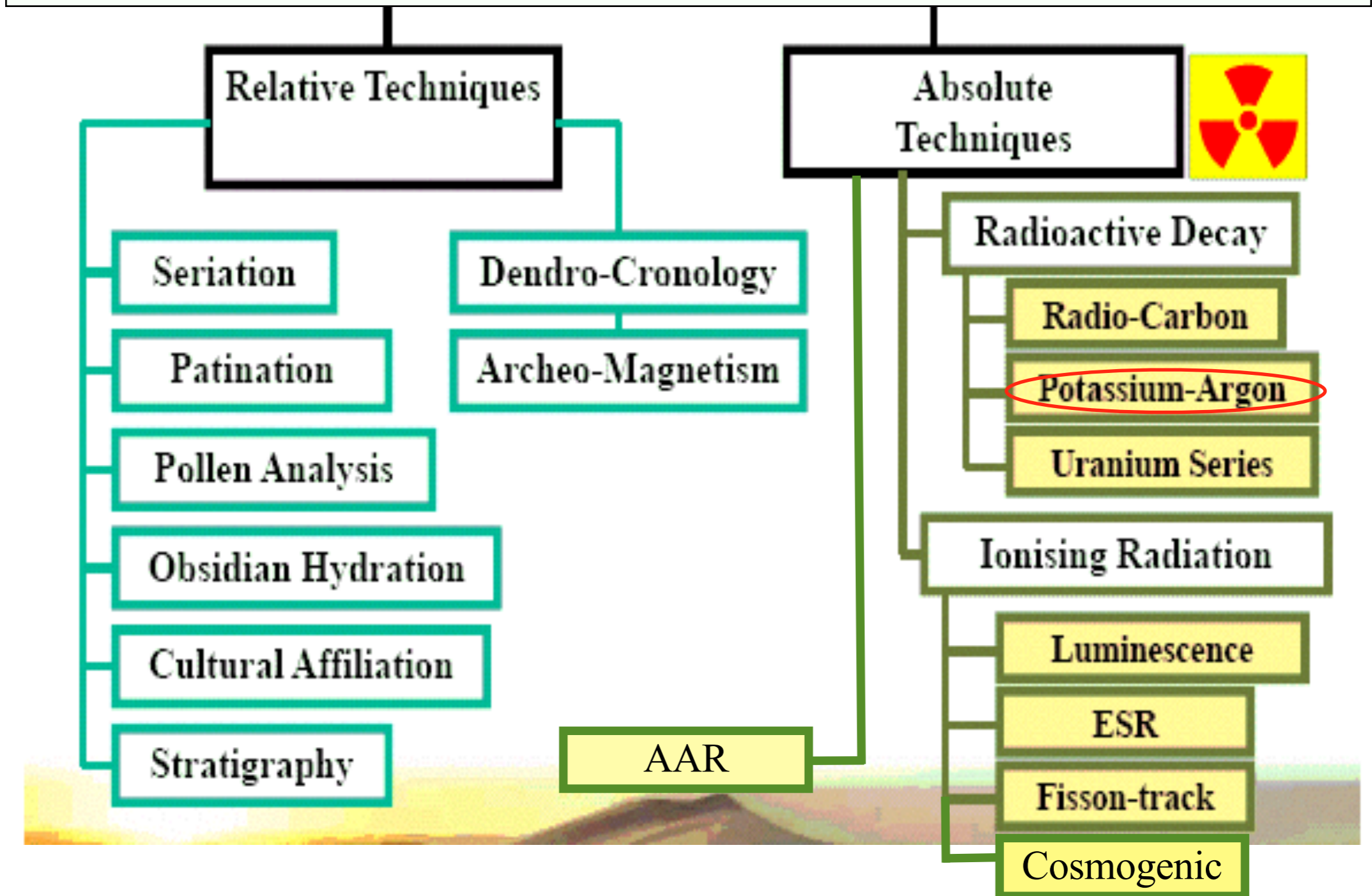


Advanced Analytical Methods in Bioarchaeology

Claudio Tuniz

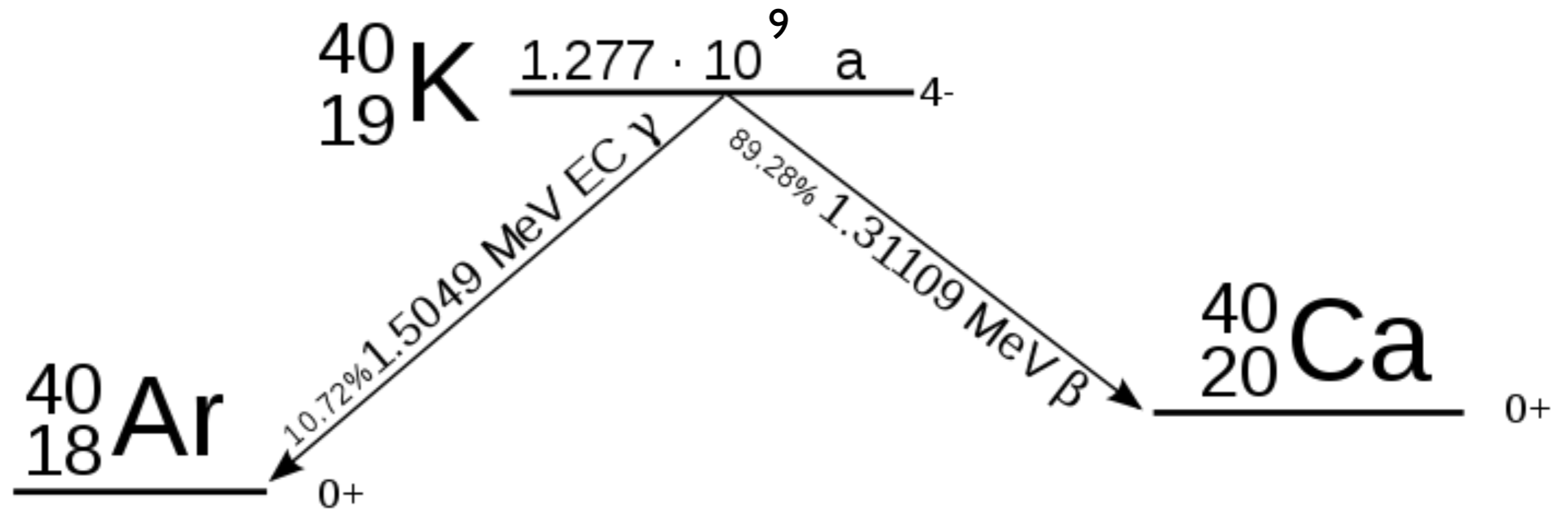
Potassium-Argon

Dating Techniques



Principles

- ^{40}K decays to both ^{40}Ar and ^{40}Ca



Principles

- mineral forms (e.g. from molten rock)
- “ is argon-free
- “ has potassium

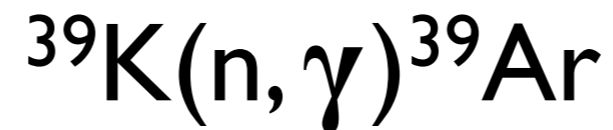
$${}^{40}\text{Ar} = {}^{40}\text{Ar}_{\text{initial}} + 0.105 {}^{40}\text{K}(1 - e^{-\lambda t})$$

t is the age

0.105 is the 'branching ratio' to ${}^{40}\text{Ar}$

Argon-argon

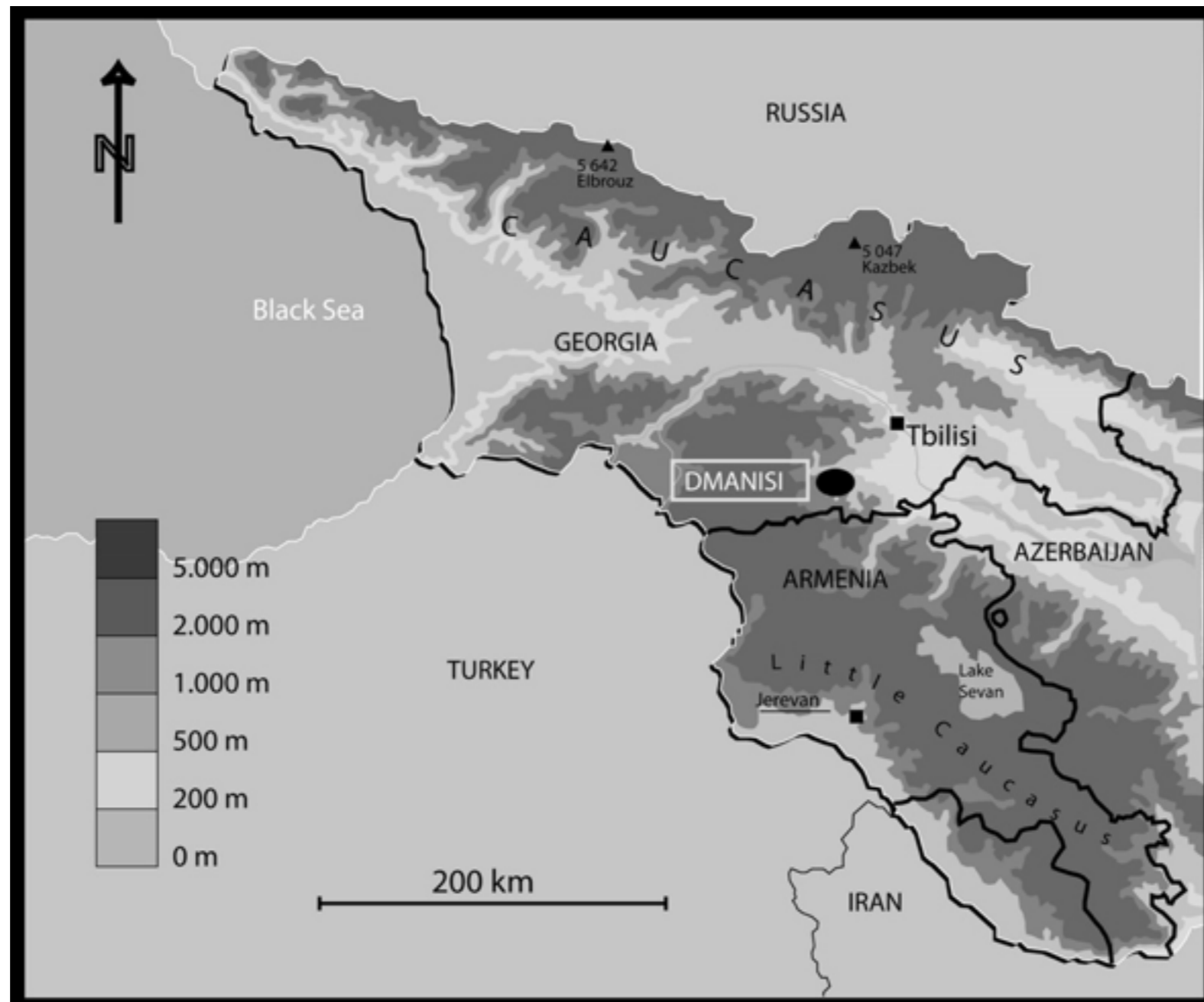
- $^{40}\text{Ar}/^{39}\text{Ar}$ is measured
- ^{39}Ar produce by reaction



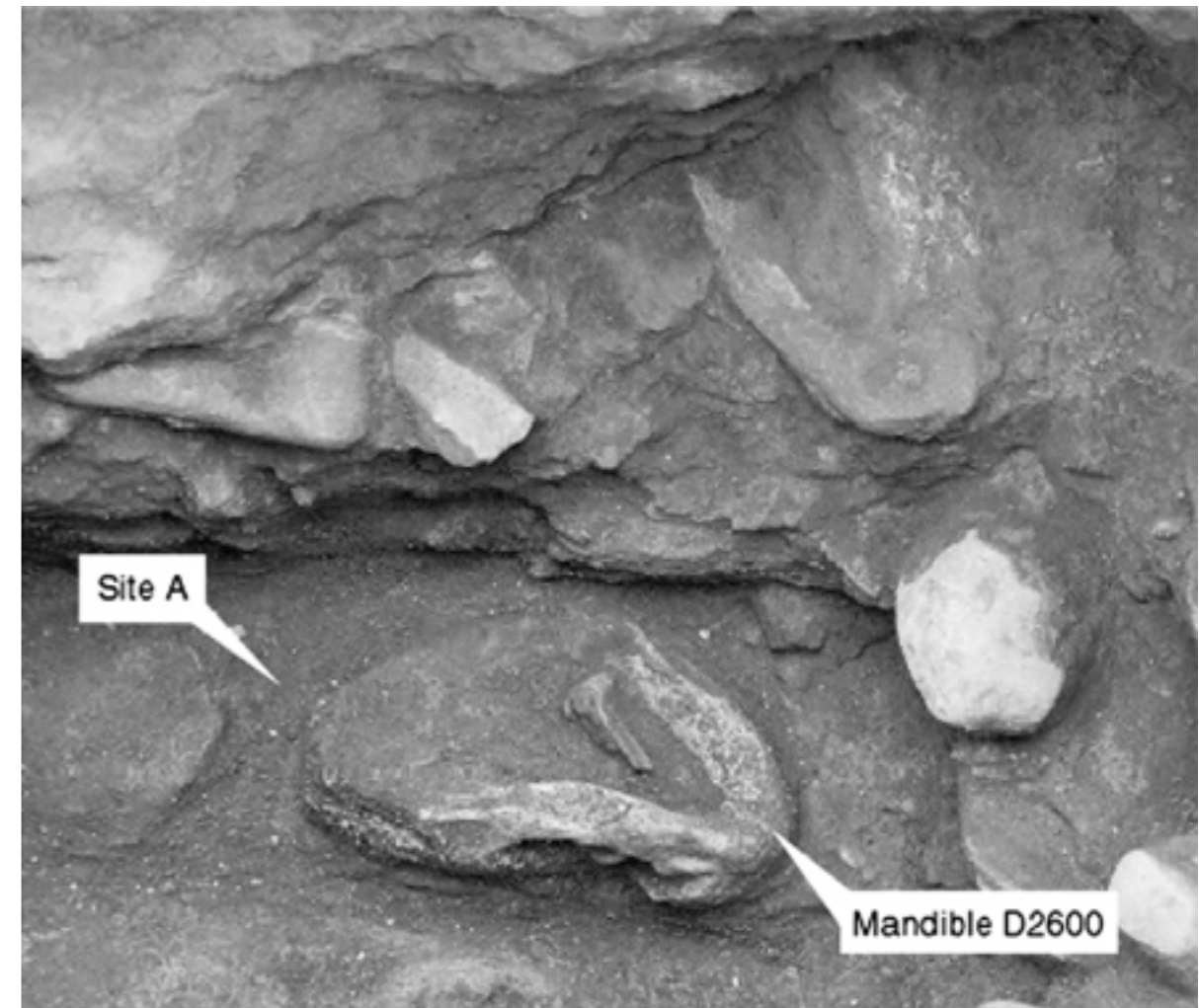
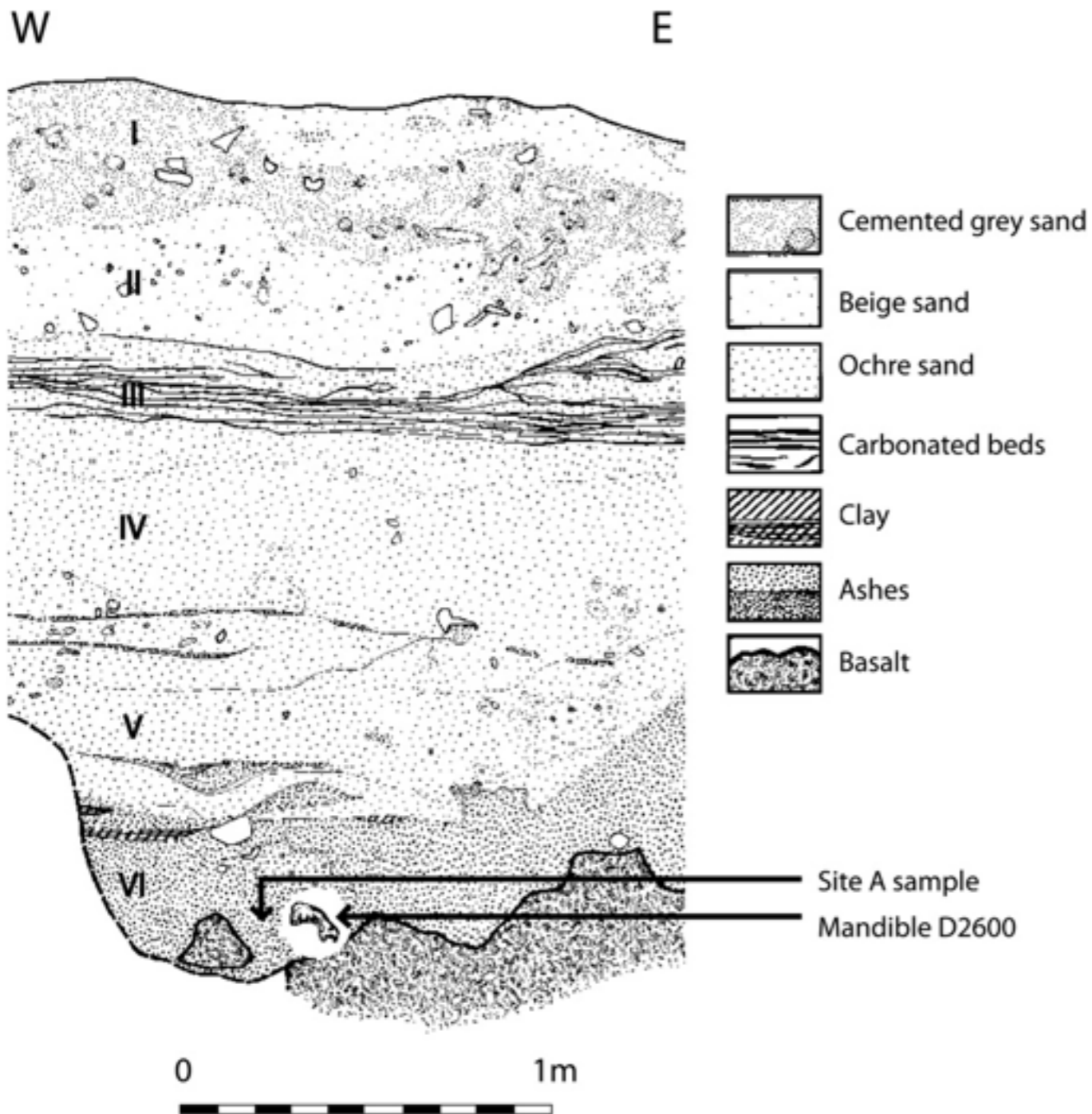
Dmanisi: *H. Georgicus*

Quaternary Geochronology 5 (2010) 443

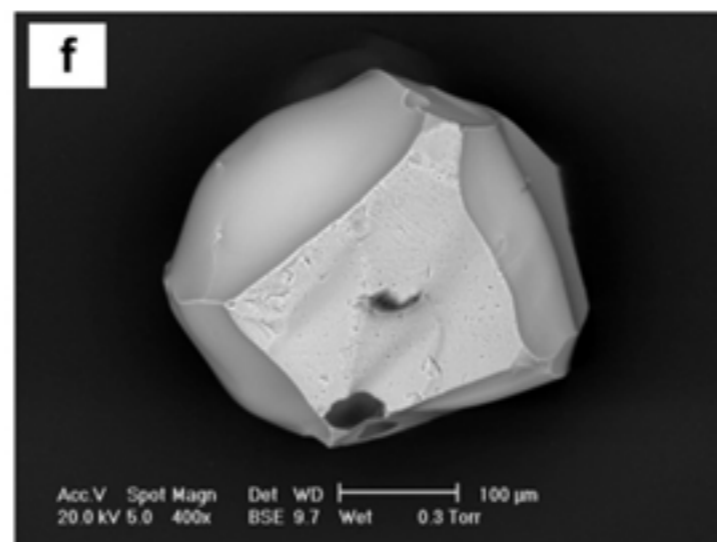
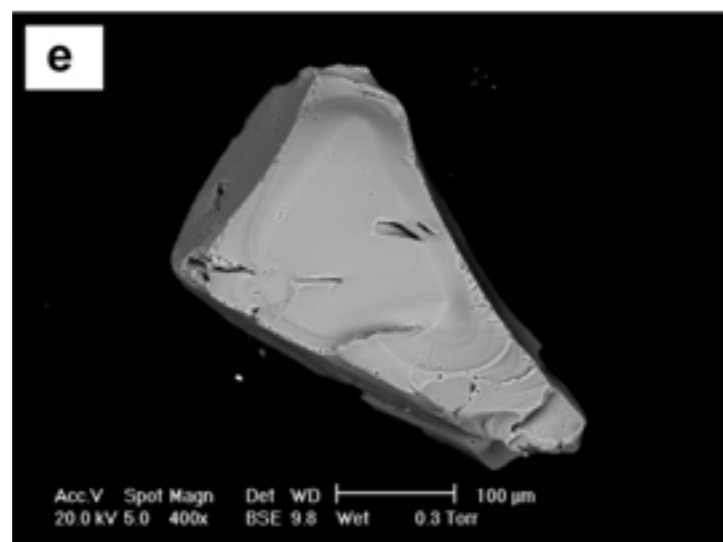
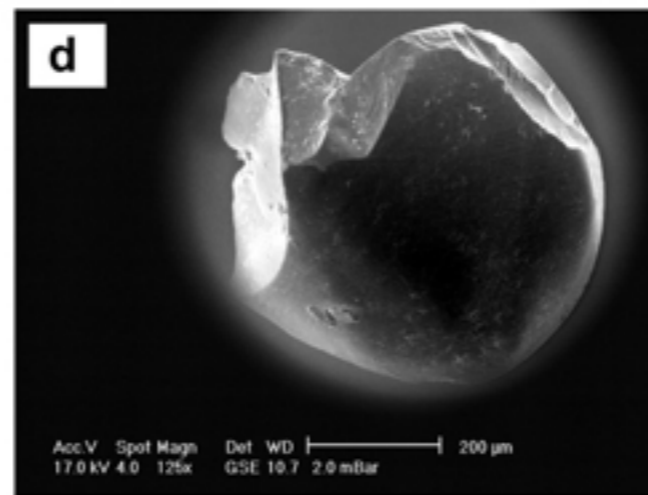
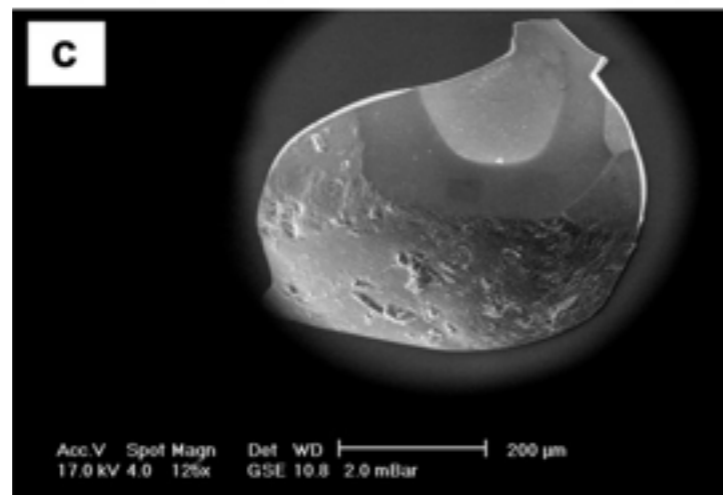
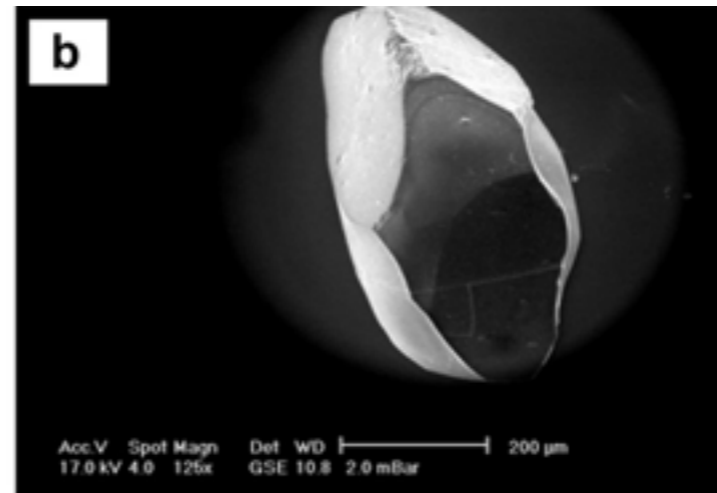
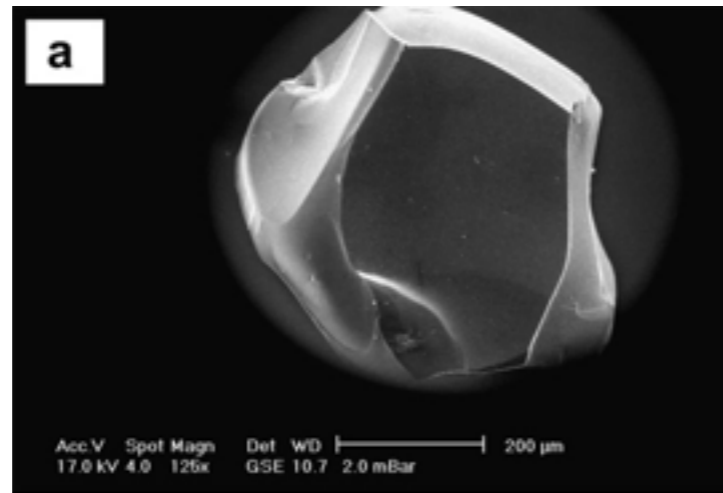
Earliest human remains in Eurasia: New $^{40}\text{Ar}/^{39}\text{Ar}$ dating of the Dmanisi hominid-bearing levels, Georgia



Dmanisi stratigraphy

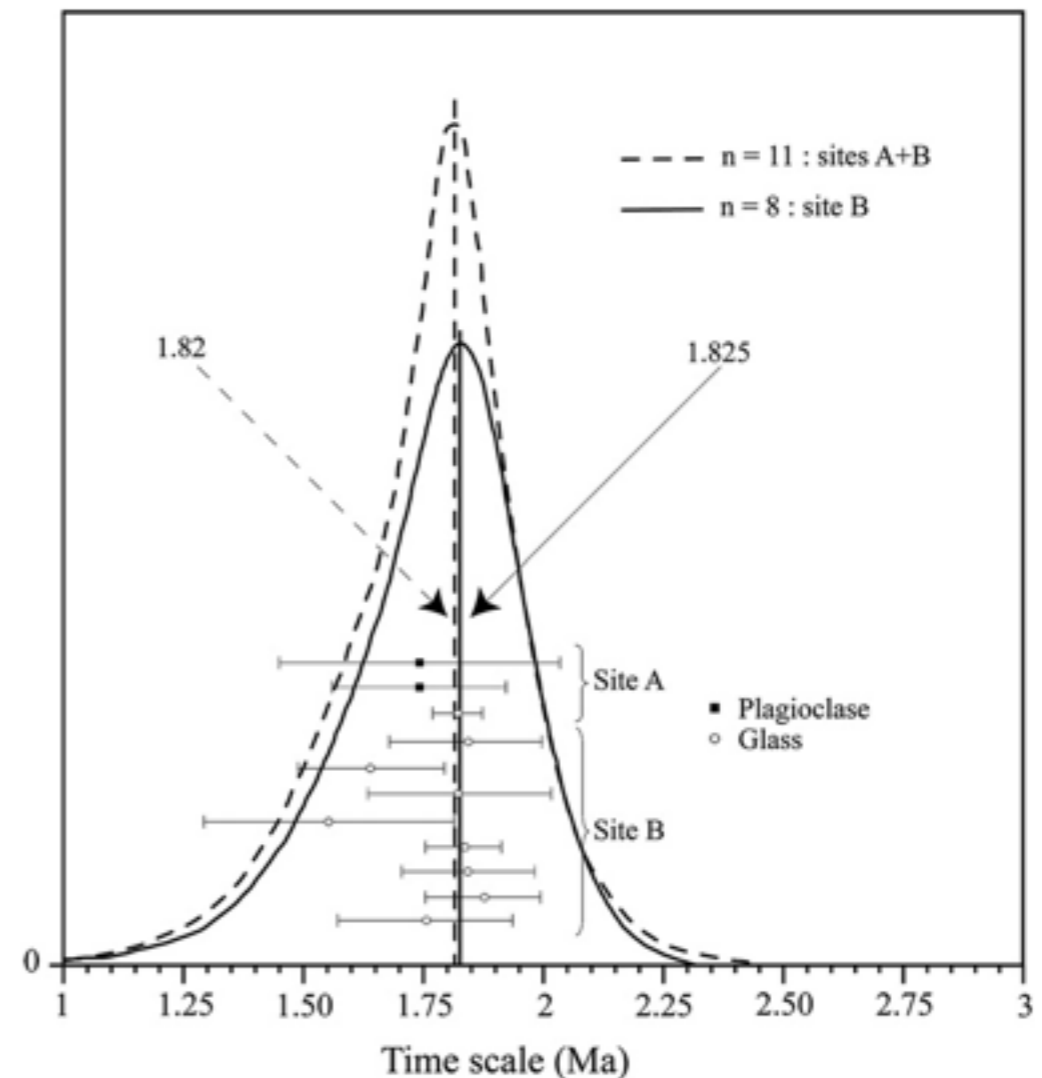


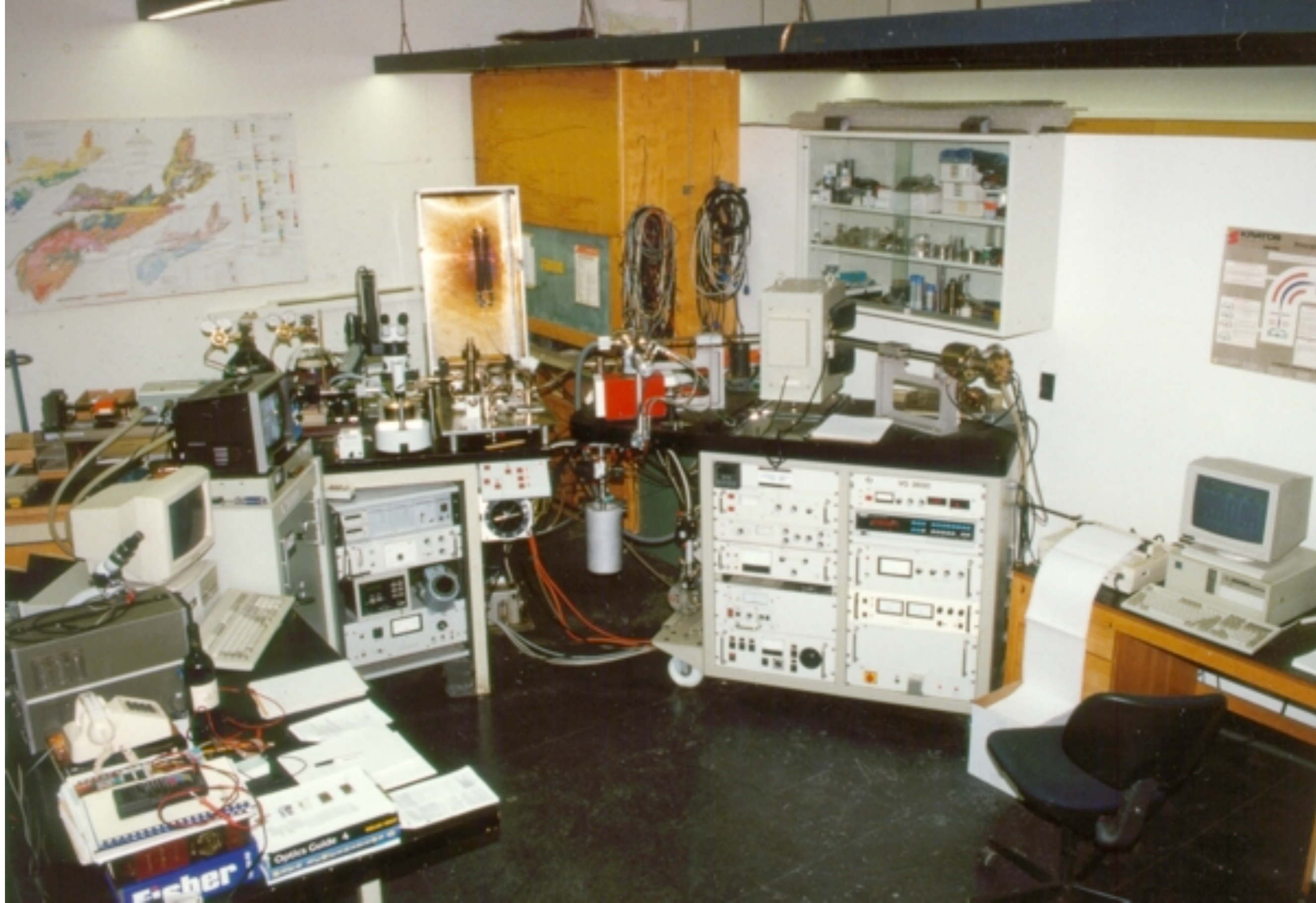
glass and plegioclaste grains



Ar - Ar dating

- grains irradiated in reactor for 2 h ($2.5 \times 10^{17} \text{ n / cm}^2$)
- gas extraction with infrared laser (50 W)
- mass spectrometer





Australopithecus afarensis

3.2 Ma BP (Argon–Argon)

30 kg, 110 cm

brain 375 to 550 cc



30 kg, 110 cm

Homo ergaster/erectus

2 Ma BP (argon-argon)



70 kg, 175 cm

brain 800 to 1000 cc

J. Gurche