Changes in Dust Flux to the Eastern Mediterranean Sea over the past 25 ky BP

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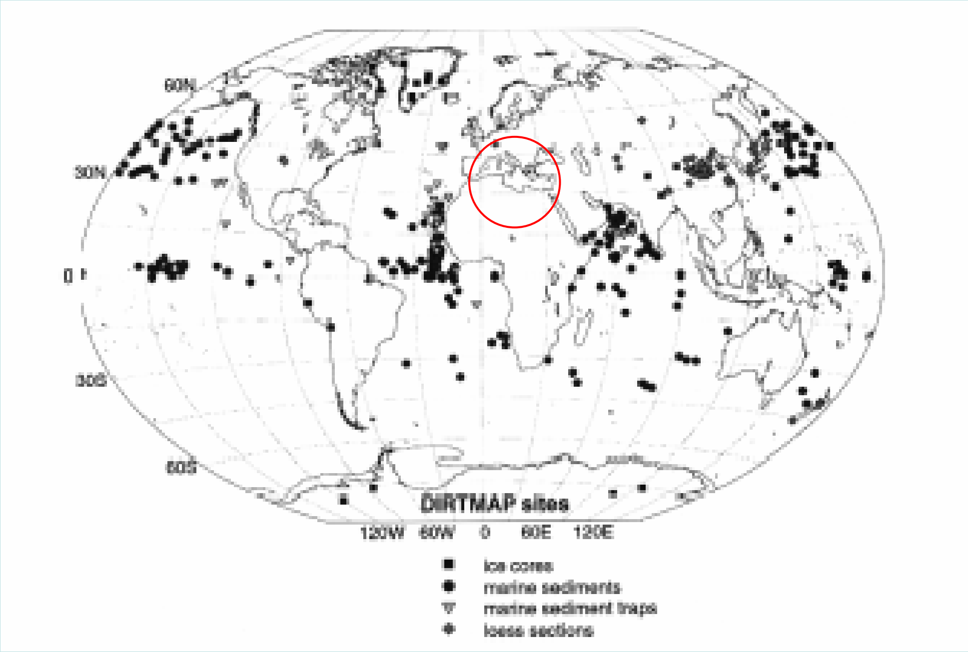
Aims of Study

• Determine Saharan dust (SD) for use: DIRTMAP.
Dust pathway: eastern Europe and Asia Minor.

• Compare dust flux to other N. African dust records.
Differences/similarities

• Palaeoclimatic indicator.
Dust source areas



DIRTMAP: Kohfeld & Harrison, 2001.

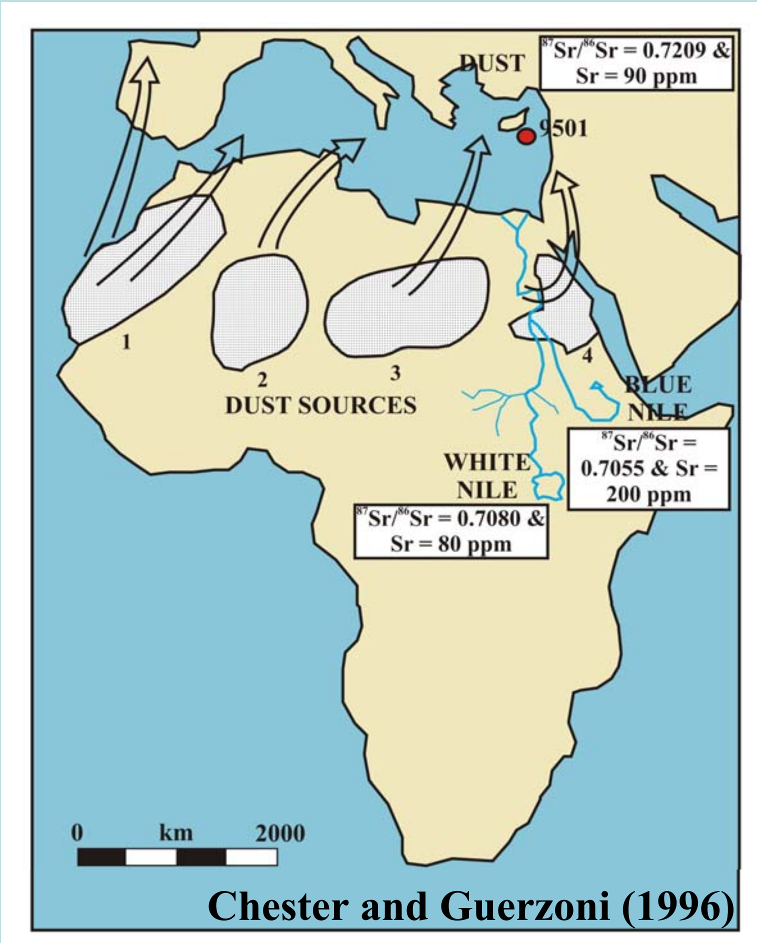
Basis – Geochemical Study

• Marine Sediment Core

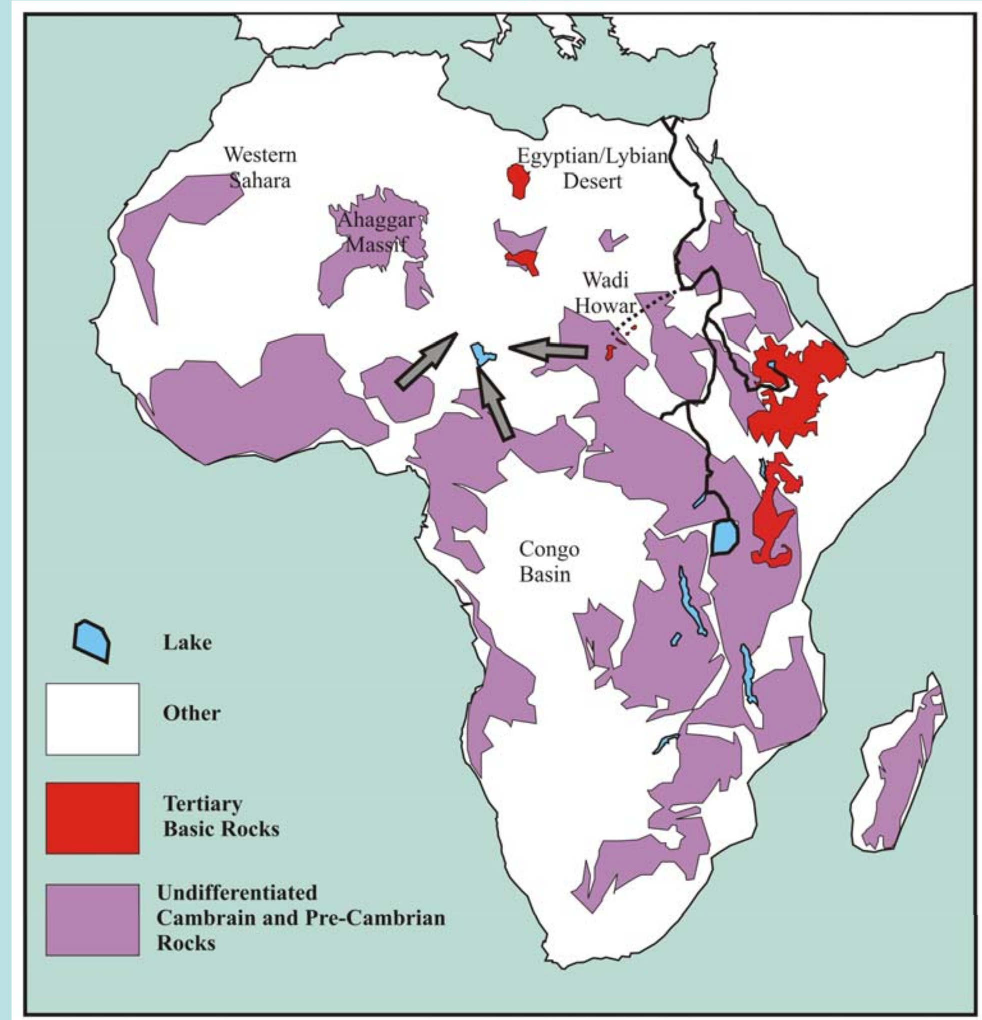
• Sr Isotopes: $^{87}Sr/^{86}Sr$ and Sr (ppm) data

• Detrital Provenance Indicator

Detrital Sources



Chester and Guerzoni (1996)



Taken from Geological Map Africa (1956)

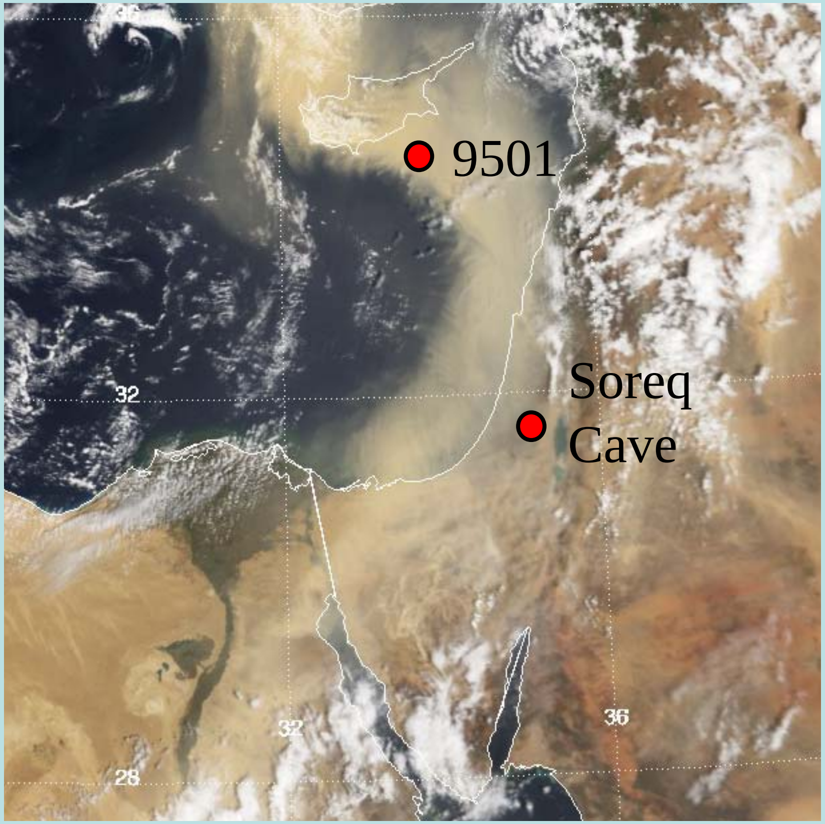
<u>Most Productive Dust Sources</u>:

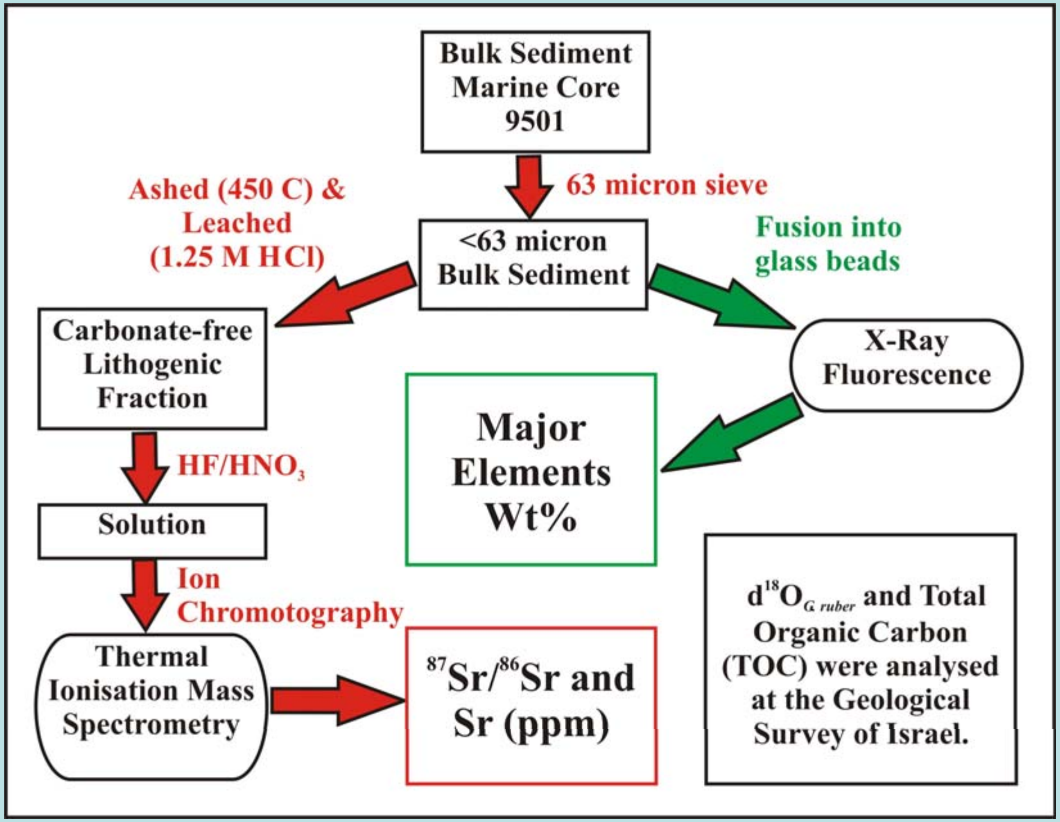
1. Western Sahara.
2. Ahaggar Massif.
3. South Libya & Chad.
4. Egyptian Desert.

Dust source areas dominated by Palaeozoic rocks → Radiogenic $^{87}Sr/^{86}Sr$ signal.

$^{87}Sr/^{86}Sr$ generally >0.720

Core Location and Methodology



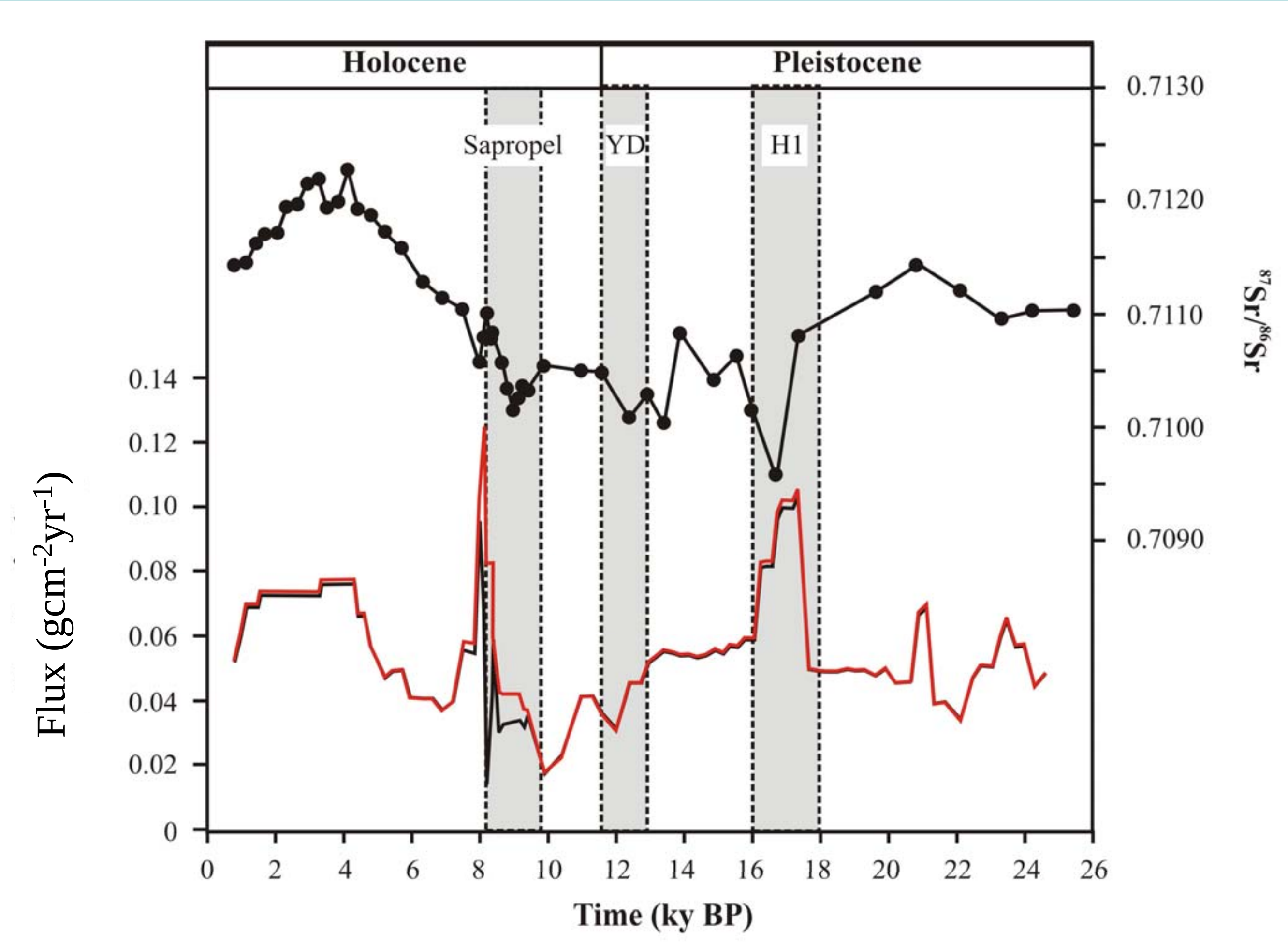


9501: 34° 32’ N/33° 59’ E,
Water depth: 980 m.
Core length: 11 m.

Age Model for core 9501:

- **$\delta^{18}O_{G. ruber}$ comparison to U/Th dated speleothem (Soreq) $\delta^{18}O_{speleothem}$ profile.**
- **^{14}C AMS dates also available.**

Results: $^{87}Sr/^{86}Sr$ Profile and Gross Flux

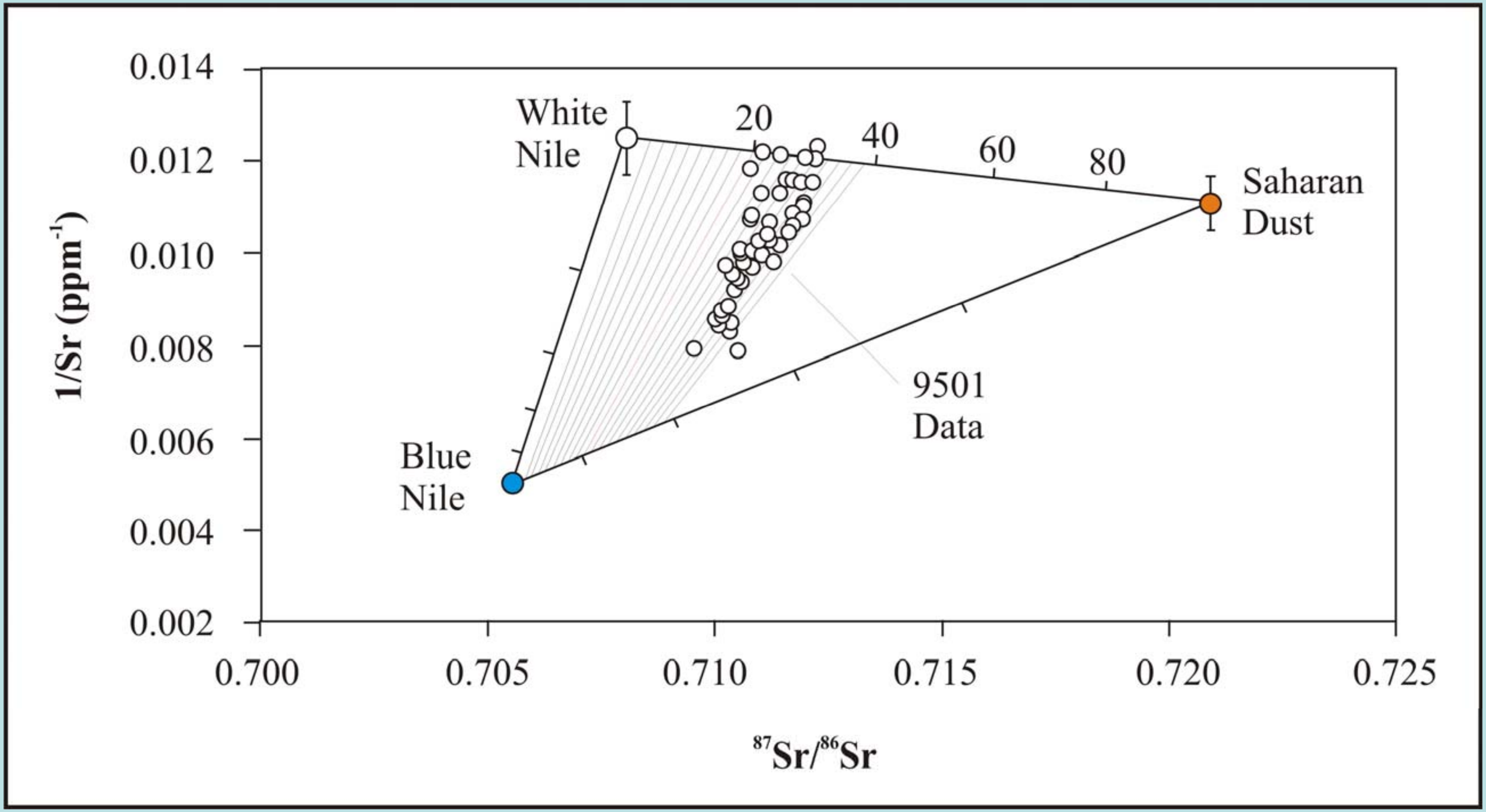


- High $^{87}Sr/^{86}Sr$ Ratios →Predominance of SD.

- Sr & Gross flux profile mantle each other. Positive correlation.

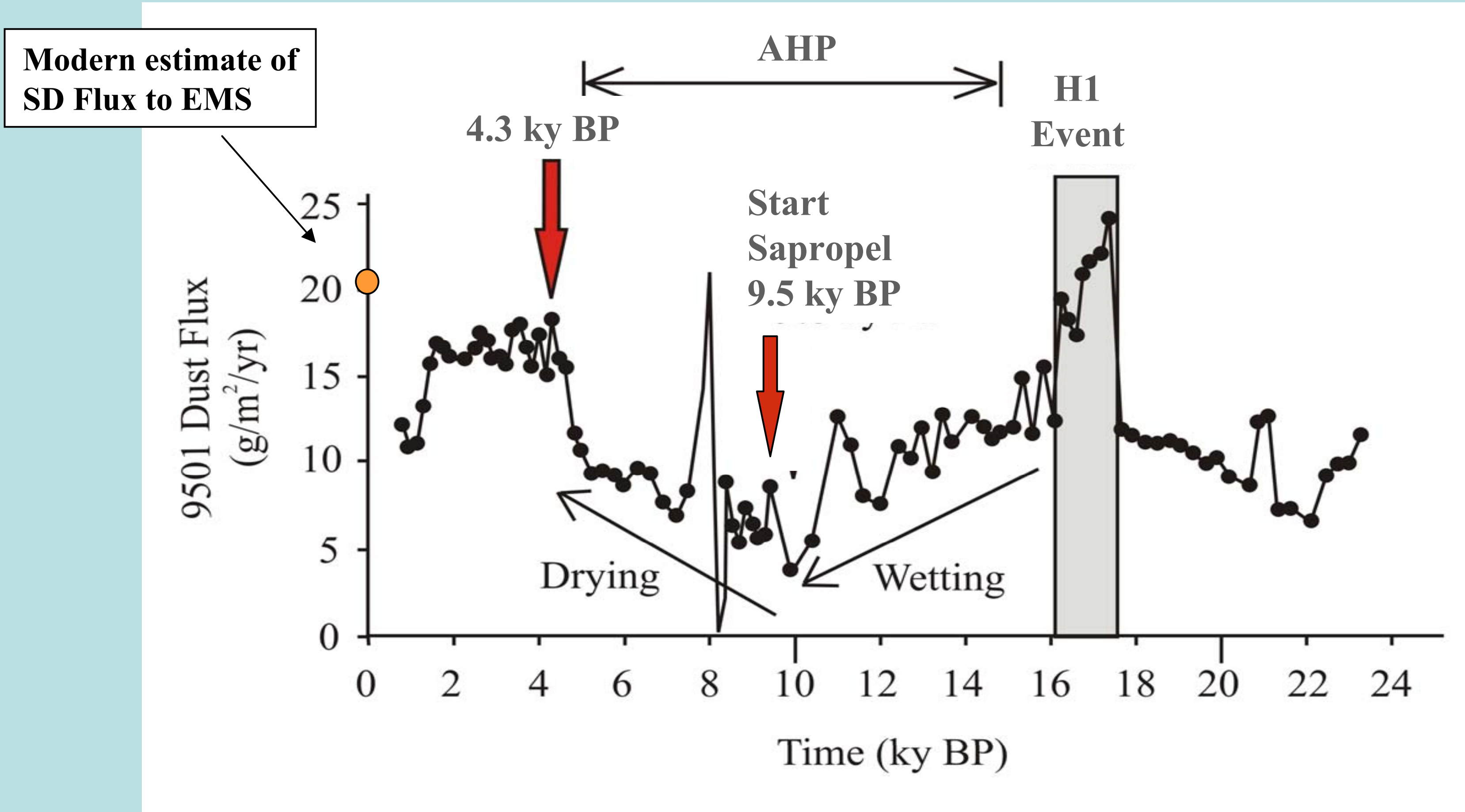
- H1 event = reverse trend.

- Peak in associated with sapropel → high biogenic flux or diagenetic redistribution.



Narrow band: 20-30% Saharan Dust
Estimates of current SD contribution ~ 40%
Sensitivity: Sr composition of end-members.

Core 9501: Calculated Saharan Dust Flux

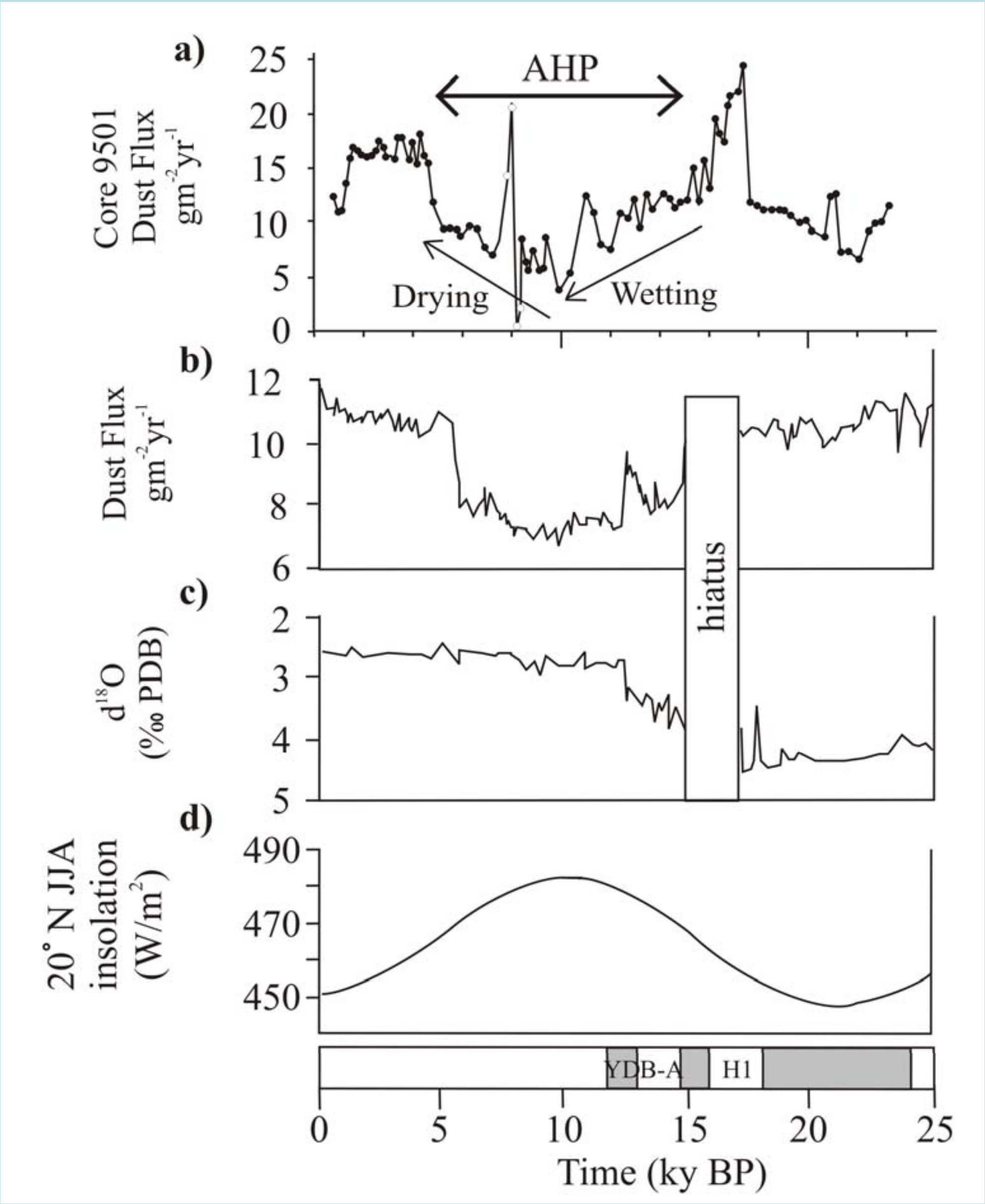


Inherent assumptions:

- **End-Members Sr composition unchanged over time.**
- **System is represented adequately by 3 end-members over 25 ky.**
- **Saharan Dust has always averaged ~ 25% $CaCO_3$.**

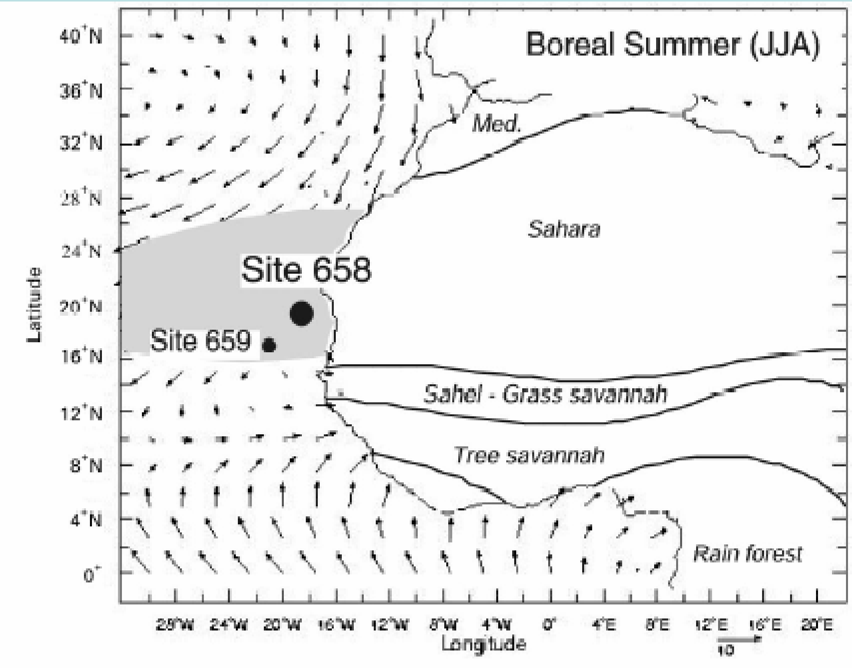
$[(f_{SD} \times (F_{Gross} - F_{CaCO3})) \times 1.25]$

Core 9501: Comparison to West African Data

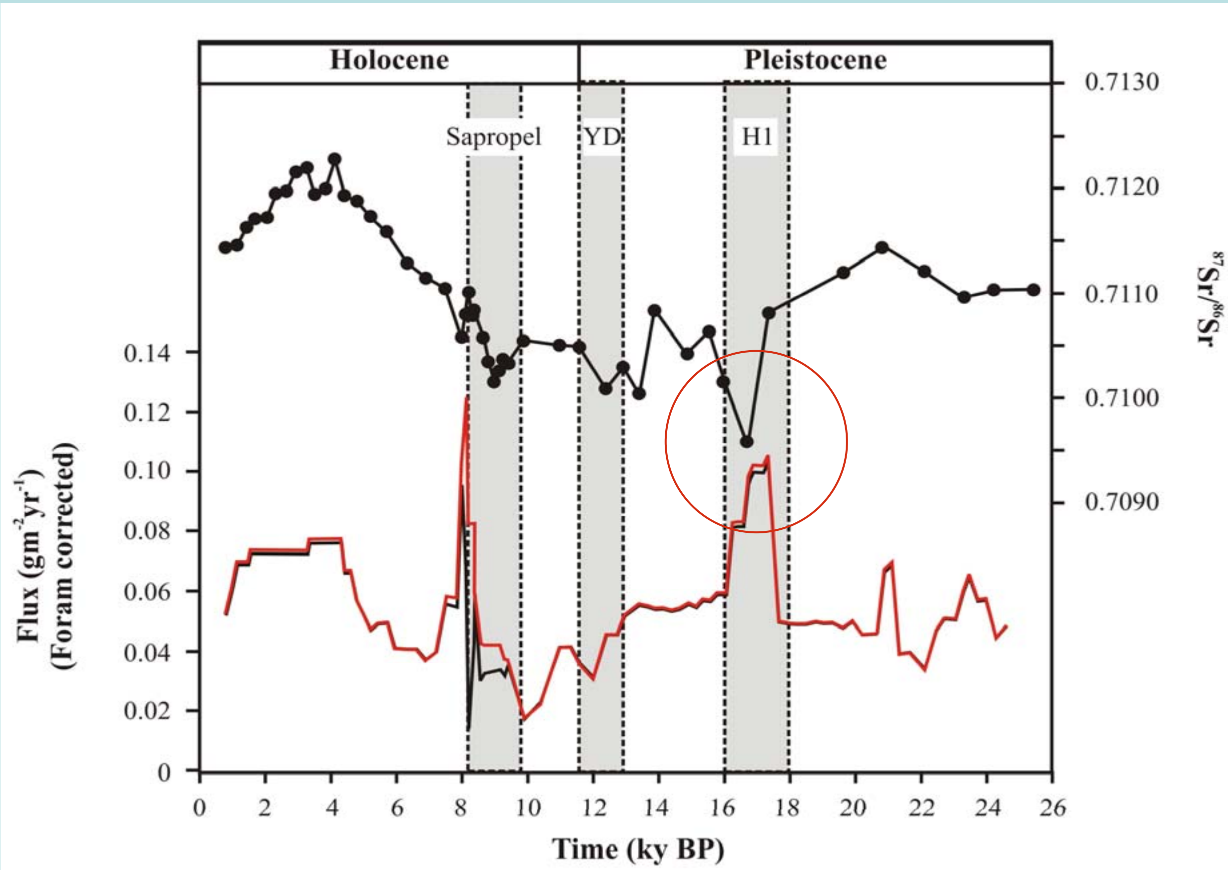


← Core 9501 Dust flux

← Terrigenous flux to core 658 deMenocal *et al*. (2000)



H1 Event – Further interpretation needed?



PALAEOSOLS
ca. 18-16 ky BP

↓

Lake Tana | **Lake Victoria**

↓

RIVER NILE DETRITAL OUTPUT REDUCED SIGNIFICANTLY

↓

"LOESS" SOURCE IMPORTANT?

Frumkin & Stein (2004); Stein *et al.* (in press)
"loess" $^{87}Sr/^{86}Sr \sim 0.7085$

To Conclude:

- **First time shows a SD flux for EMS that displays a good correlation to W. Africa estimates.**
  - **AHP**
  - **YD spike**
  - **H1 Event**

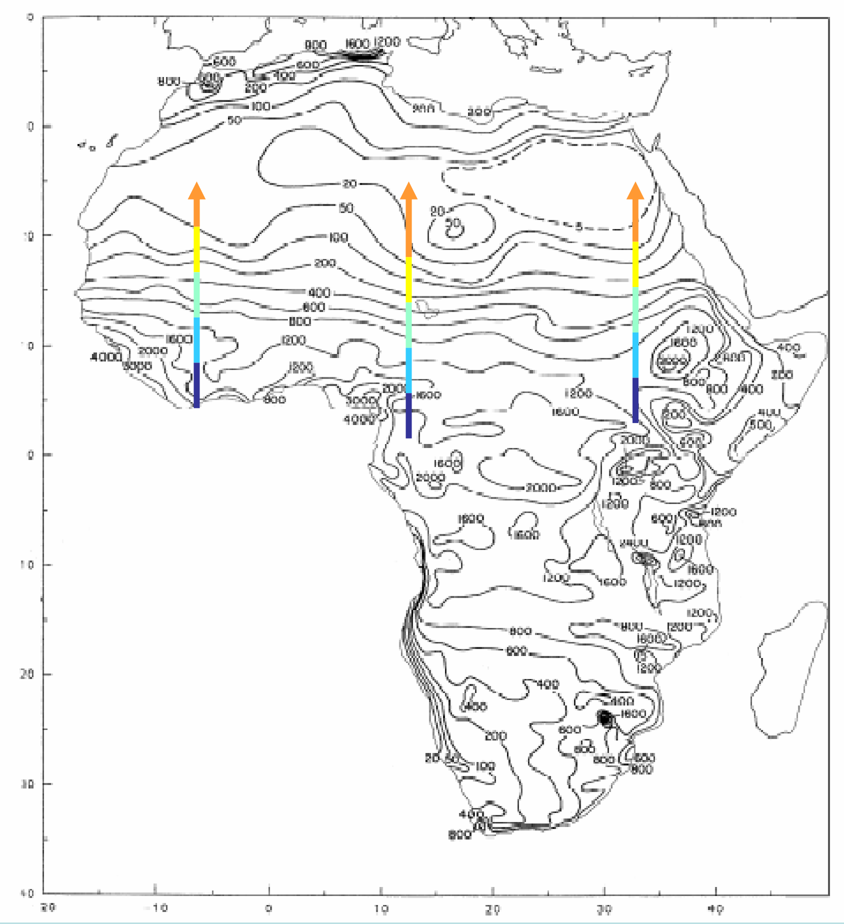
- **H1 event displays abrupt dust peak. Possible “loess” contribution at this time.**

- **4.3 ky BP return to <u>high</u> dust flux during Late Holocene.**

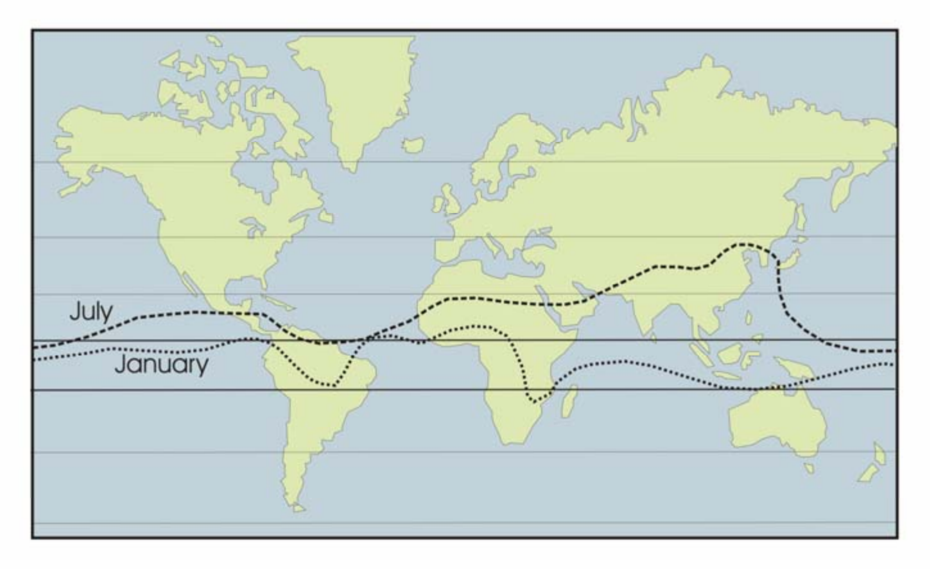
  (*End of Old Kingdom in Egypt ca. 4.2 ky BP…*)

Thank You

Inter-Tropical Convergence Zone (ITCZ)



Nicholson (2000)



- **ITCZ brings summer monsoon to semi-arid regions**

- **Vegetation very sensitive to changes in rainfall.**

- **ITCZ N-S migration sensitive to changes in insolation (orbital forcing).**

ORBITAL FORCING → INSOLATION → VEGETATION → DUST FLUX