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Interactive comment on "Uranium incorporation in fluorite and exploration of U-Pb dating" *by* Louise Lenoir et al.

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We warmly thank Dr. Troy Rasbury for her positive comments regarding our manuscript. The information about the oxidation state of U in fluorite from Round Top is taken from Piccione et al., 2019 (Section 4.1.2. Green Fluorite: "The U in fluorite was determined to be in the 6+ oxidation state by U M5-edge and L3-edge XANES"). In the preprint version of our manuscript, we intended to refer to Piccione et al., 2019, but the reference is indeed missing ("Recently, reported hexavalent uranium in fluorite from the Round Top Mountain in Texas (USA).", should be "Recently, Piccione et al., 2019 reported hexavalent uranium in fluorite from the Round Top Mountain in Texas (USA)."). We apologize for this missing reference and for the resulting confusion. In our study, uranium oxidation state was not measured. We have indeed speculated

that U was incorporated as U(IV) because the U-bearing fluorite growth band contains pyrite inclusions. We acknowledge that this hypothesis may be wrong, and introduce appropriate modifications in the revised version of our manuscript: 1/ "The transition between Flog1 and Flog2 can be explained by the development of a redox front, causing the reduction of U(VI) into U(IV). Theoretically, fluorite can incorporate U(IV) as UO2 and U(VI) as CaUO4 (Kröger, 1948; Recker, 1961). Recently, reported hexavalent uranium in fluorite from the Round Top Mountain in Texas (USA). " Is now replaced by: "The transition between Flog1 and Flog2 may be explained by the development of a redox front, causing uranium incorporation in the crystal lattice." 2/ We remove these two sentences below:

"These sulfur species are electron donors that can reduce U(VI) to insoluble U(IV), thus causing uranium precipitation (Bonnetti et al., 2015; Campbell et al., 2012; Yi et al., 2007). Alternatively, direct microbial reduction of U could also have occurred (Bhattacharyya et al., 2017; Lovley et al., 1991)"

3/ We modify our conceptual model in fig. 10. The hypothesis of U reduction mediated by H2S is removed. Please find below the revised figure:

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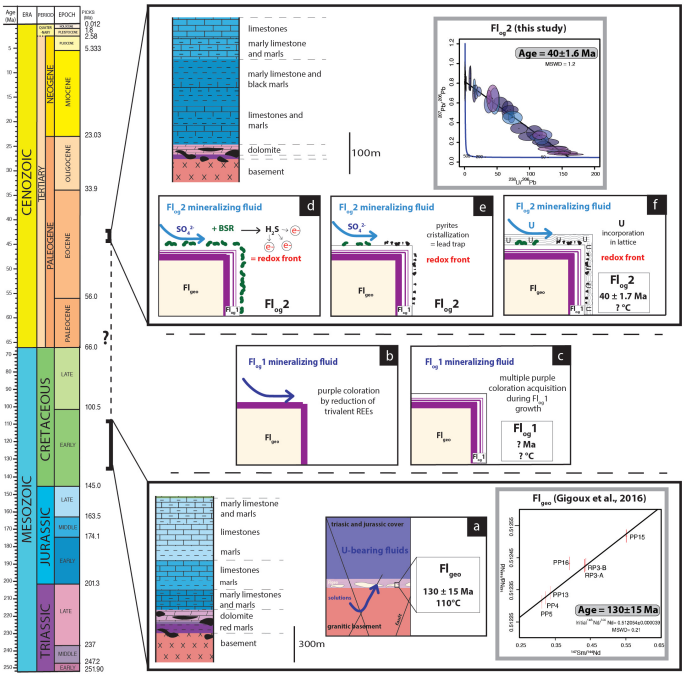

Fig. 10: Conceptual model of uranium incorporation in the fluorite lattice. a) Uranium is leached by F-rich solutions flowing through the granitic basement and reaching Flgeo in the basement/cover interface, b) formation of purple layers on the fluorite surface by F-bearing fluids, c) crystallization of Flog1, d) a local redox front is generated by BSR, e) sulfur species react with iron oxyhydroxides or dissolved Fe to form pyrite, f) uranium is incorporated in Flog2.

Fig. 1.