C-3 MIOCENE VALLEY FILLED NETWORK IN THE RHODANIAN-PROVENCAL BASIN, INFLUENCE OF THE ALPINE FOREBULGE

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Introduction

The Rhodanian-Provencal Basin is the southernmost part of the Peri-Alpine Seaway developed during the Miocene from Austria to the Mediterranean Sea (Fig. 1). This basin is located in a peripheral or external domain of the Western Alps foreland basin. Flexural subsidence related to alpine thrust loading provides accomodation space. Usually, in many foreland basins, the basal flexural basin unconformity is very regular and corresponds either to a transgressive surface or to a pene-planation surface related to emersion prior to loading. In the study area the Miocene transgression, coming from the south, flooded and covered a highly complex pre-existing topography. One of the most striking features is the occurrence of deeply incised valleys, more than 150 meters deep, which were filled by marine Miocene Molasse deposits. These valleys are incised into different strata: basement (Fig. 2), Mesozoic carbonate/ clastic cover (Fig. 3) or Oligocene fluvio-lacustrine deposits, (Fig. 4) [Rubino *et al.*, 1998].This topography could result from a long term structural history and geomorphic inheritance, because the area has been successively affected by Late Cretaceous sub-aerial erosion, Eocene Pyrenean folding and subsequent erosion, Oligocene extension and finally a pre-Burdigalian / Serravallian erosion. We will seen that this final episode is the most important phase of erosion and could be related to the uplift and westward migration of the alpine fore-bulge.

Incised Valleys location

All the valleys are located at a certain distance from the Sub-alpine Front. They are known from northern Lyon till Avignon to the south (Fig. 1).However some of them are located in a more internal setting, for example along the Durance fault, located at 25 Km of the Digne Sub-alpine Front. Incised valleys are diachronically flooded from east to west; the youngest being flooded during Lower Serravallian Maximum Flooding - 15Ma - (Fig. 2) and the oldest at the base of the Burdigalian - 21Ma - (Fig. 4).

Timing of the incision

When these valleys are incised, either in the basement, (Fig. 2) or in the Mesozoic (Fig. 3), the timing of the incision is not well constraint, since the flooding section post-dated the incisions. For example the Vienne-Véga paleo-valley incised within the granite [David, 1967], is flooded by Serravallian tidal sandstone [Latreille, 1969; Rubino, 1985] or in the Valreas complexes the incision post dated the Eocene folding and predated the Burdigalian transgression [Lesueur *et al.*, 1990]. For this later case, the time lap could be 25 Ma.
However, at the end of the Oligocene, it appears that most of the reliefs have been flattened out as well as the adjacent "Centralian" basement, where a regular gently eastward dipping piedmont surface occurs [Mandier, 1988; Clauzon *et al.*, 1992]. This shows that the timing of this incision is already better constrained and that occurs during the Aquitanian time.
This timing is cross-checked in the areas where an Upper Oligocene continental section was incised, (Fig. 4), and the valley was subsequently flooded during Burdigalian time. This is the case in the Carpentras

sub-basin (Saumane and Fontaine-de-Vaucluse paleovalleys) where erosion takes place very rapidly and occurs between 27 Ma and 20 Ma.

Origin of the Incision

The depth of the incision, ranging between 100 to 150 meters, started from an initial surface (almost in equilibrium profile). This incision can not be only explained by the Aquitanian/Burdigalian eustatic sea level fall, since the area was never located far away from the bayline. The bayline was initially located near the Mediterranean coast during the Aquitanian and slowly shifted to the north first and later on towards the northwest from Burdigalian to Serravallian time [Demarcq, 1970]. It means that the incision was tectonically enhanced.

In most of the cases where growth folds are absent incisions need to be explained by another type of uplift. Taking into account the spatial distribution of the valleys, mainly at the periphery of the alpine foreland basin from Lyon to Avignon, and the timing of the incisions which fit very well to a significant westward migration of the Subalpine Front, at least in the northern Subalpine Ranges (Chartreuse), [Beck *et al.* (1998]. We strongly suggest that incised valleys are directly link to isostatic fore-bulge uplift and its westward migration. South of Lyon, the depth of the incision fits with the modelled uplift value (120 m), taking a 100 Km long flexured crust, roughly corresponding to the distance between the Alpine front and the bulge. For the most internal valleys, where the timing of the incision is similar, their location could be driven by local fault inversion.

Along the southernmost part of the basin, near the Mediterranean coastline, a possible interference between fore-bulge uplift and rift shoulder or isostatic uplift related to the opening of the Gulf of Lion may exist. On going studies will try to decipher the driving mechanism of these incisions.

References

Becq C., Deville E., Blanc E., Philippe Y., Tardy M. (1998) Horizontal shortening control of the Middle Miocene marine siliciclastic accumulation (Upper Marine Molasse) in the southern terminaison of the Savoy Molasse Basin (Northwestern Alps/Southern Jura). *In*: Mascle A., Puigdefàbregas C., Luterbacher H.P., Fernàndez M. (Eds) Cenozoic foreland basin of Western Europe. *Geol. Soc. London, Sp. Publ.134, pp. 263-278*

Clauzon G., Aguilar JP., Delannoy JJ., Guendon JL., Klein C., Mandier P., Michaux J., Rubino JL., Vaudour J. (1992) Génèse et Evolution du Piémont Néogène subalpin du Bas Dauphiné, *Travaux URA 903, CNRS,19, 78p.*

David L. (1967) La faune helvétienne des "Sables de Saint-Fons" (Miocène, Rhône). *Bull. Soc. Linn. Lyon*, 36, 1, pp. 9-13

Demarcq G. (1970) Etude Stratigraphique du Miocène Rhodanien, *Mém.BRGM, 61, 257p.*

Latreille G. (1969) La sedimentation détritique au Tertiaire dans le Bas-Dauphiné et les régions limitrophes. *Doc. Lab. Géol. Fac. Sci. Lyon*, 33. 254 p.

Lesueur JL., Rubino JL., Giraudmaillet M. (1990) - Organisation et structures internes des dépôts tidaux du Miocène rhodanien. *Bull. Soc. géol. Fr., Paris, sér. 8, t. 6, n° 1, pp. 49-*

Mandier P. (1988) Le relief de la moyenne vallée du Rhône au Tertiaire et au Quaternaire. Essai de synthèse paléogéographique. *Doc. BRGM,* 151, 654 p.

Parize O., Rubino JL., Javaux C., Fonta O., Clauzon G. (1998) Large scale valley fill complexes along the western margin of the alpine foreland: the example of Miocene Carpentras basin, (SE France) , *IAS international Congress, Alicante, Abstract*

Rubino (1985) - Sedimentary facies of Tertiary molasse of Bas-Dauphiné, Southeast France. In: *Intern. Symposium "Foreland basins", Fribourg, Suisse. Abst., p. 111.*

Rubino JL., Parize O., Javaux C., Fonta O., Clauzon G. (1998) Stratigraphical organization of large scale valley Fill complexes along the southwestern margin of the Alpine foreland. In: *"Strata and sequences on shelves and slopes" SEPM-IAS Meeting Catane, Abstract*