Constraining aggradation phases of braided river deposits using granulometry, geochemistry and cosmogenic radionuclides: the case of the Campine Plateau

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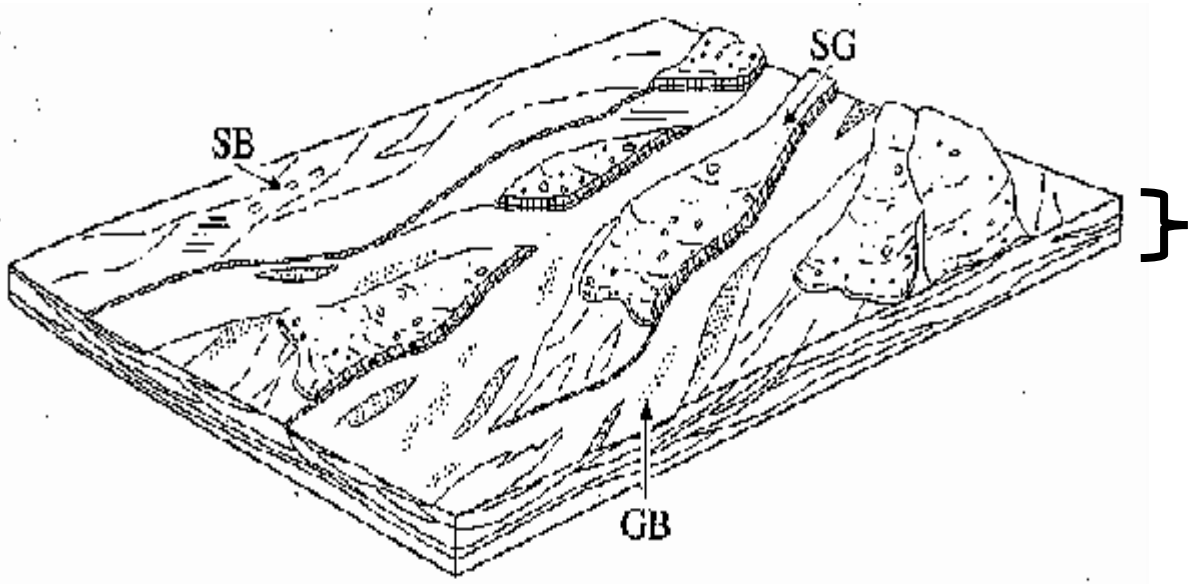
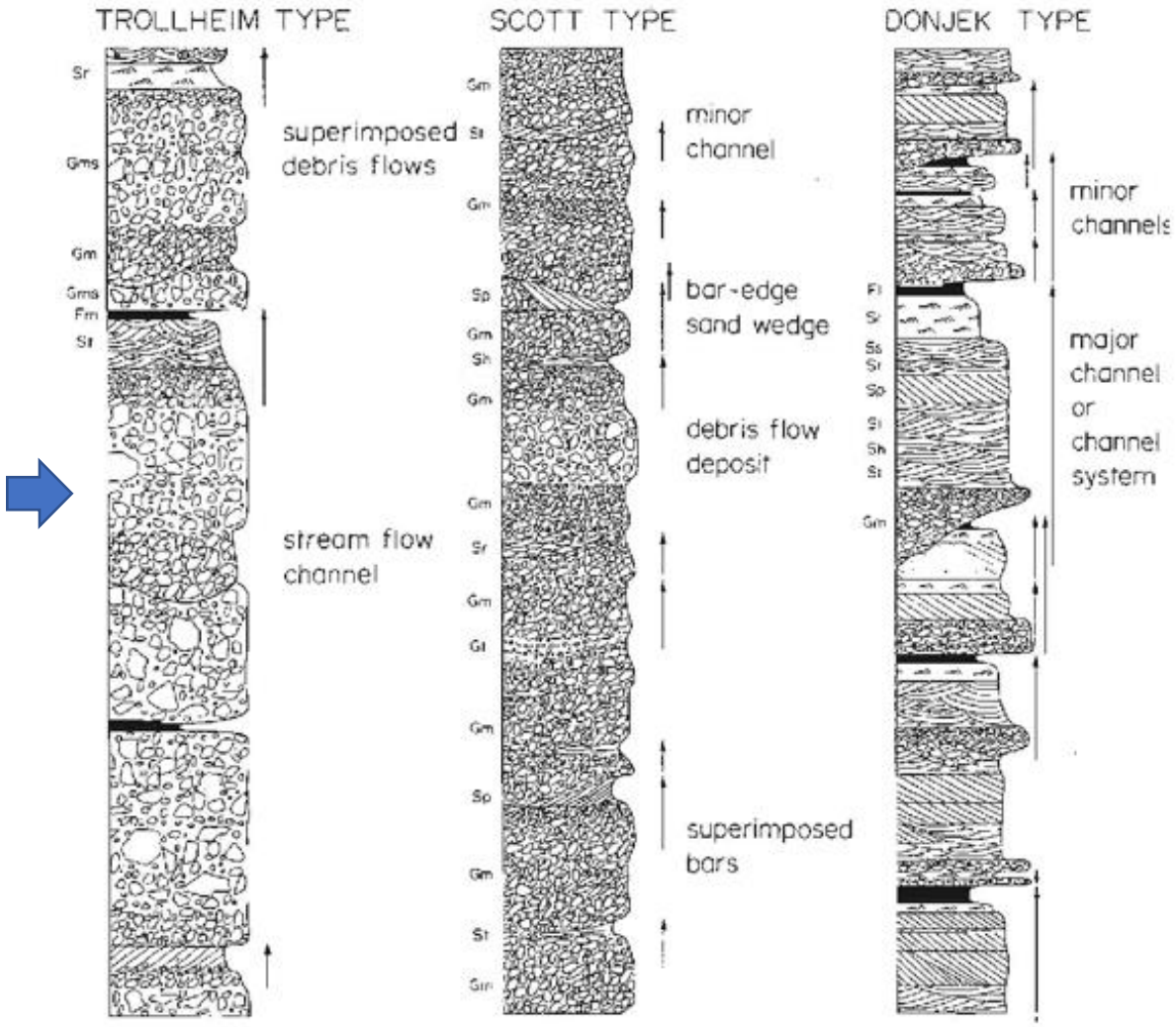
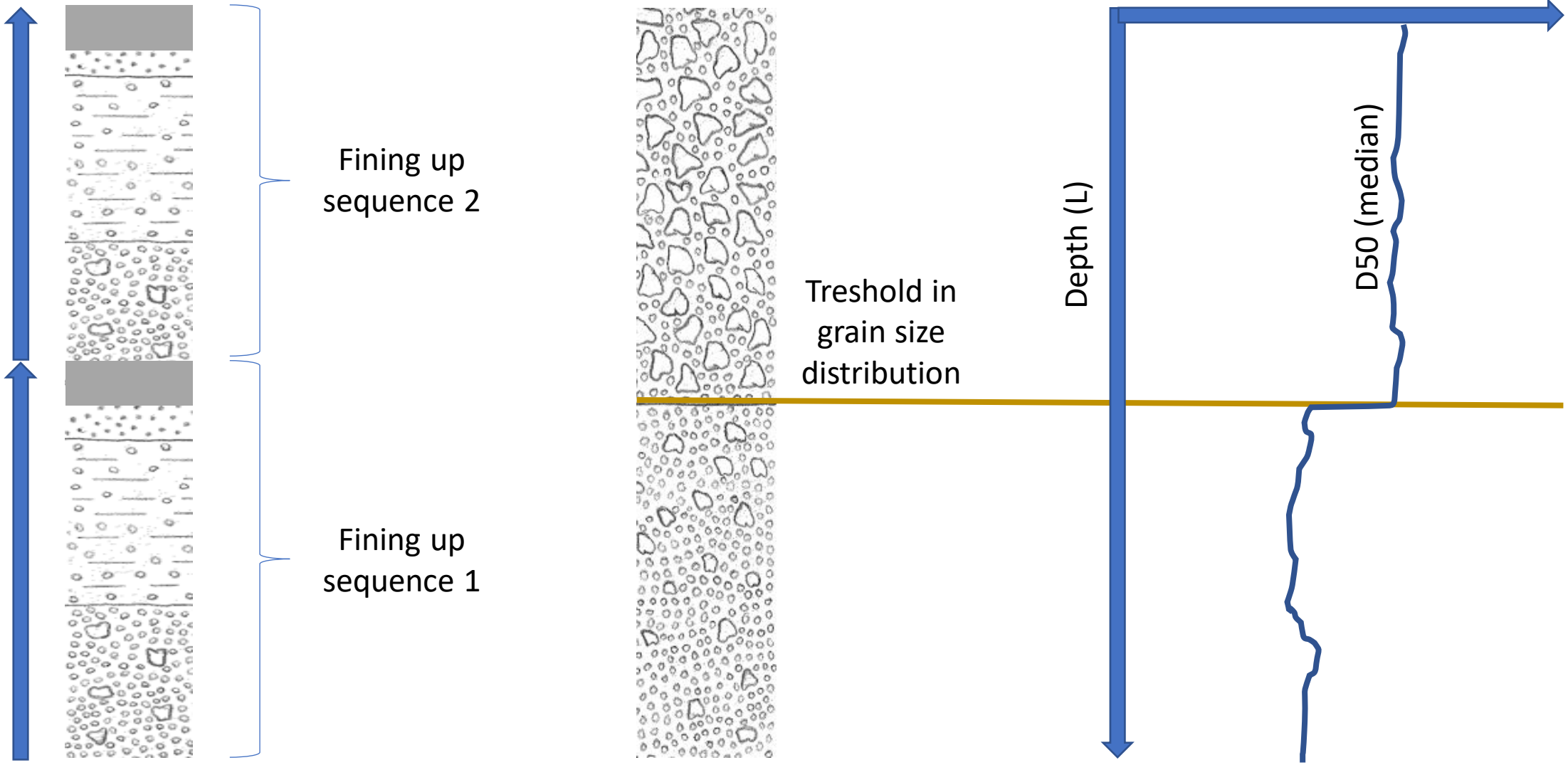
Introduction : Fluvial deposits from braided river often show complex depositional patterns





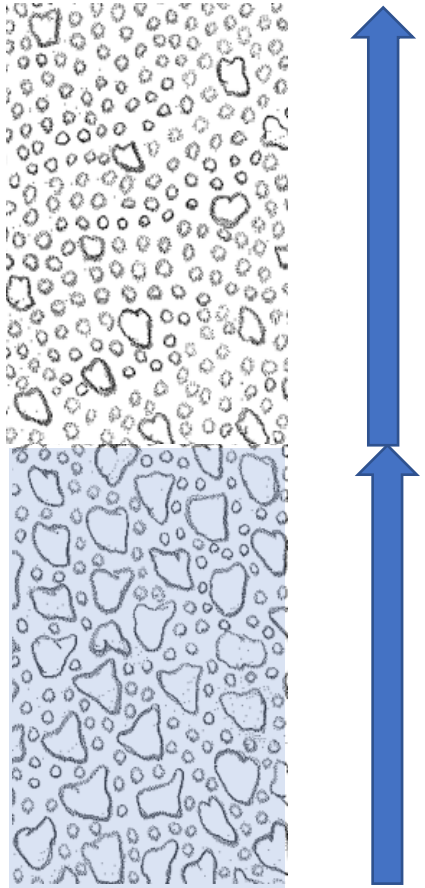
Source: Miall, 1996

Grain size analysis is routinely used to ~~discernate~~ distinguish one aggradational unit from another

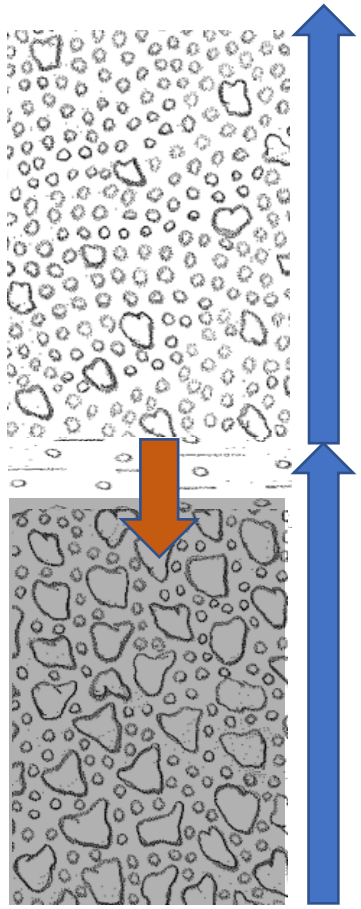


Changes in chemical element contents over depth profiles are used to differentiate depositional units. Different processes could be the cause of these changes.

1) **Provenance signature**: the sediments from 2 units aggraded at different times do not show the same element content as their provenance is different

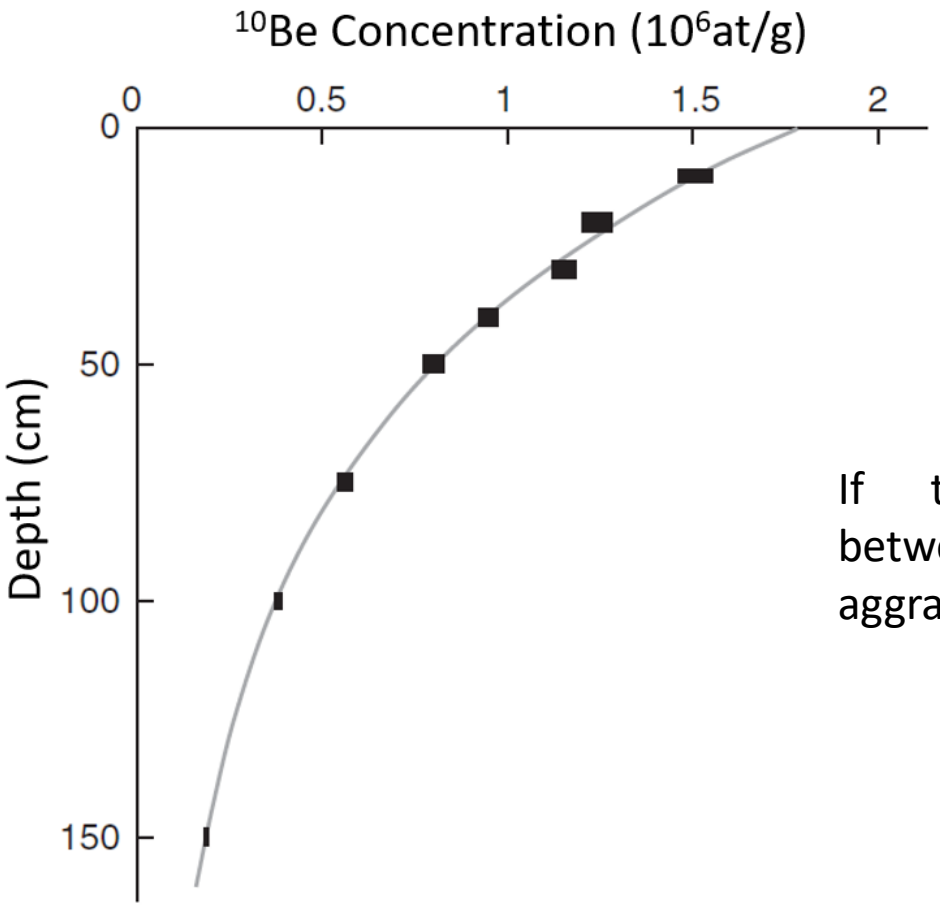


2) **Intraformational weathering**: 1 unit undergoes weathering after aggradation and some elements reprecipitate over a following stability phase

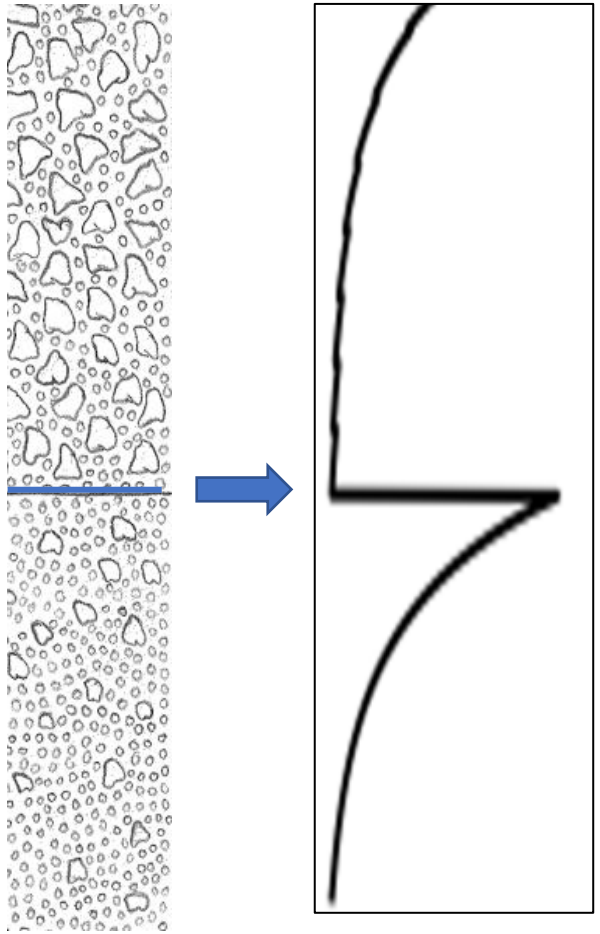


The cosmogenic radionuclide (CRN) [^{10}Be] depth profile is used to constrain the exposure age of fluvial deposits, but can also record complex aggradation mode.

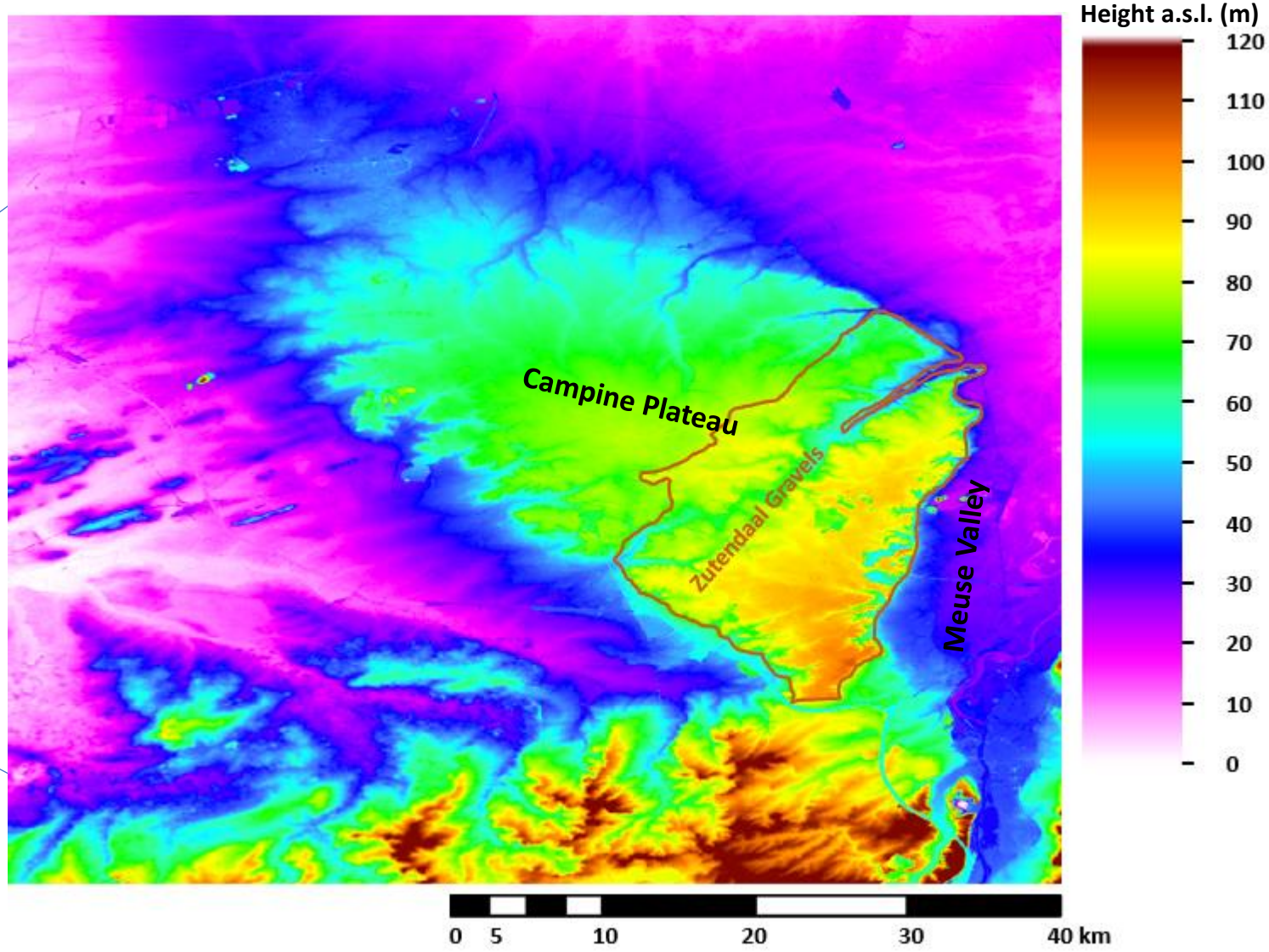
[^{10}Be], [^{26}Al] ~ t , inverse function of erosion and shielding depth



If time elapses between the two aggradation phases



The Zutendaal gravels is fluvial deposit from the (formerly braided) Meuse whose deposition time and mode are poorly constrained

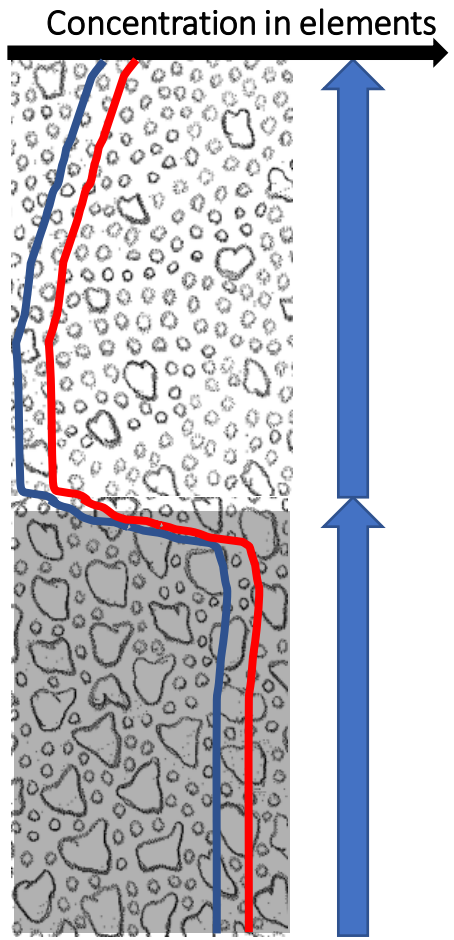


Research question

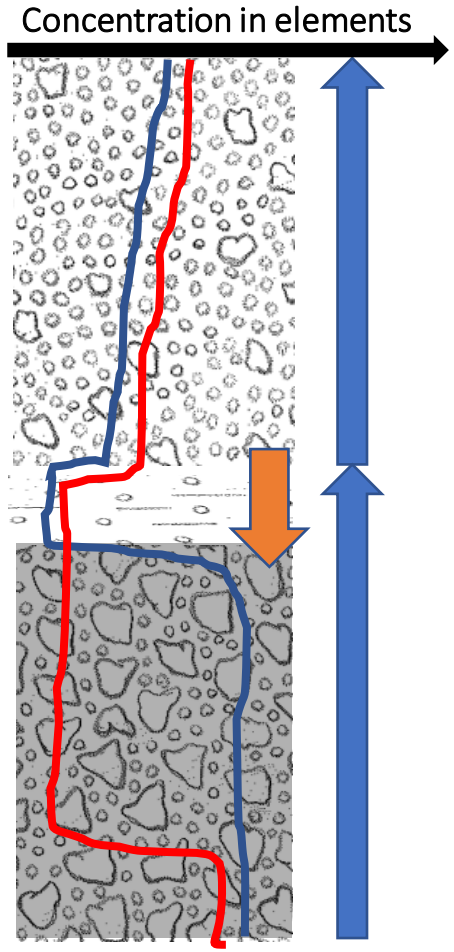
(1) Based on granulometry, geochemistry and a [^{10}Be] depth profile, is it possible to identify distinct depositional phases in a braided gravel sequence of the Zutendaal gravels?

Assumption: geochemistry may reflect either provenance and/or weathering

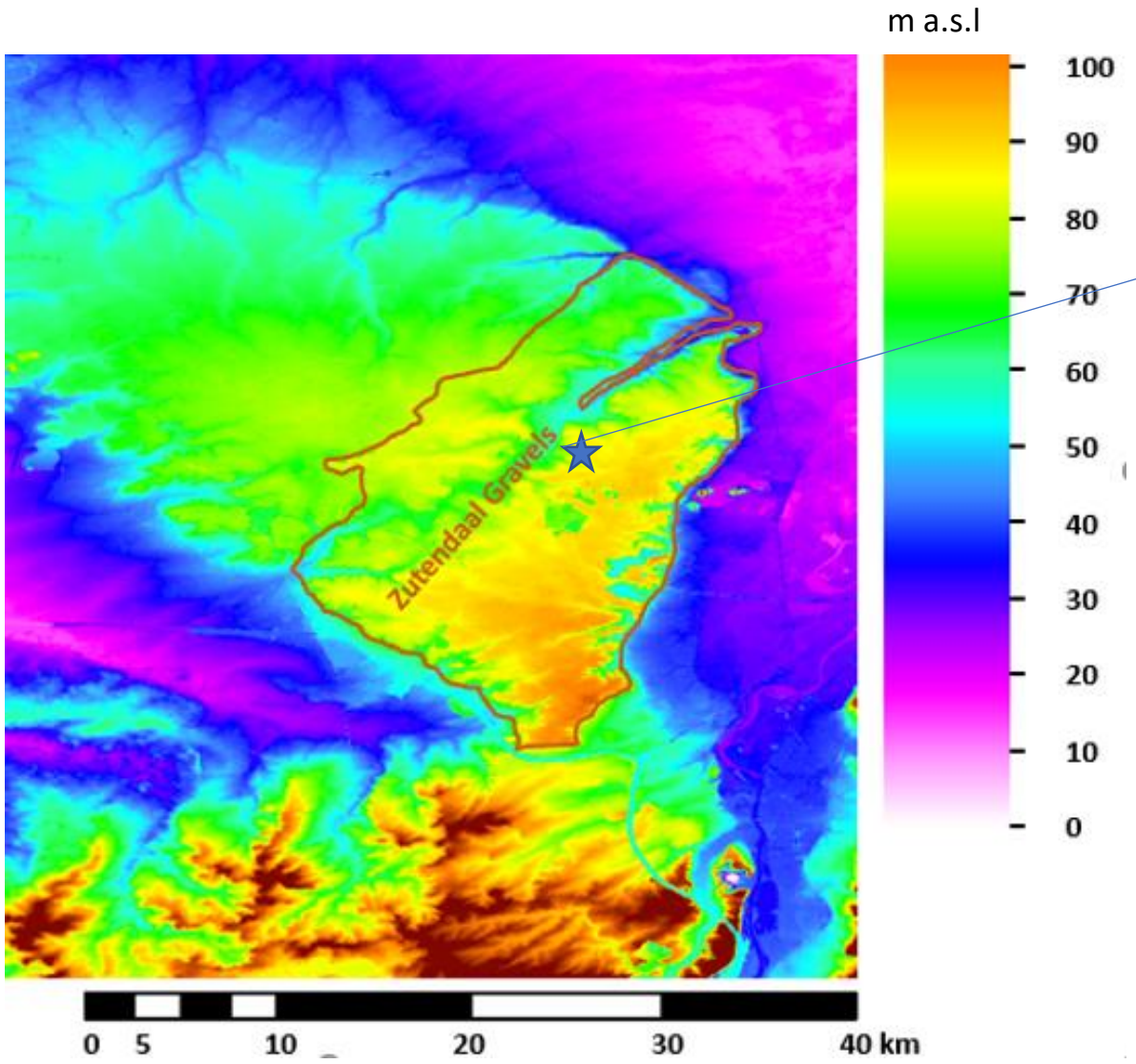
1) **Provenance signature**: 2 units with different provenance have different geochemical signature



2) **Intraformational weathering**: 1 unit undergoes weathering which causes redistribution of elements

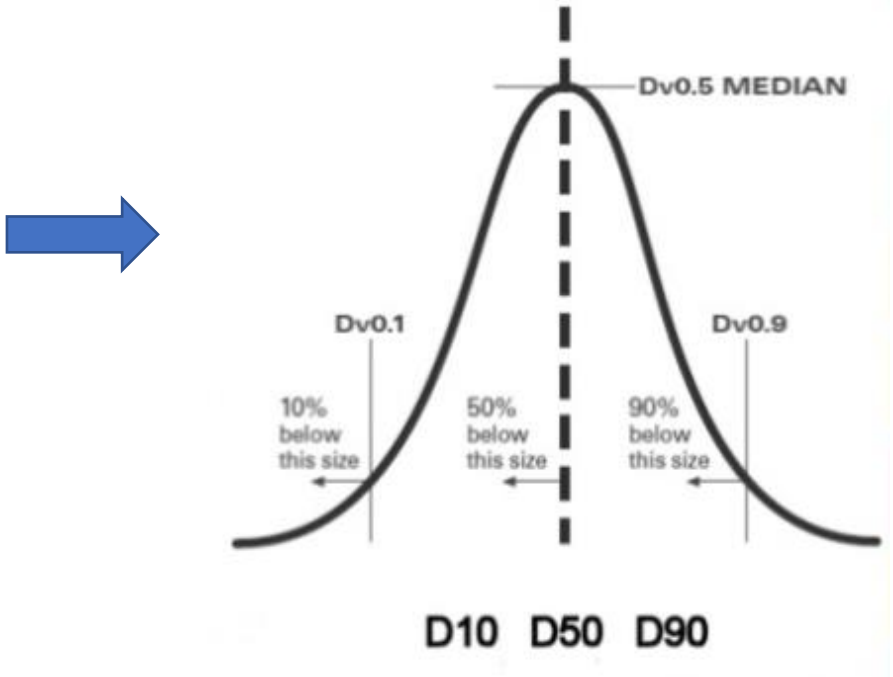


Method: Sampling location – The Hermans Quarry



Method : Analysis of grain size and relevant element concentrations over depth

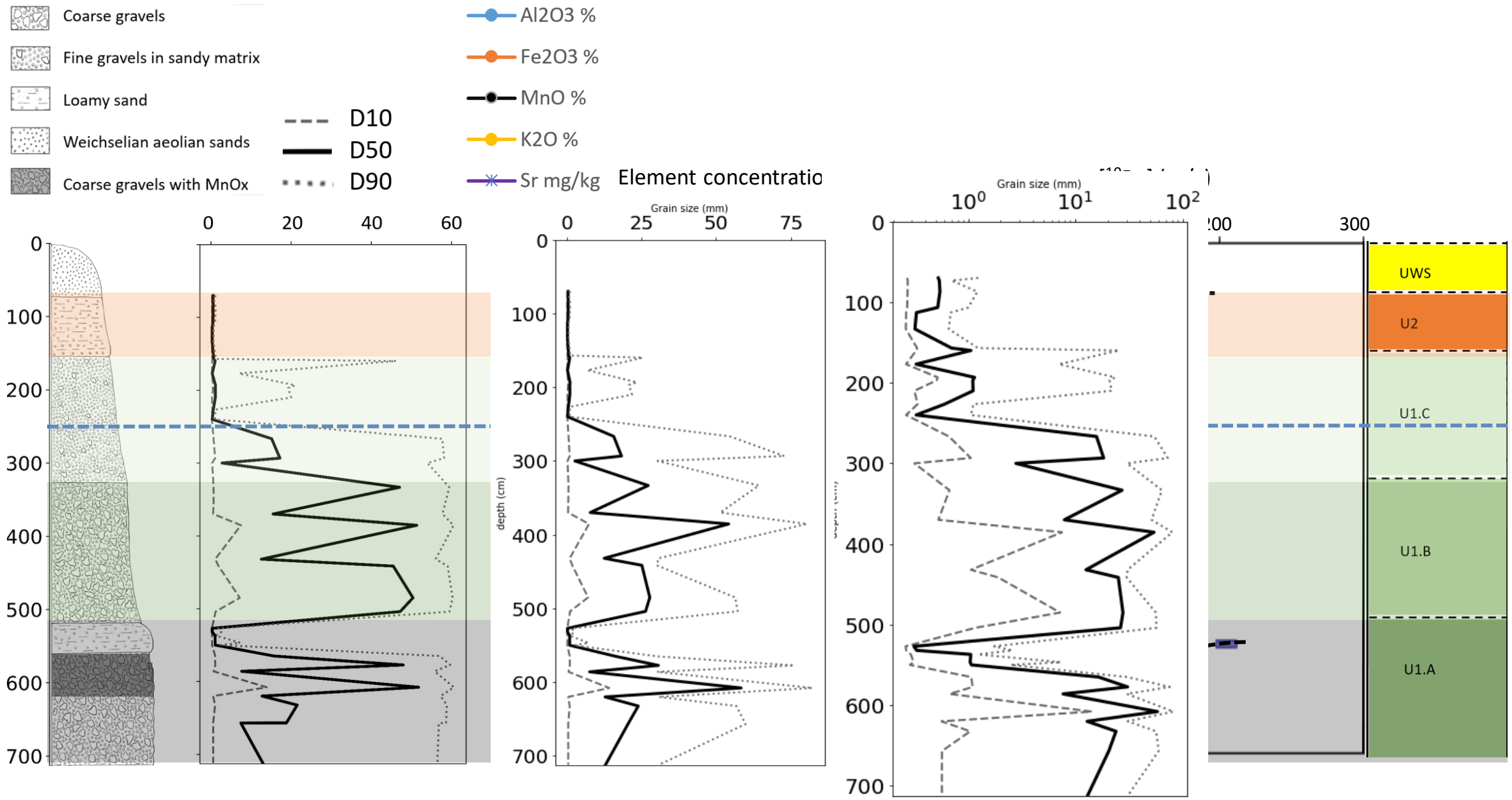
D10/ D50/ D90 determined with sieving



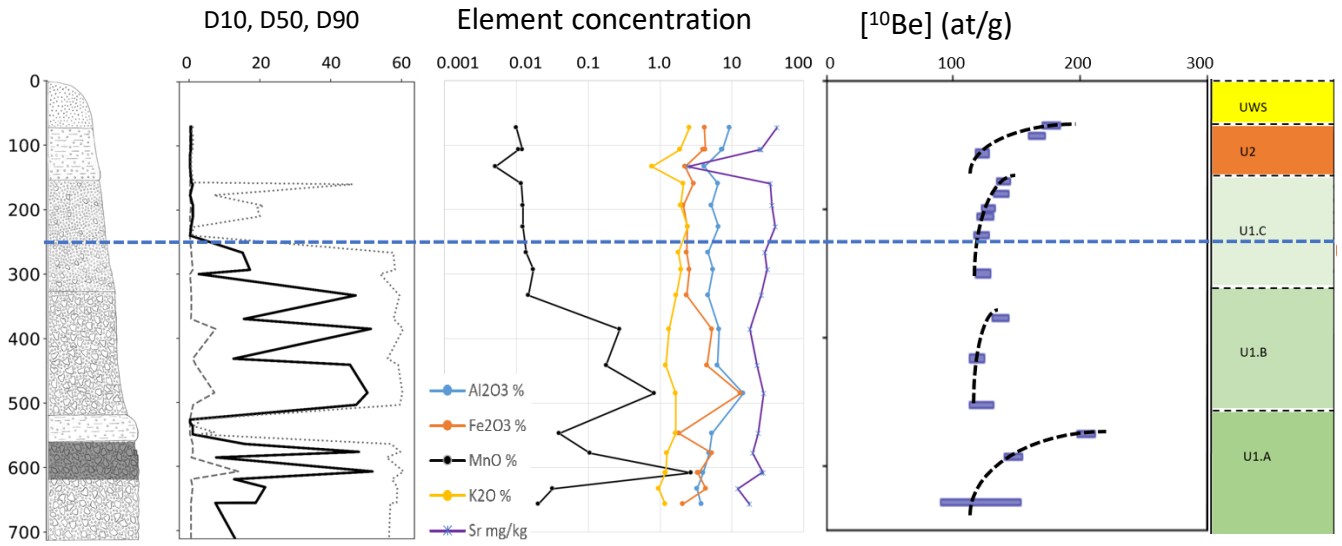
Geochemistry: Analysis of Fe, Al, K, Mn, Sr in search for (absence of) covariation of their content over depth (following e.g. Zielhofer et al., 2008)

CRNs: 15 samples analyzed over 7m depth

Results : 4 units are identified in the fluvial deposit based on grain size and element content



Discussion: Are the units differentiated from each other based on grain size, geochemistry and [^{10}Be]?



Unit	Difference following grain size	Difference following geochem. Case 1	Difference following geochem. Case 2	Difference following [^{10}Be] pattern
U2	+++ Only sand	+	-	+
U1.C	+ Fining upward	+++	-	+
U1.B	+	+++	+ (% 1.A) - (% 1.C)	+
U1.A	+++	-	+++	+++

Difference in concentration between two unit with covaration (case 1)

Interruption of covariation due to differential reprecipitation (case 2)

Conclusion : The indices do not converge to a unique differentiation, but the existence of 4-5 units can be postulated

To go further...

The different possibilities of unit classifications should now be used to constrain the aggradation mode of the Zutendaal gravels through various scenarios of aggradation and post depisitional history

⇒ These scenarios will simulate the accumulation of CRN over the phases of aggradation and over the following post depositional period.

⇒ The best scenarios of aggradation will be used to constrain the different aggradation phases and the potential time hiatuses between them.

Thank you for your attention ! ☺

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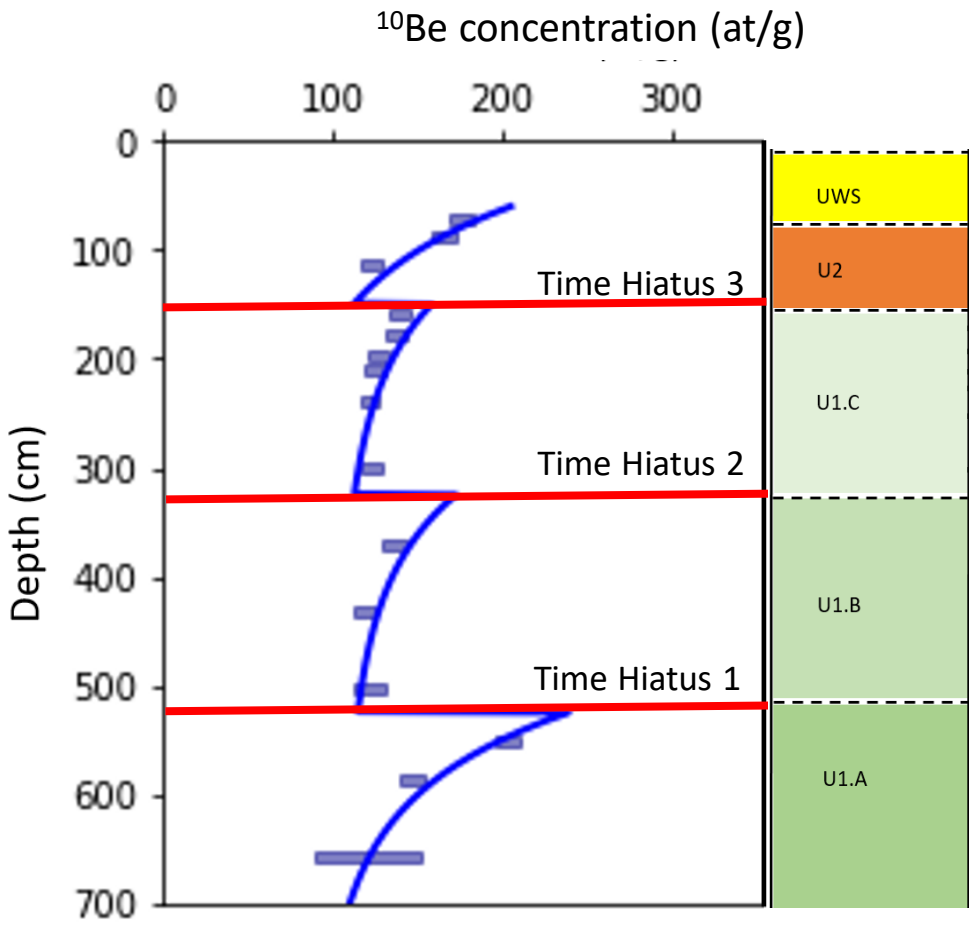
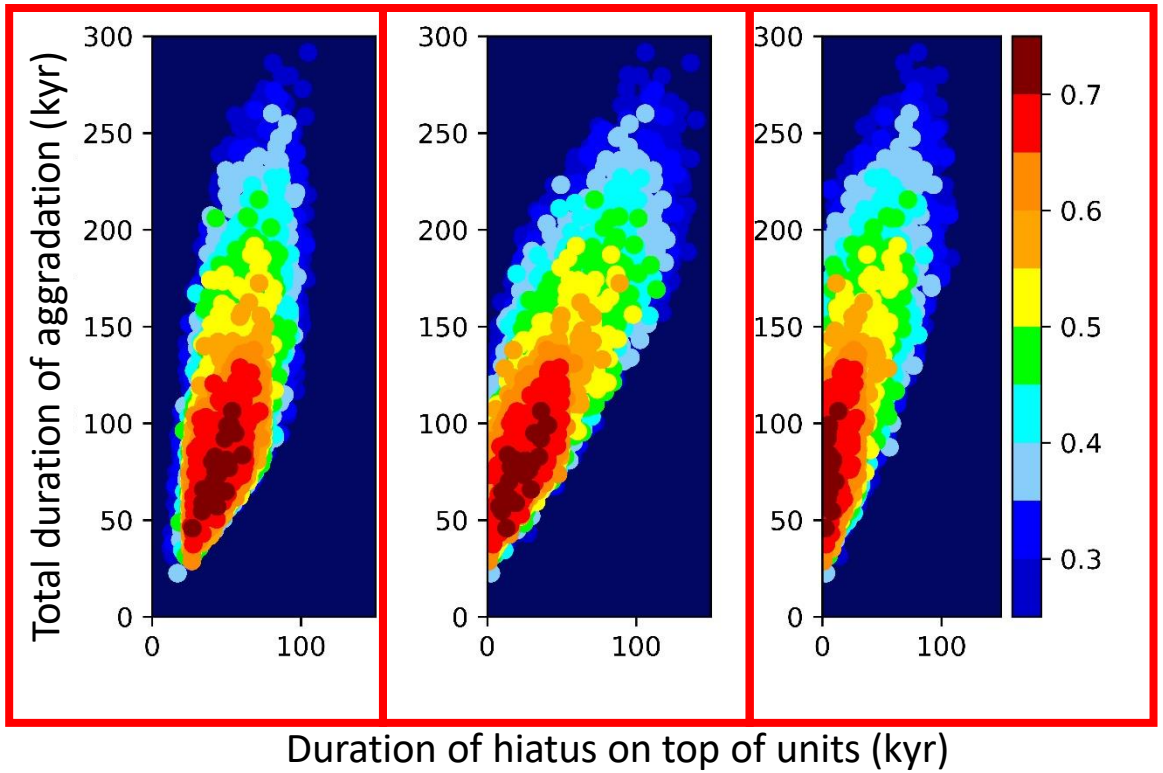
Supplementary slides: if different deposition phases exist, then what hiatuses do they represent ?





An interruption of sedimentation is likely on top of U1.A, and less clear on top of U1.B.
A hiatus between U1.C and U.2 is not supported by the results