Chronostratigraphy of the lower Guadalquivir Basin: an update and future challenges

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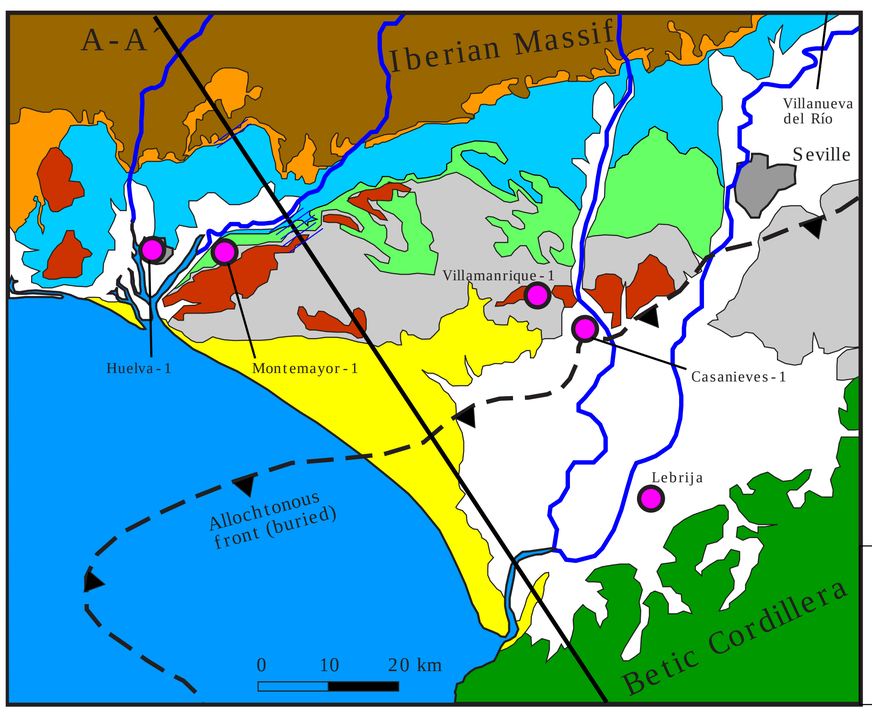
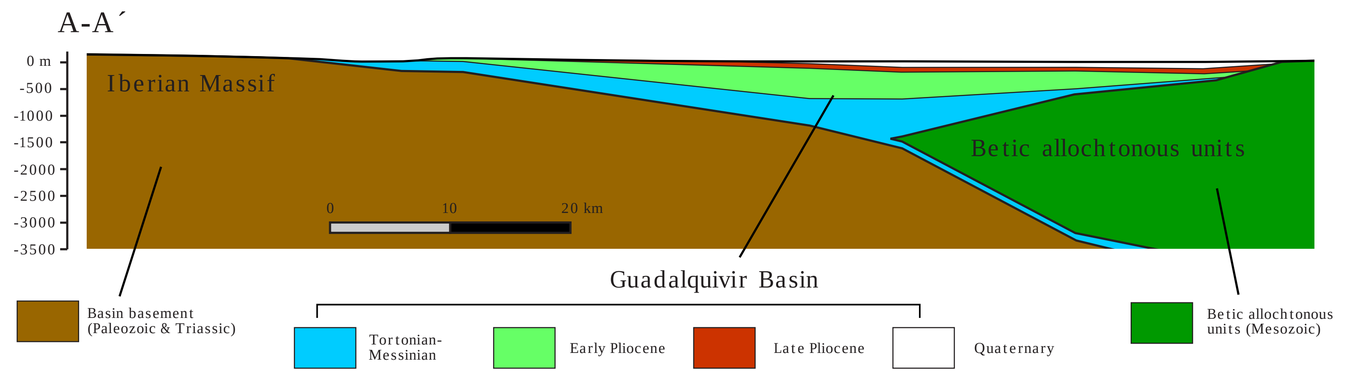
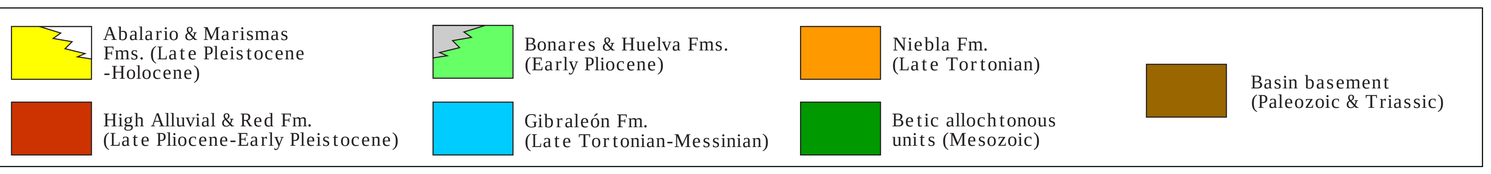
Figure 1. Geological sketch map and cross section of the LGB





The Guadalquivir Basin is an elongated foreland basin developed during the late Neogene at the foothill of the Betic Cordillera. Here we provide an update of the chronology of the sedimentary infill of its westernmost sector, the so-called lower Guadalquivir Basin (LGB). This update is used to identify chronological issues that need to be furhter improved.



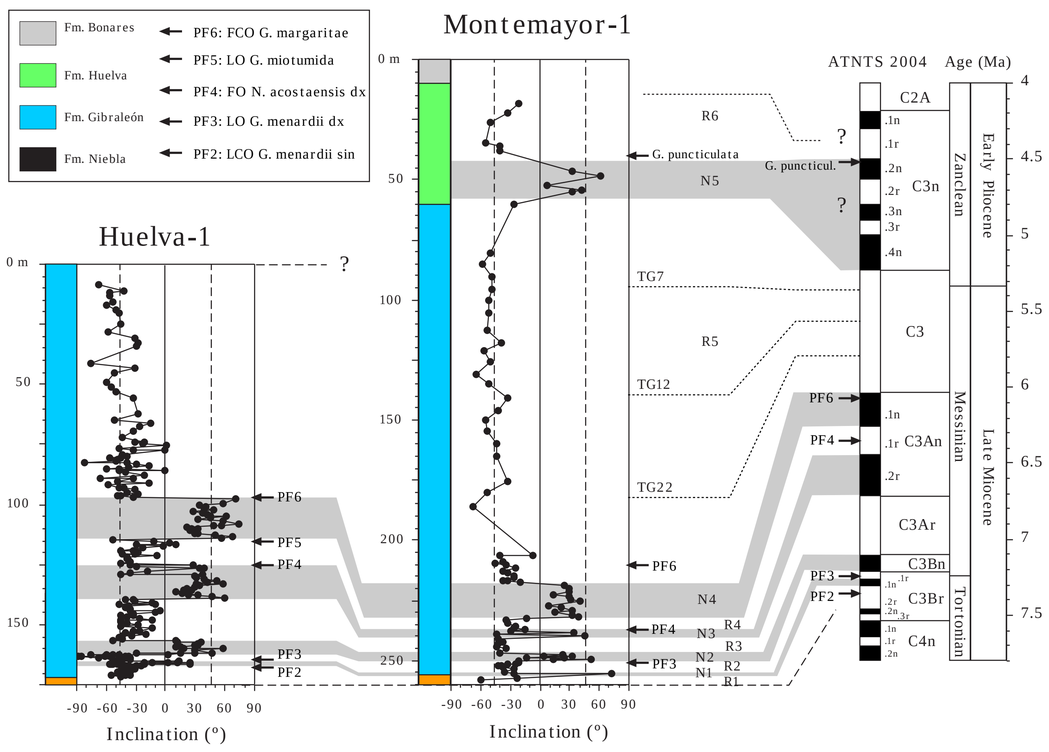


Figure 2. Magnetobiochronology of boreholes Huelva-1 and Montemayor-1

Magnetobiostratigraphic data from boreholes (see location in Figure 1) have constrained the onset of sedimentation in the northern LGB to Late Tortonian (ca 7.4 Ma) (Figure 2) (Larrasoaña et al., 2008), with marine sedimentation prevailing till the Early Pliocene as documented also in land sections (Sierro et al., 1996). Oxygen stable isotope data enable identification of stages TG7, 12 and 22 in the Montemayor-1 borehole, providing an improved chronological framework (Jiménez-Moreno et al., 2013). Cyclostratigraphic analyses in exploratory boreholes date the onset of marine deposition in the central part of the LGB to Late Tortonian (ca 7.8 Ma) (Figure 3), with continued marine sedimentation prevailing till the Early Pliocene (Ledesma, 2000). In the northernmost margin or the LGB, biostratigraphic constrains from land sections provide a coarse, yet consistent Late Tortonian age of <9.8 Ma for the onset of sedimentation in shallow marine-continental environments (Figure 4) (Pendón et al., 2004). Magnetostratigraphic data have provided the first chronology for the overlying fossil-barren continental sequence of the central LGB, dated as Late Pliocene to Early Pleistocene (ca 3.7-0.1 Ma) (Figure 5) (Salvany et al., 2011). This constraints the end of marine sedimentation to the end of the Early Pliocene (ca 3.7 Ma). Radiocarbon techniques date the final stages of sedimentation in transitional (marsh) environments as latest Pleistocene and Holocene (110-0 ka) (Figure 5) (Pozo et al., 2010; Salvany et al., 2011).

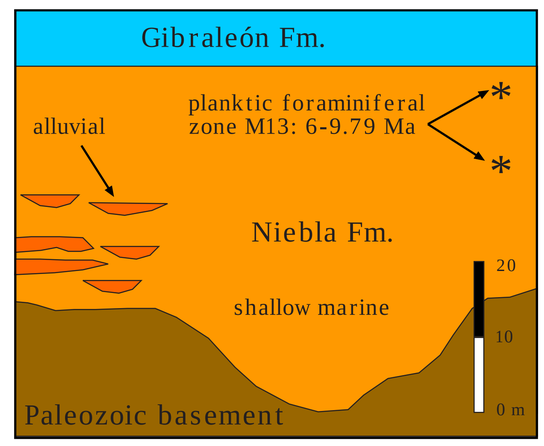


Figure 4. Biostratigraphy of the Villanueva del Río sections

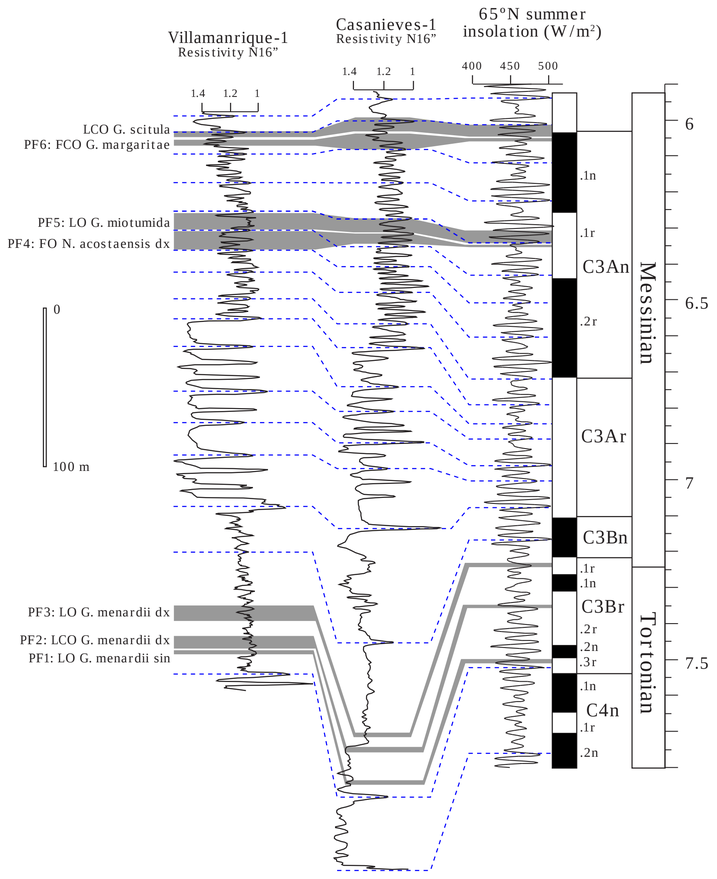


Figure 3. Astronomically-tuned chronology of boreholes Villamanrique-1 and Casanieves-1

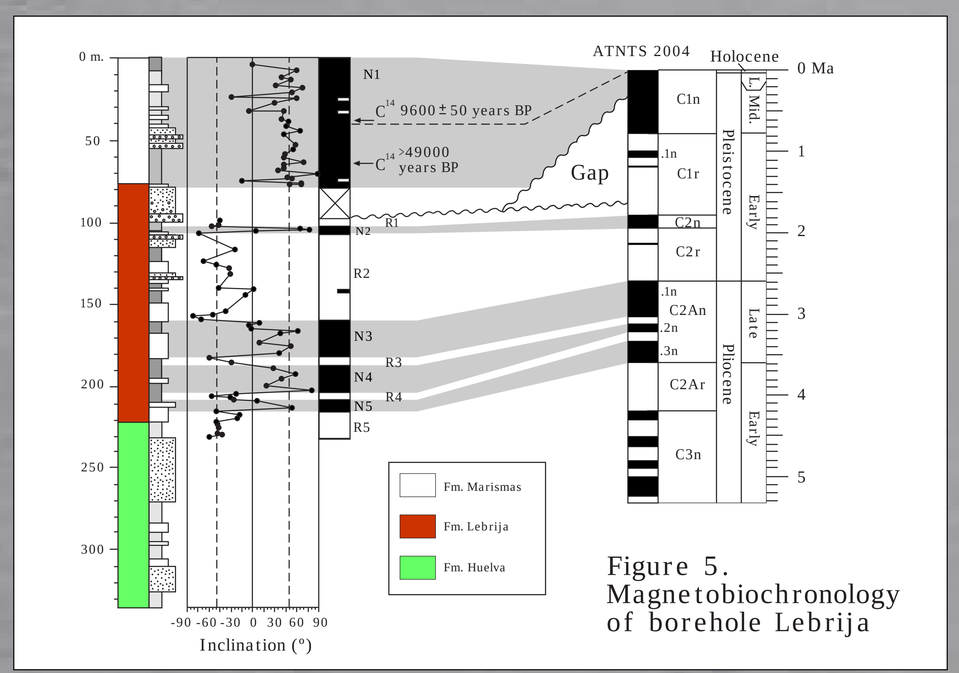


Figure 5. Magnetobiochronology of borehole Lebrija

This improved chronostratigraphic framework suggests continued sedimentation in the LGB with the exception of a sedimentary gap between 1.6 and 0.3 Ma. In the northern margin of the LGB, other smaller unconformities appear to record the tectonic evolution of the Betic Cordillera. The following issues need to be readdressed: 1) the precise chronology of the onset of sedimentation in the basin as recorded in land sections. This will be addressed by combining magnetostratigraphic and biostratigraphic data; 2) the precise chronology of marine sedimentation. This will be tackled combining magnetostratigraphic, biostratigraphic and cyclostratigraphic techniques; and 3) the extent and duration of the major sedimentary hiatus identified in the Quaternary sequence. This will be addressed by combining magnetostratigraphic data and amino acid racemization of ostracod shells. An improved knowledge on the chronostratigraphy of the basin infill will be the starting point for disentangling the role of tectonic and climatic processes in the sedimentary evolution of the LGB.