

# Upstream prolongation of Messinian canyon in the Rhone system and its tributaries

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The first 3D map of the Messinian Rhone River did not go upstream of Valence city because of data consistency. By reevaluating all available data, we can now propagate the Messinian incision 150 km northward up to the Jura and Chartreuse ranges. As in the South, present-day river network is superimposed on the incision, except in places where rivers realized epigenesis during the Late Pliocene. This is evidenced in the Saint-Désirat meander as well as near Vienne where in both places Pliocene marine sediments rest over the basement. Further North as shown by Mandier and Ballesio the Rhone valley runs into the Garon River. Northward, in Lyon, recent works confirm the Russo's views and a major incision into the basement up to 0 m of elevation is proved, 250/320 m beneath the pre-Messinian interfluves. Upstream of Lyon, seismic and electric profiles, and spot outcrops where marine Pliocene occurs tend to show that the valley partly occupied the trace of the Ain River. The valley reached Ambérieu, where boreholes provide marine microfossils just in front of the "Cluse des Hôpitaux", a major valley cut through the Jura Ranges. Therefore, it is tempting to consider this major valley, which is out of scale from the present-day Albarine Stream, as the result of the Messinian incision of the Rhone River as suggested by Clauzon a long time ago. Ultimately BRGM maps suggest an incision down to the Génissiat Dam. Regarding the eastern tributaries flowing from the Alps, incision seems to run 50 km landward such as the Bievre and its tributaries that go up to the Chartreuse Front where marine Pliocene has been reported in two wells, Paladru and Saint-Ondras. In this respect, we assume that the Cluse de l'Isère is not only the product of a glacial incision but was predated by a Messinian one, as revealed by two seismic profiles, one close to Grenoble where a double erosion is imaged and another one downstream near Romans where an incision 400m deep can be easily propagated 50 km upstream. The Northward extension of the Saone and Rhine Messinian rivers is not yet solved because of a lack of good data and a consistent age model, however preliminary boreholes analysis seems to show that Pliocene is encased within Miocene. Meanwhile we significantly update the initial mapping in the northern part of the Rhone system and the regressive erosion unsurprisingly propagates far landward in agreement with the huge Messinian sea-level fall like for the others large peri-Mediterranean rivers such as the Nile and the Shabi system.