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## **Exploring uranium minor isotopes (U-233, U-236) as a new tracer to highlight uranium contamination downstream former uranium mine sites**

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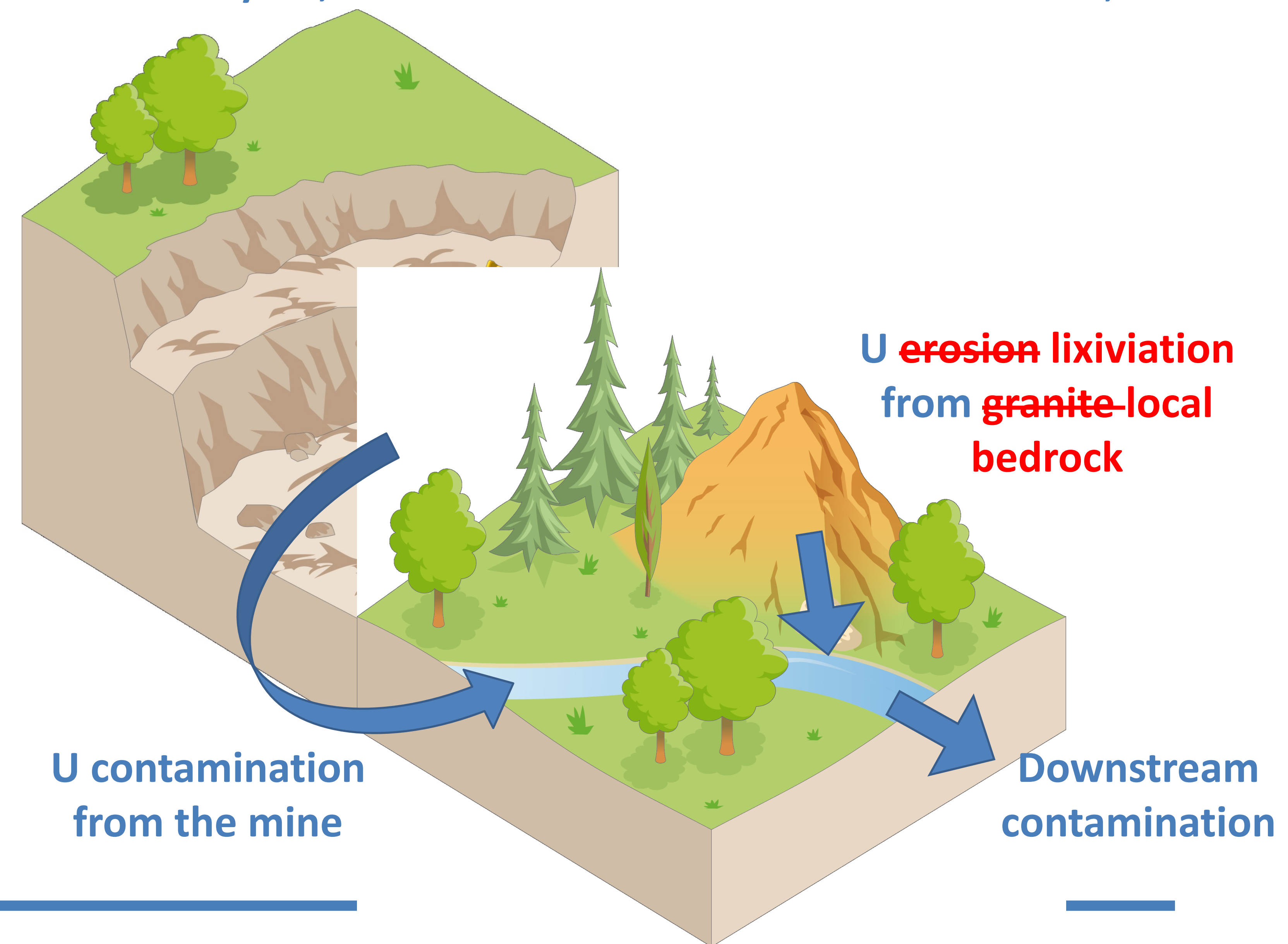
## Introduction:

- About 250 former U mines in France.
- Potential **U contamination dissemination** in the vicinity of **U mines by due to** extraction processes

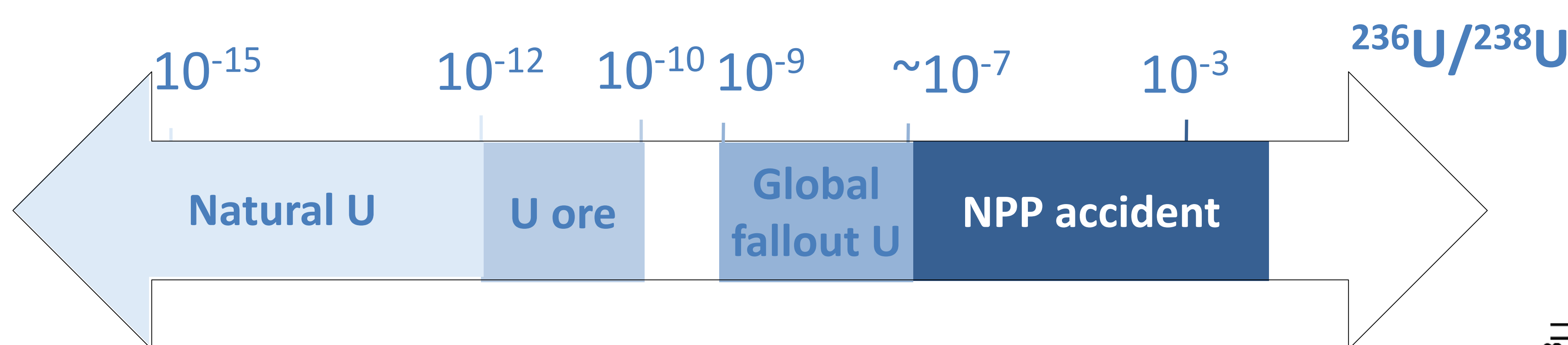
Versus

- Geochemical background of the site containing high concentrations of U

**Objective: identifying uranium origin (mine versus geochemical background) in the vicinity of former uranium mines**

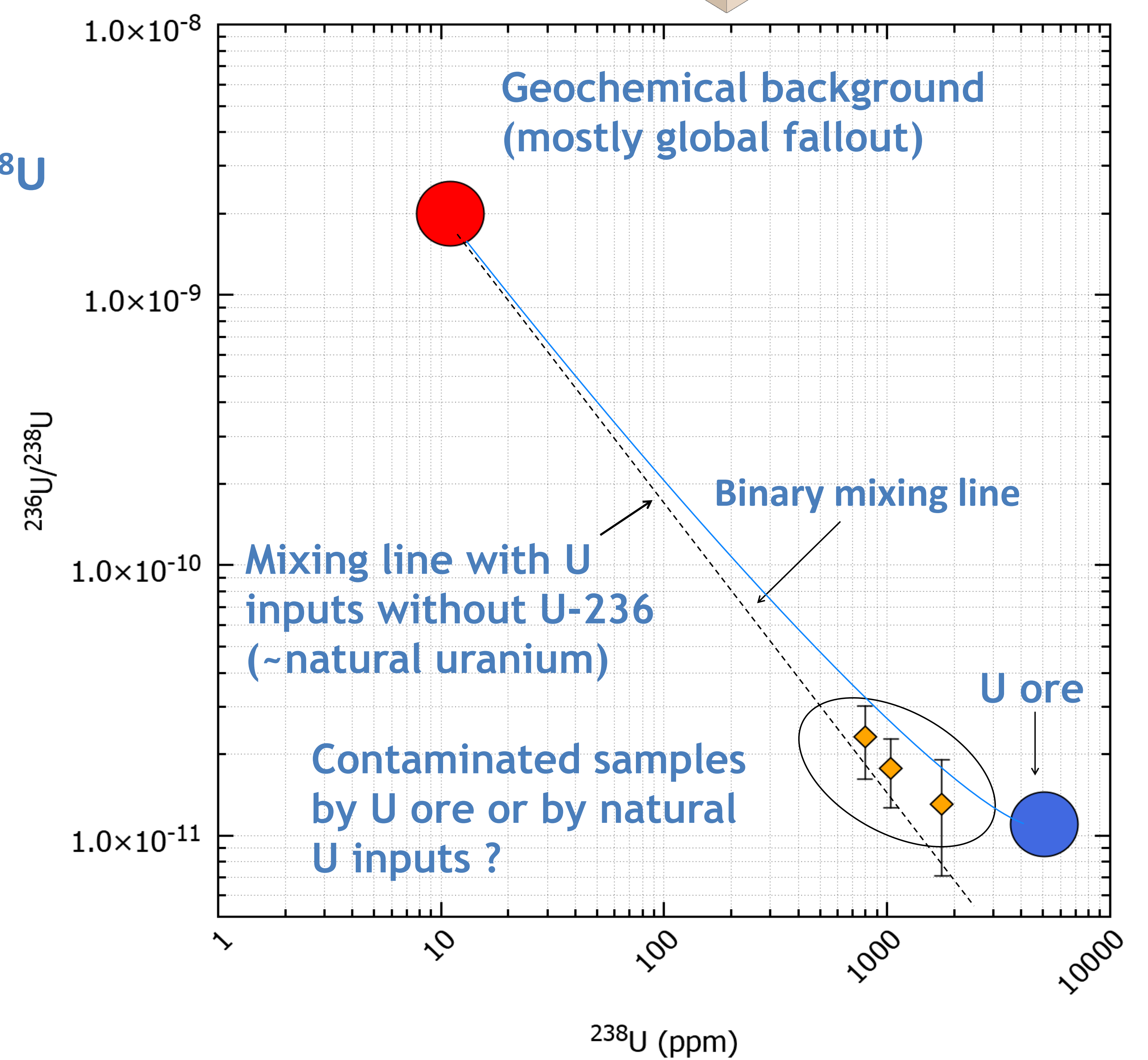


## ➤ Use of $^{236}\text{U}/^{238}\text{U}$ isotope ratios

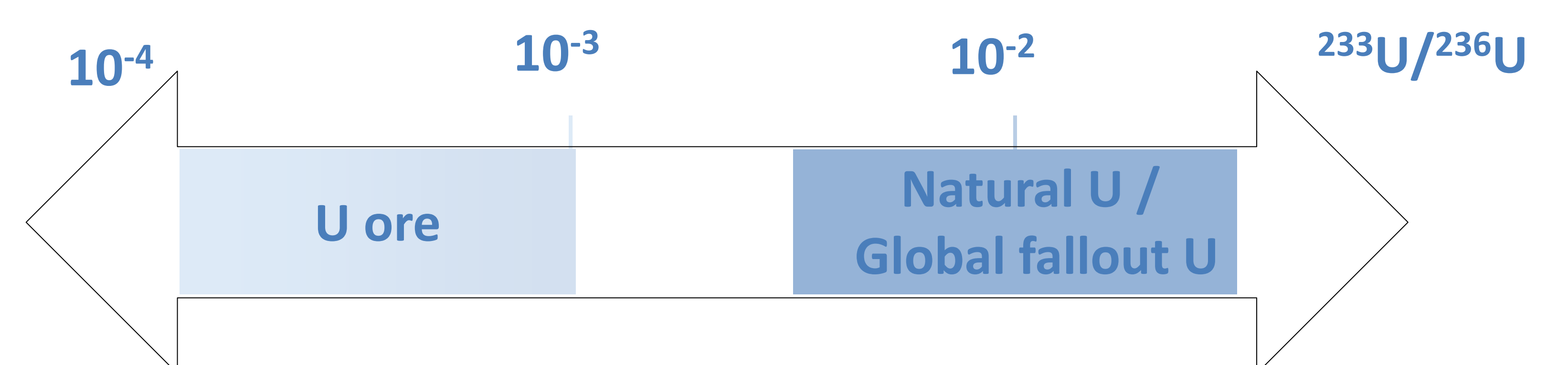
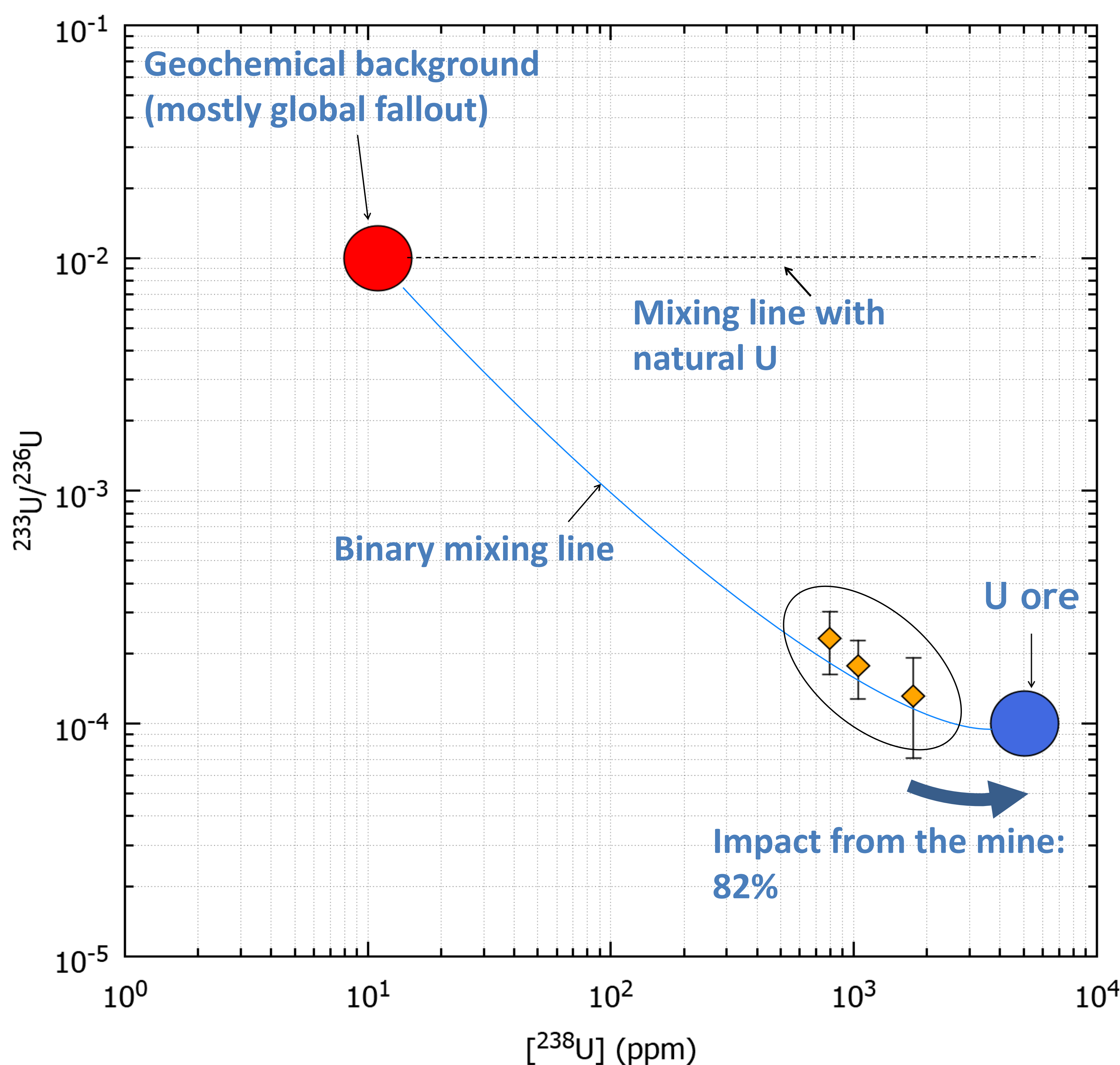


## Limitations:

- Anthropogenic inputs increased the  $^{236}\text{U}/^{238}\text{U}$  ratio of the geochemical background
- Natural  $^{238}\text{U}$  concentration variations can induce a fluctuation of the  $^{236}\text{U}/^{238}\text{U}$  isotope ratios.
- **Dilution of the  $^{236}\text{U}/^{238}\text{U}$  due to  $^{238}\text{U}$  inputs without  $^{236}\text{U}$  (or a  $^{236}\text{U}/^{238}\text{U}$  close to geochemical background)**



## ➤ Use of $^{233}\text{U}/^{236}\text{U}$ isotope ratios



## Conclusion:

- Natural minor isotopes ( $^{233}\text{U}$ - $^{236}\text{U}$ ,  $^{236}\text{U}$ - $^{233}\text{U}$ ) were measured in environmental samples,
- Minor isotopes can be used to trace **the origin of uranium contamination** in the environment,
- **The contribution of uranium mining activities in the environment can be quantified.**

## However:

- Production of minor isotopes depends on **several parameters** (neutron flux, presence of light elements, thorium concentration),
- **Source term-Endmembers** signatures (Global Fallout and U Ore) are **highly heterogeneous**,
- Further works are needed on other samples to better characterise the **production processes of minor isotopes.**