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The River Orontes in Syria and Turkey: Downstream variation of fluvial archives in different crustal blocks

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ABSTRACT

The geomorphology and Quaternary history of the River Orontes in western Syria and south-central Turkey have been studied using a combination of methods: field survey, differential GPS, satellite imagery, analysis of sediments to determine provenance, flow direction and fluvial environment, incorporation of evidence from fossils for both palaeoenvironments and biostratigraphy, uranium-series dating of calcrete cement, reconciliation of Palaeolithic archaeological contents, and uplift modelling based on terrace height distribution. The results underline the contrasting nature of different reaches of the Orontes, in part reflecting different crustal blocks, with different histories of landscape evolution. Upstream from Homs the Orontes has a system of calcreted terraces that form a staircase extending to ~200 m above the river. New U-series dating provides an age constraint within the lower part of the sequence that suggests underestimation of terrace ages in previous reviews. This upper valley is separated from another terraced reach, in the Middle Orontes, by a gorge cut through the Late Miocene–Early Pliocene Homs Basalt. The Middle Orontes terraces have long been recognized as a source of mammalian fossils and Palaeolithic artefacts, particularly from Latamneh, near the downstream end of the reach. This terraced section of the valley ends at a fault scarp, marking the edge of the subsiding Ghab Basin (a segment of the Dead Sea Fault Zone), which has been filled to a depth of ~1 km by dominantly lacustrine sediments of Pliocene–Quaternary age. Review of the fauna from Latamneh suggests that its age is 1.2–0.9 Ma, significantly older than previously supposed, and commensurate with less uplift in this reach than both the Upper and Lower Orontes. Two localities near the downstream end of the Ghab have provided molluscan and ostracod assemblages that record somewhat saline environments, perhaps caused by desiccation within the former lacustrine basin, although they include fluvial elements. The Ghab is separated from another subsiding and formerly lacustrine depocentre, the Amik Basin of Hatay Province, Turkey, by a second gorge, implicit of uplift, this time cut through Palaeogene limestone. The NE–SW oriented lowermost reach of the Orontes is again terraced, with a third and most dramatic gorge through the northern edge of the Ziyaret Dağı mountains, which are known to have experienced rapid uplift, probably again enhanced by movement on an active fault. Indeed, a conclusion of the research, in which these various reaches are compared, is that the crust in the Hatay region is significantly more dynamic than that further upstream, where uplift has been less rapid and less continuous.

1. Introduction

The Orontes ('Asi' in Arabic) is the principal river draining to the Levant coastline of the Mediterranean Sea. From its source in the Bekaa Valley of Lebanon, on the flank of the Lebanon mountain range,

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it flows northwards across western Syria through the cities of Homs and Hama and into Hatay Province, southern Turkey, before turning sharply south-westward to reach the sea ~30 km downstream of Antakya (Fig. 1). In north-west Syria the Orontes forms the axial drainage of the Ghab Basin, a linear valley marking the Dead Sea Fault Zone (DSFZ), the boundary between the African plate (to the west) and the Arabian plate (to the east), along which left-lateral relative plate motion is accommodated (Fig. 1). Upstream of the Ghab Basin, the terrace sequence of the Middle Orontes has been well documented, largely on account of attention from archaeologists interested in its Palaeolithic contents (e.g. Burkhalter, 1933; Modderman, 1964; Clark, 1966a, b, c, 1967, 1968; Van Liere, 1966; Besançon et al., 1978a, b; Besançon and

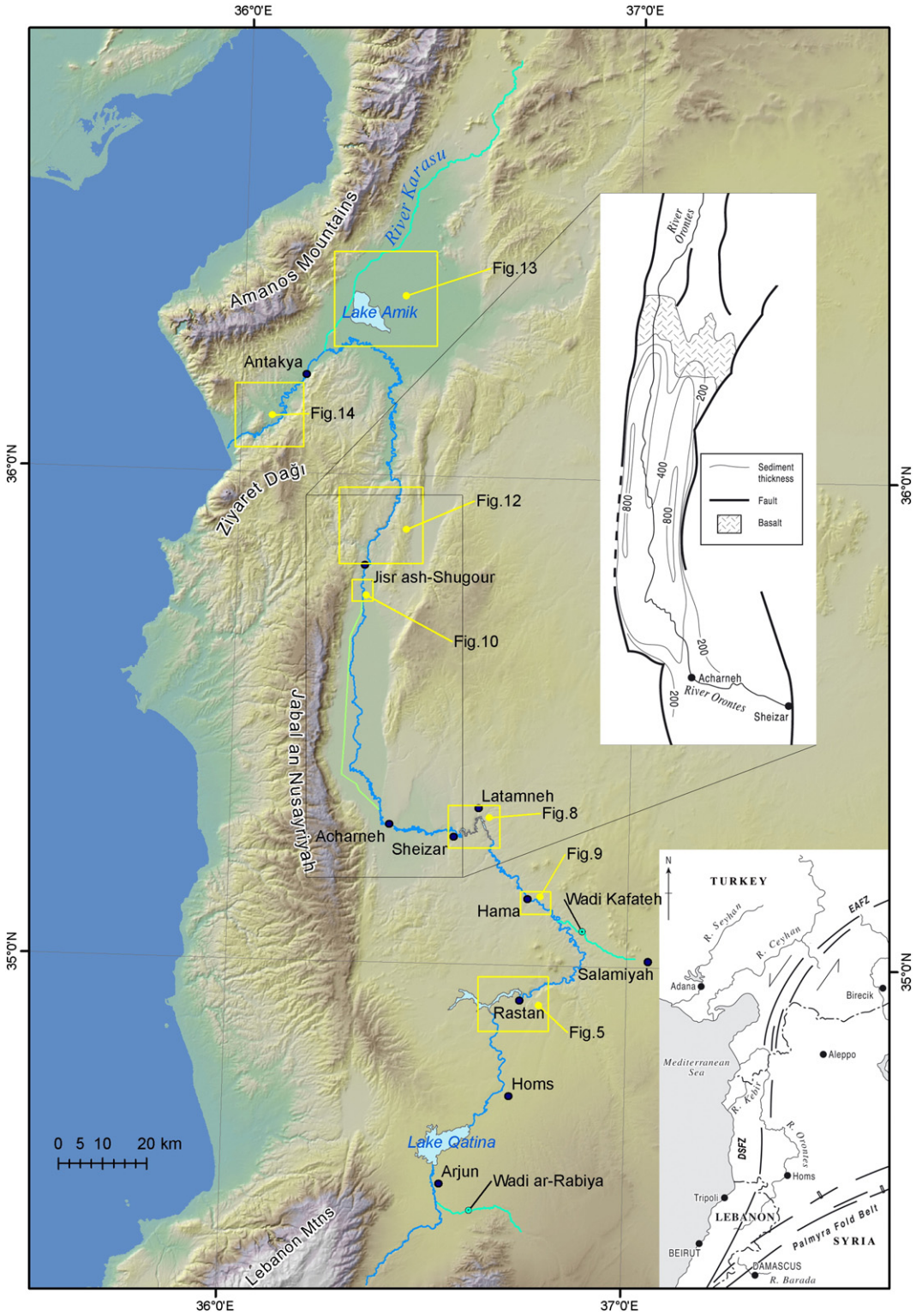

Fig. 1. Course of the Orontes in relation to topography (main image, a DEM derived from SRTM) and structural setting (lower inset). Locations are shown of places described in the paper and of other figures. Abbreviations: DSFZ = Dead Sea Fault Zone; EAFZ = East Anatolian Fault Zone. The upper inset shows the fault control and sediment thickness of the Ghab Basin.