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Pierre Voinchet, Jean Airvaux, David Hérissou, Cédric Beauval, Pierre Antoine, et al.. ESR dating of the Clain alluvial deposits at Saint-Georges-Lès-Baillargeaux (Vienne, France). Geological and archaeological implications. Quaternaire 12, Feb 2020, Paris, France. . hal-02471060

HAL Id: hal-02471060

<https://hal.science/hal-02471060v1>

Submitted on 7 Feb 2020

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ESR dating of the Clain alluvial deposits at Saint-Georges-Lès-Baillargeaux (Vienne, France) Geological and archaeological implications.

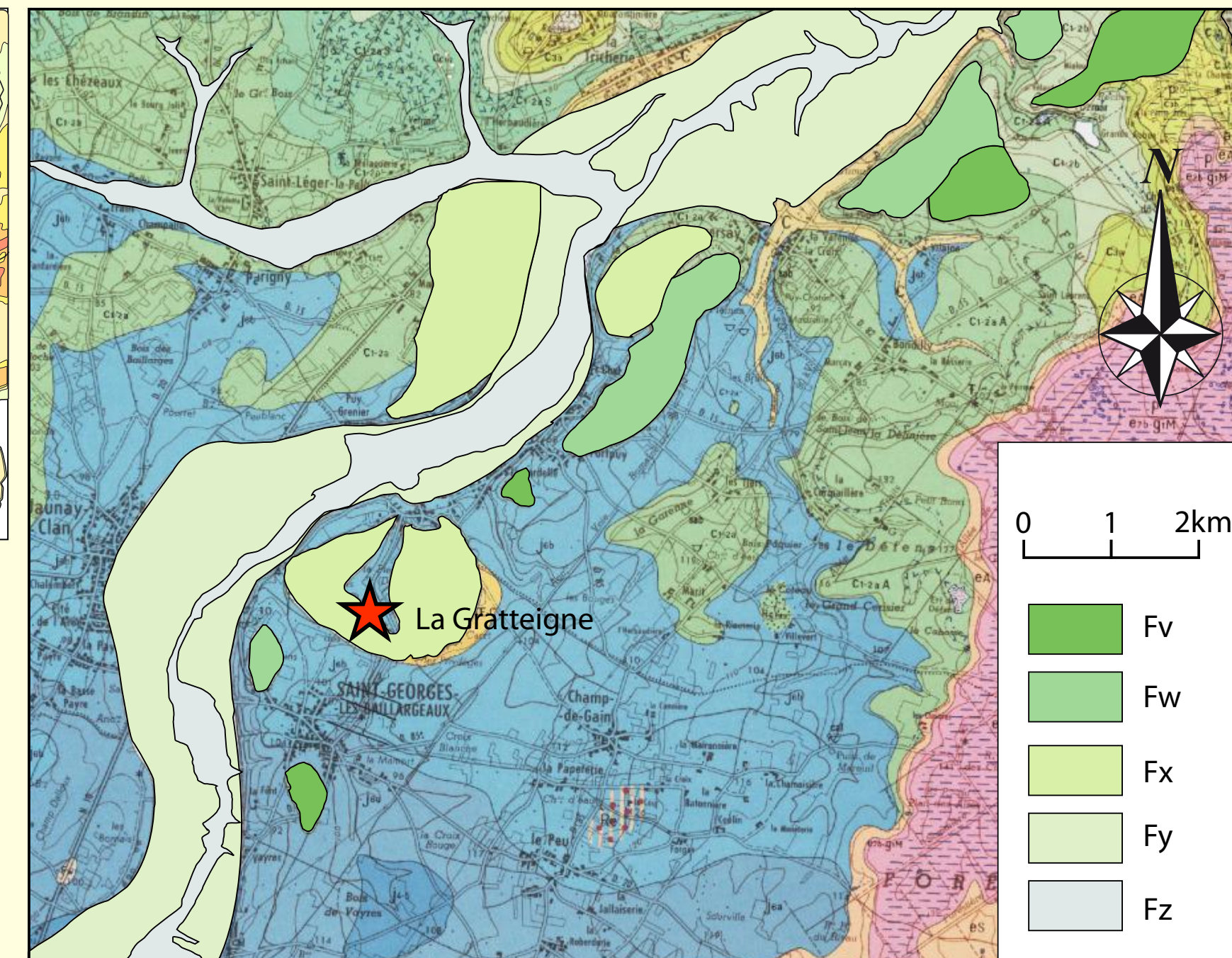
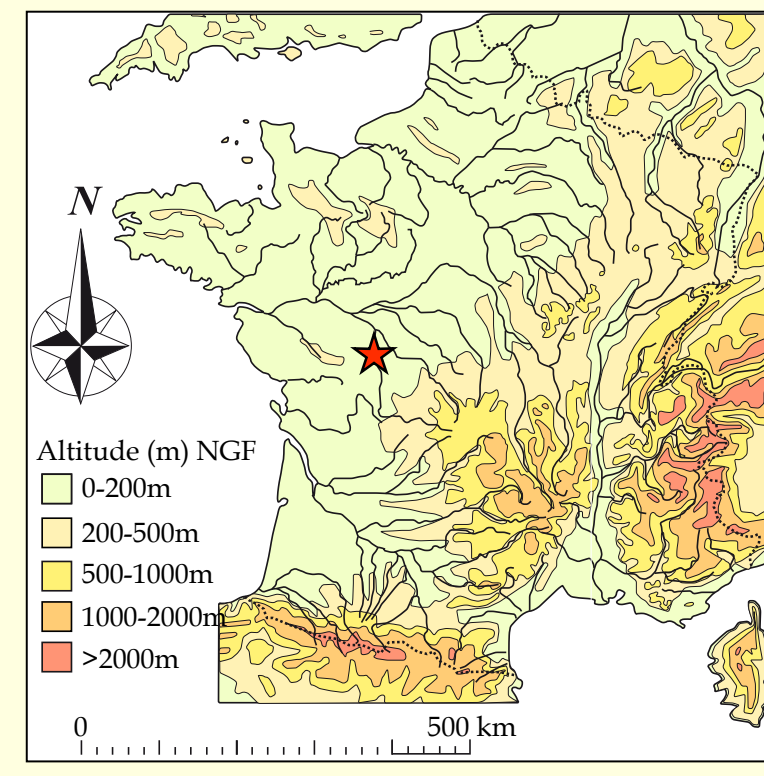
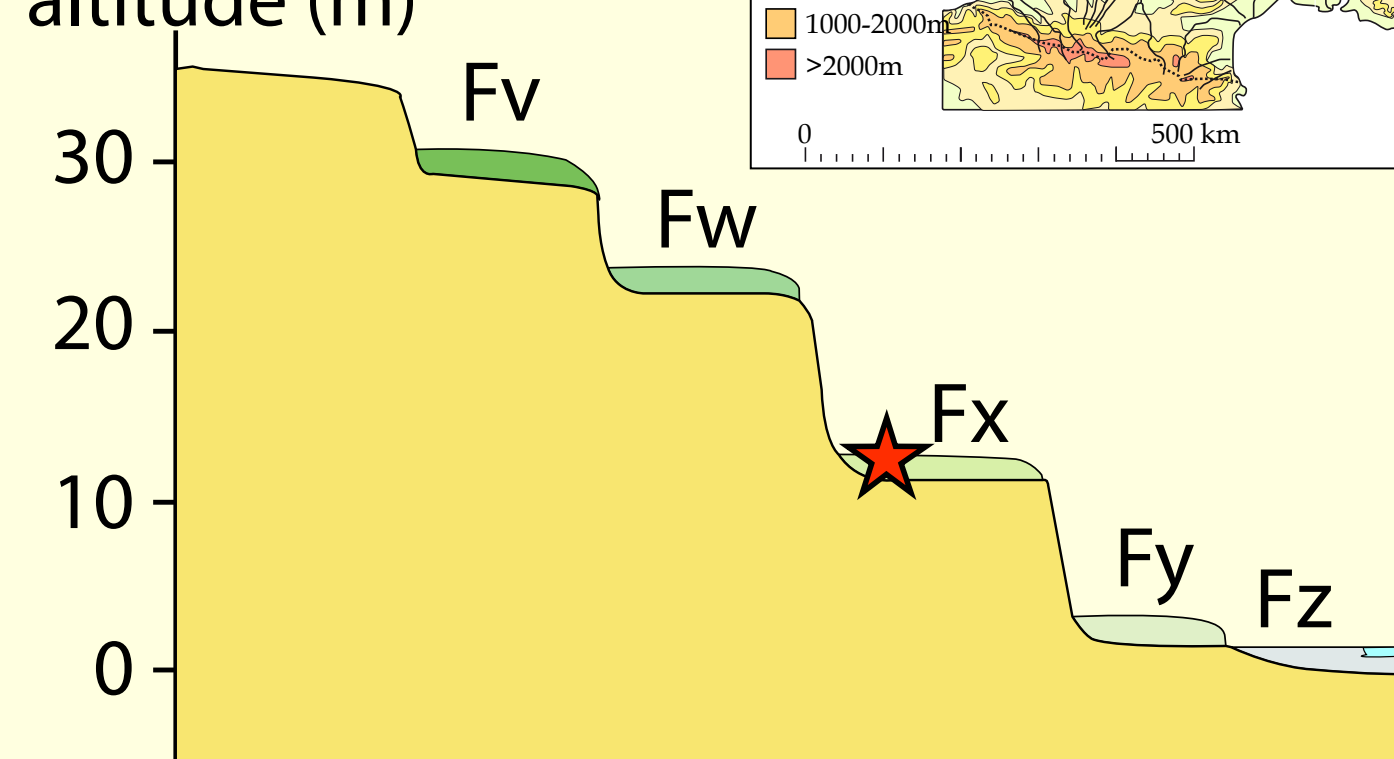
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Introduction

The establishment of a system of at least four fossil alluvial terraces staged during the Quaternary is attested in the valley of the Clain, a tributary of the Vienne, and several witnesses are still visible in the landscape. Alluvial deposits from one of these terraces are located in the commune of St Georges-les-Baillargeaux, at the place called "la Gratteigne" in a Clain palaeomeander. Due to its relative altimetry, this vestige of the alluvial sheet has been attributed to the Fx sheet of the fluvial system. It was exploited as a sandpit for nearly a century and many lithic industries were discovered throughout the extraction work. These industries, both Acheulean, were saved and studied by an amateur researcher, Maurice Taillet, and are today deposited in the Sainte-Croix Museum in Poitiers. This alluvial formation was the subject of a geological and archaeological study between 2015 and 2018, as part of an operation led by Jean Airvaux and David Hérisson.

Relative altitude (m)



Sampling



During the 2015, 2016 and 2018 campaigns, we sampled sediment in the fine sand layers of several levels of alluvial deposits, as well as gamma radiation measurements using an Inspector Digidart (Ortec) for the ESR dating on optically bleached quartz.

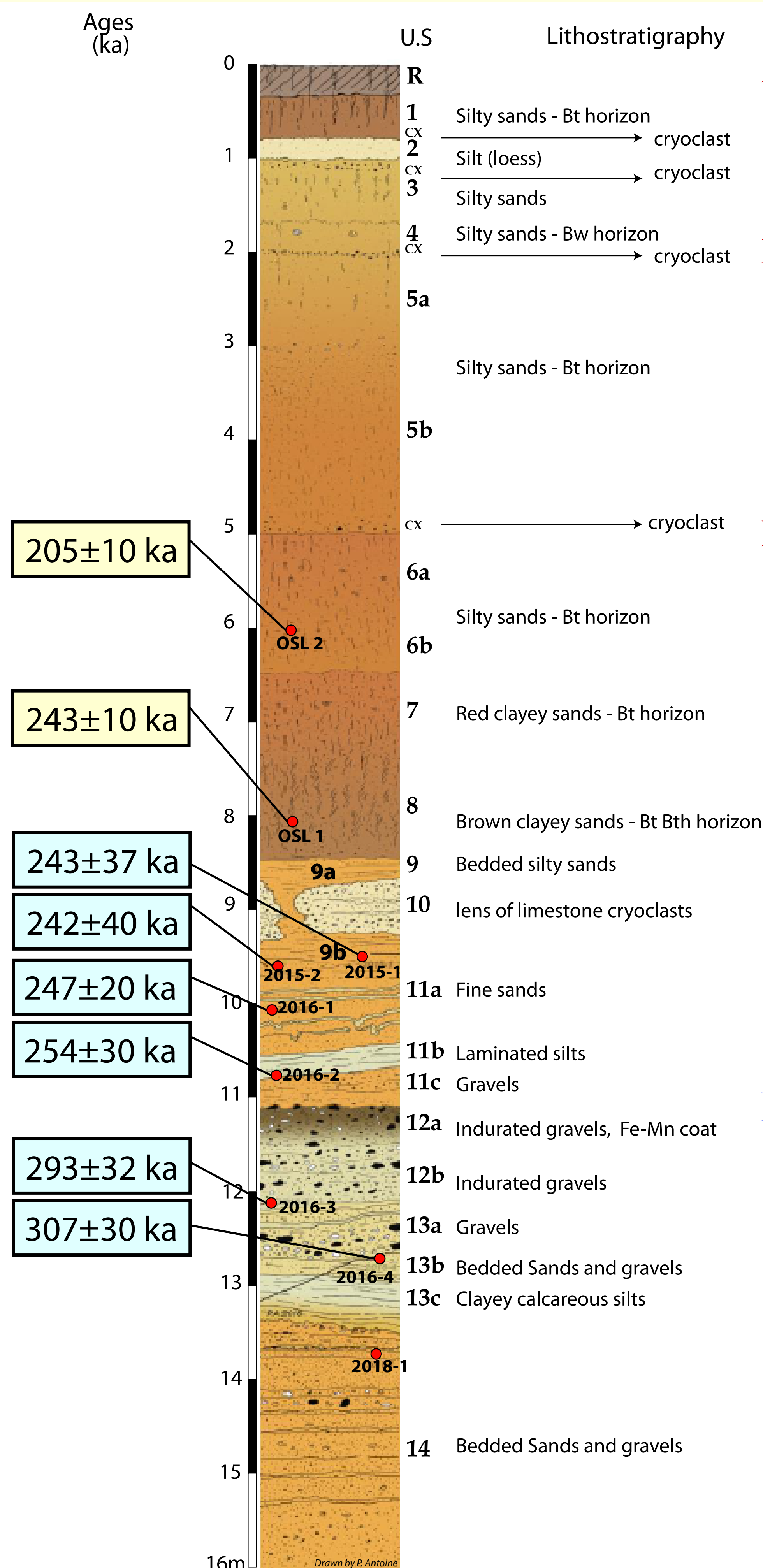


Several sediment samples were also collected from the cover levels for OSL dating and analysed by the Re.S.Artes laboratory.

Stratigraphy

Alluvial deposits at Saint-Georges-les-Baillargeaux were deposited in a Clain river paleomeander and were deposited during several phases. They are surmounted by important interglacial red soils and then by colluvial formations (periglacial solifluction and eolian deposits) from the beginning of a glacial phase. The alluvium underlying the interglacial soils forms a sequence of about 6 to 7 metres in thickness. The base of the sequence was not reached during excavation.

"La Gratteigne" synthetical section



Prehistory

Thanks to the efforts of an amateur researcher, Maurice Taillet, the alluvial formation of St Georges delivered from the 1940s and during almost half a century of Acheulean industries

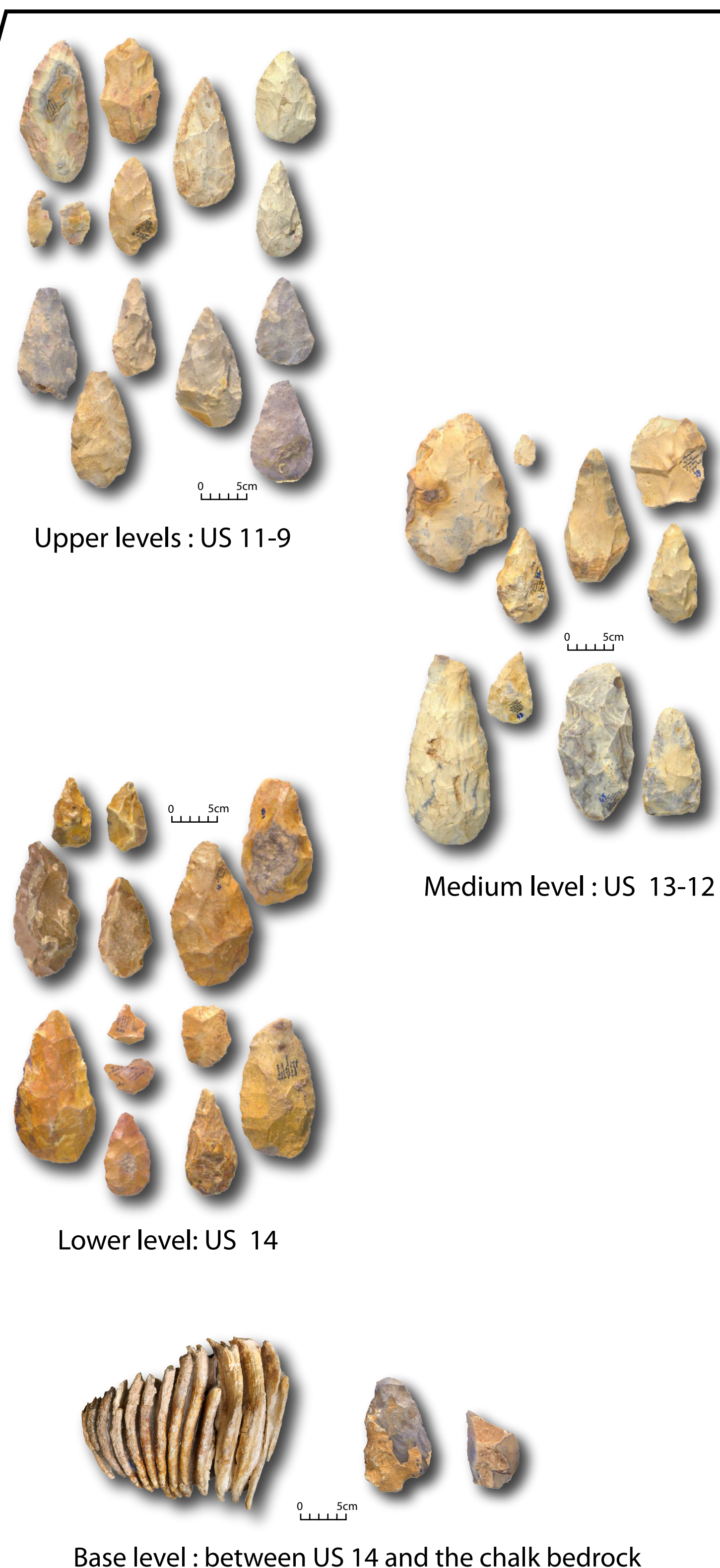
Three main levels groups have been individualized according to their position in the alluvial deposit stratigraphy, after the work of Maurice Taillet and after reinterpretations.

The lower group of levels contains highly rolled lithic artifacts that are clearly the result of the dismantling of older terraces. But it also contains a much less altered industry. It is composed of bifaces and flakes.

The medium group of levels contains a very well-preserved industry. It is composed of fine and some slender bifaces, sometimes very large (L > 250 mm) and typological cleavers and of possible Levallois and more variable flakes.

The upper group of levels consists of an industry attributable to an advanced phase of the Acheulean with much smaller bifaces than previous sets and very thin, slender and sharp trihedrons.

Outside these groups, a depression in the bedrock (river trough) at the base of the fill yielded a Proboscidian molar (species to be specified) and two flint artifacts.



ESR measurements and Results

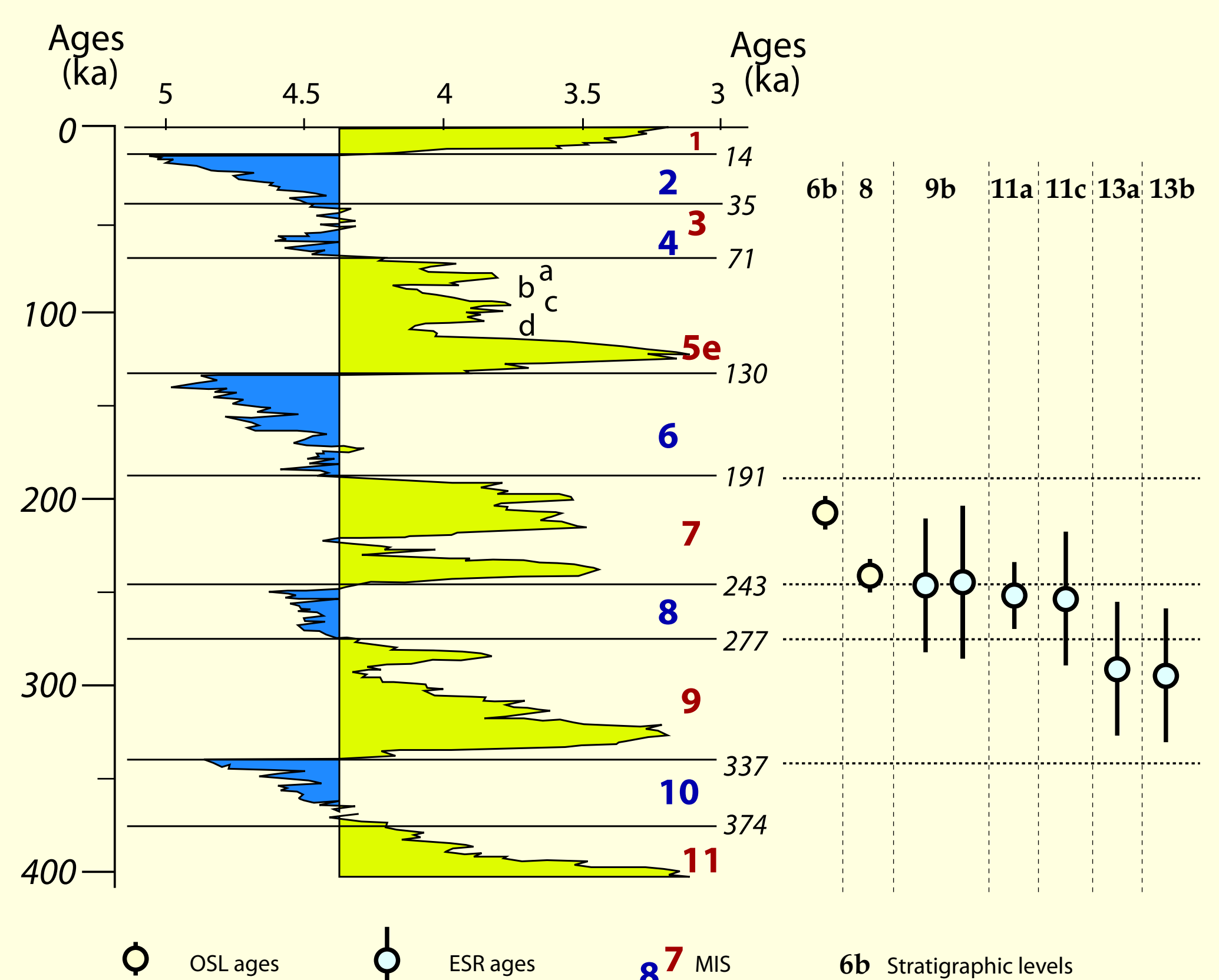
In this work, ESR analyses were made on 100–200 μm quartz grain, using the aluminium-center (Al-center) and titanium-lithium center (Ti-Li center). Quartz is separated using a chemical and physical protocol already detailed in the literature (Yokoyama et al., 1985; Voinchet et al., 2004). De have been determined by "additive dose method". Irradiations were performed using a ⁶⁰Co source (CENIEH, Spain). Nine aliquots have been submitted to doses ranging between 200 and 12,000 Gy. The determination of the proportion of non-bleachable deep centre (DAT) is realized with a solar simulator SOL2. ESR measurements were performed at the temperature of liquid nitrogen with a Bruker EMX spectrometer using the experimental conditions proposed by Voinchet et al. (2004). Equivalent doses (De) were then determined from the obtained ESR intensities vs doses growth curve using an exponential-linear function (Duval et al., 2009; Voinchet et al., 2013) with Microcal Origin Pro 8 software with 1/l² weighting.

$$I(D) = I_{sat} (1 - e^{-D_0(D+De)}) + B(D + De)$$

Water contents (W%) were estimated by the difference in mass between the natural sample and the same sample dried for a week in an oven at 50°C (323.15 K). Dose rates were determined using dose rate conversion factor updated by Guerin et al. (2011). Alpha and beta attenuations estimated for the selected grain sizes from the tables of Brennan (2003); k-value of 0.15 (Yokoyama et al., 1985), cosmic dose rate calculated from the equations of Prescott & Hutton (1994). For St Georges site, Al and Ti results agree with 1σ and it is possible to calculate weighted average ages combining these different ESR centres. These mean ages are calculated using IsoPlot3.0 (Ludwig, 2003).

Sample	Level	ESR center	Dα μGy/a	Dβ μGy/a	Dγ μGy/a	Dcosmic μGy/a	Da μGy/a	De Gy	Ages ka	Mean age ka
SGB 1501	9b	Al	24±1	705±17	580±13	53±3	1361±22	333±25	245±22	243±37
		Ti-Li					328±35	241±38		
SGB 1502	11a	Al	24±1	710±17	580±14	49±2	1364±22	356±55	260±58	242±40
		Ti-Li					326±30	239±30		
SGB 1601	11c	Al	26±1	805±17	591±13	47±3	1469±25	367±46	250±28	247±20
		Ti-Li					359±43	244±24		
SGB 1602	13a	Al	26±1	675±17	602±14	44±2	1347±22	355±51	263±35	254±30
		Ti-Li					328±55	243±38		
SGB 1603	13b	Al	22±1	780±17	589±14	38±2	1428±36	431±25	302±20	293±32
		Ti-Li					406±35	284±21		
SGB 1604	13c	Al	24±1	725±18	637±15	36±2	1422±40	427±25	300±21	307±30
		Ti-Li					446±35	314±21		

ESR results obtained on quartz extracted from sediments. Analytical uncertainties and ages are given with ± 1σ.



Conclusions

The dating results show that the Clain paleomeander alluvial deposits at St Georges-les-Baillargeaux were deposited in several phases that can be globally attributed to MIS 8. The first phase (Fluvial 1: US 14 to 12), with ages between 261 and 337 ka (maximum age range given by the uncertainty domains of samples 2016-1 and 2016-2), seems to correspond to the transition between MIS 9 and MIS 8. The second phase (Fluvial 2: US 11 to 9) corresponds to the MIS 8, with a fluvial activity end of record around 247 ka. These alluvial deposits are surmounted by important red interglacial soils whose the two lowest levels (US 8 and 7) correspond, according to OSL dating and litho-stratigraphy, to MIS 7. These data make it possible to attribute an age of between 300 and 247 ka for the installation of the Fx (MIS 9/8) of Clain terrace and to make it correspond to the first phase of the Saalian.

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