarselli, N., Dominici, S., (2014). Hinterland basin development and infilling through tectonic and eustatic processes: latest Messinian Gelasian Valdelsa Basin, Northern Apennines, Italy. Basin Research, 26, 387-402.
Bertotti, G. and Mosca, P., (2009). Late-orogenic vertical movements within the arc of the SW Alps and Ligurian Alps. Tectonophysics 475, 117–127.
Biella, G., Polino, R., De Franco, R., Rossi, P.M., Clari, P., Corsi, A., Gelati, R., (1997). The crustal structure of the western Po plain: reconstruction from integrated geological and seismic data. Terra Nova 9, 28–31.
Boano, P., and Forno, M.G., (1999). La successione "villafranchiana" nell'area di Castelnuovo Don Bosco (Asti). Il Quaternario 12, 161-194.
Carraro, F., (1996). The Villafranchian in the Villafranca d'Asti type-area: a revision. Il Quaternario 9, 5-120.
Ghinassi, M., Fidolini, F., Magi, M., Sagri, M., (2013). Depositional environments of the Plio-Pleistocene Upper Valdarno Basin (Tuscany, Italy). Italian Journal of Geoscience 132, 33-53.
Irace, A., Clemente, P., Piana, F., De Luca, D.A., Polino, R., Violanti, D., Mosca, P., Trenkwalder, S., Natalicchio, M., Ossella, L., Governa, M., Petricig, M., (2010). Hydrostratigraphy of the late Messinian-Quaternary basins in the southern Piedmont (northwestern Italy). Memorie Descrittive della Carta Geologica d'Italia 90, 133-152.
Lisiecki, L.E., and Raymo, M.E., (2005). A Pliocene-Pleistocene stack of 57 globally distributed benthic δ^{18} O records. Paleoceanography 20, PA1003. doi:10.1029/2004PA001071Piana, F., 2000. Structural setting of Western Monferrato (Alps-Apennines Junction Zone, NW Italy). Tectonics 19, 943-960.
Roveri, M., and Taviani, M., (2003). Calcarenite and sapropel deposition in the Mediterranean Pliocene: shallow- and deep-water record of astronomically driven climatic events. Terra Nova 15, 279-286.
Vigna, B., Fiorucci, A., Ghielmi, M., (2010). Relations between stratigraphy, groundwater flow and hydrogeochemistry in Poirino Plateau and Roero areas of the Tertiary Piedmont Basin, Italy, Memorie descrittive della Carta Geologica d'Italia 90, 267-292.