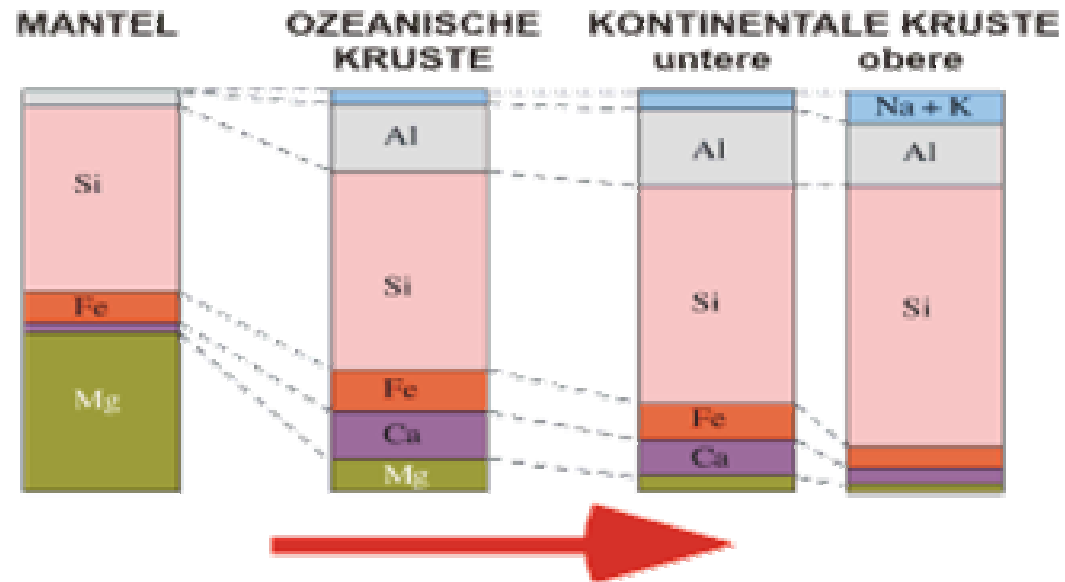
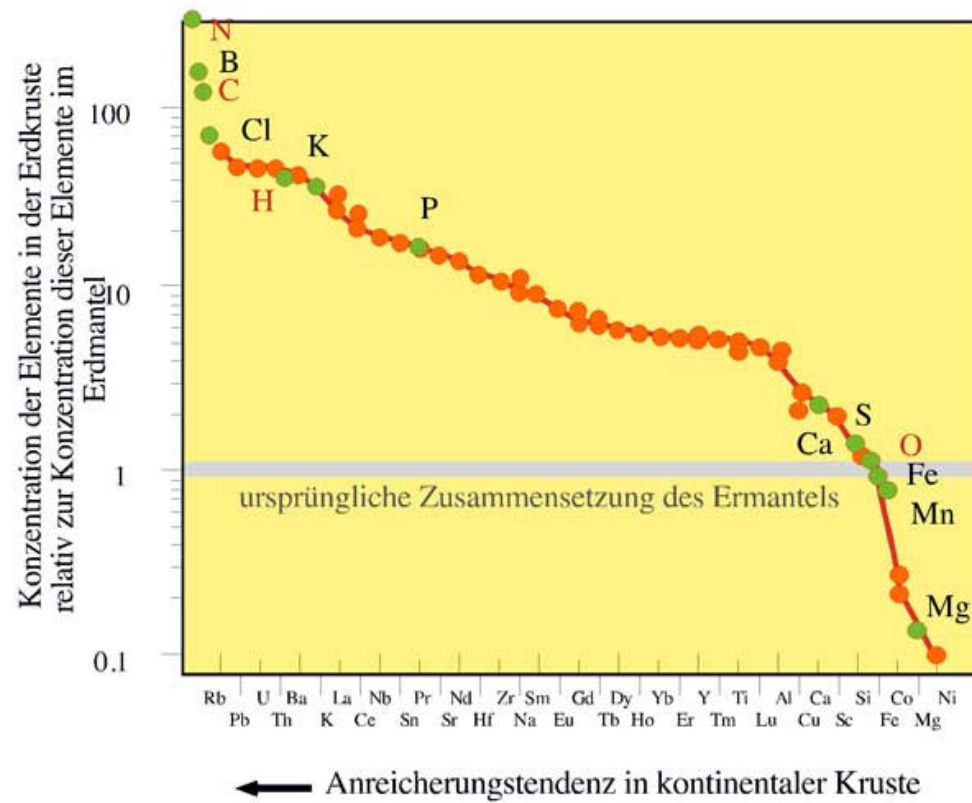


Geochemie der Kruste



Element distribution between crust and mantle



The early Earth environment

1956



2000



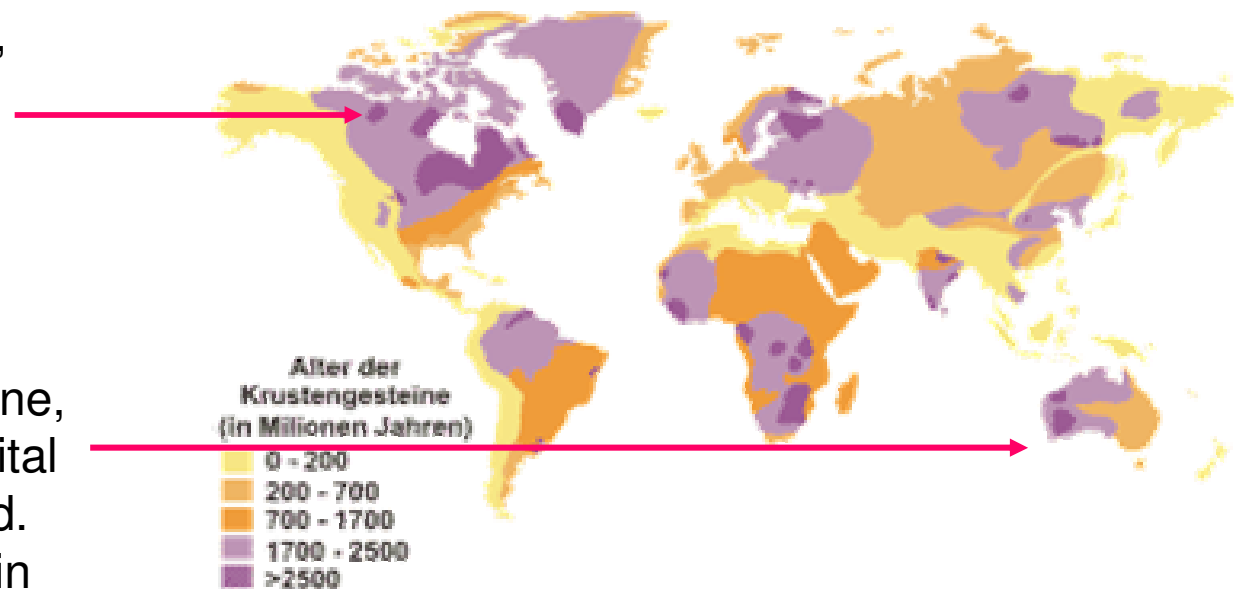
The early crust

The oldest rocks recovered to date are only around 4 b.y. old, suggesting that the crust had not developed sufficiently to become permanent until about 3.9 b.y. ago.

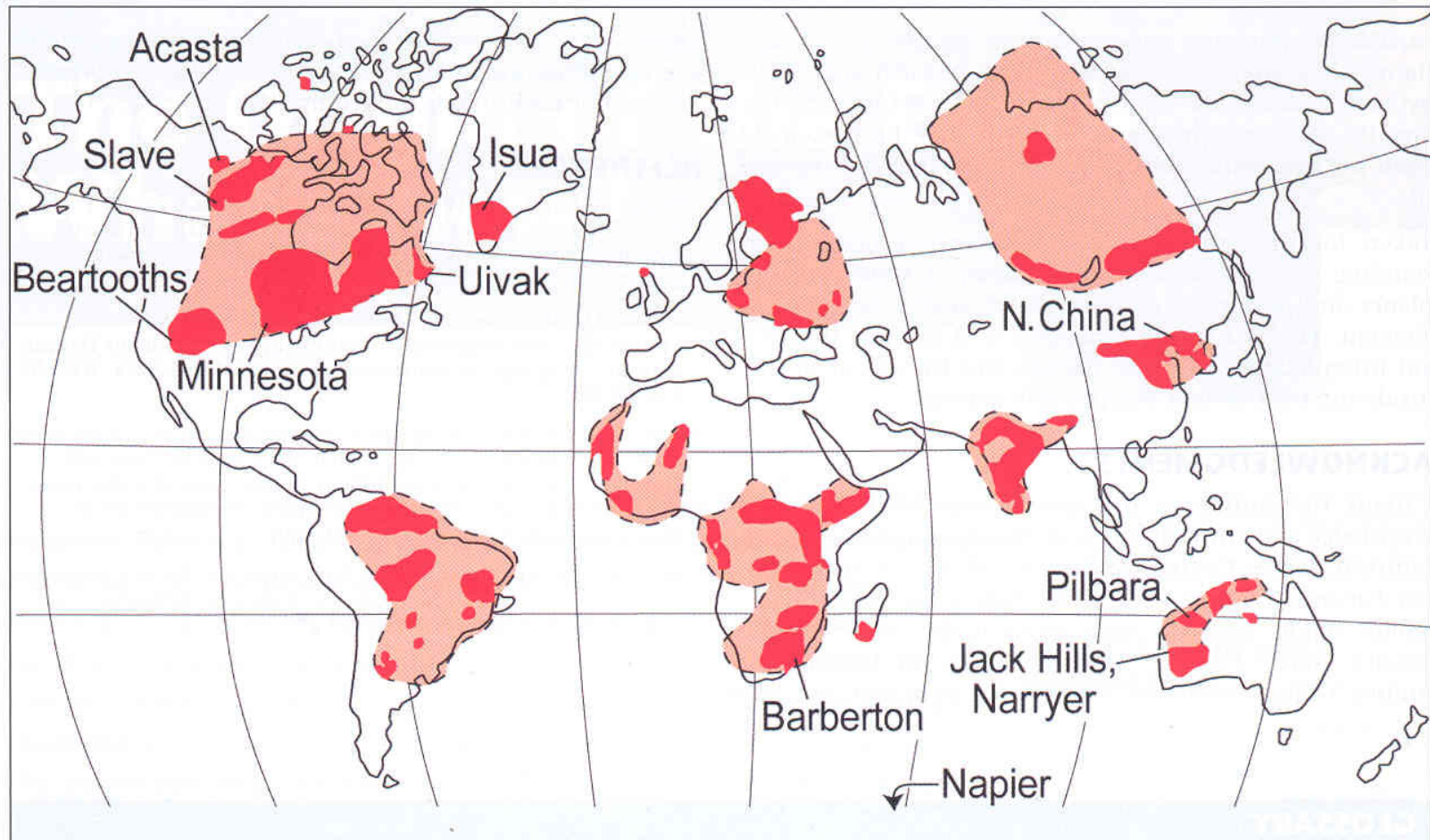
Acasta Gneiss Complex,
Slave craton
Northwest Territories,
Canada ~4 Ga

Jack Hills, Narryer Terrane,
Western Australia – detrital
zircons 4.1 to 4.4 b.y. old.

The zircons were found in
much younger sedimentary
rocks. These zircons suggest that the 4.1-4.4 b.y. old proto-crust was probably
more silicic than basalt, possibly having a composition close to diorite.

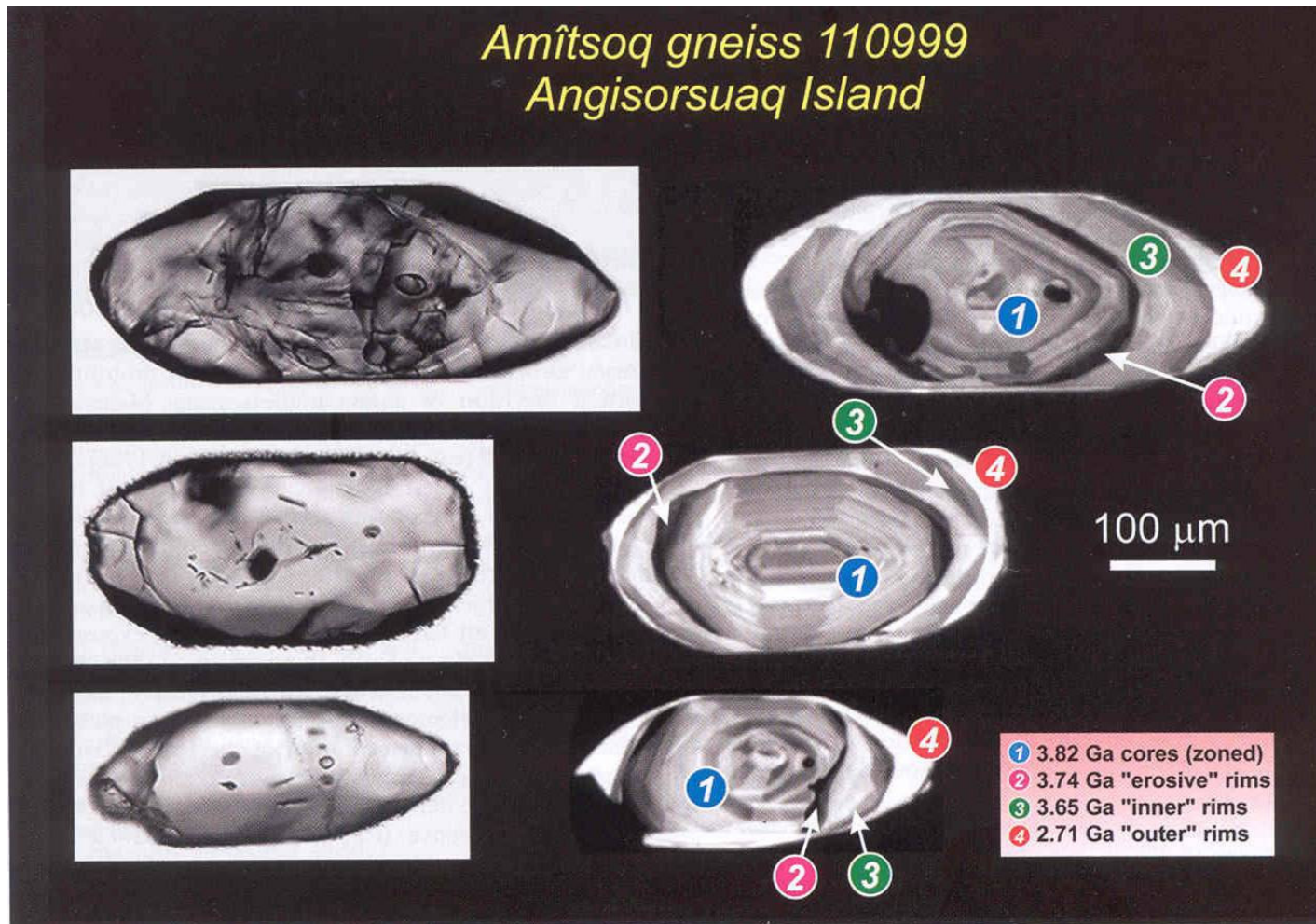


Oldest crust



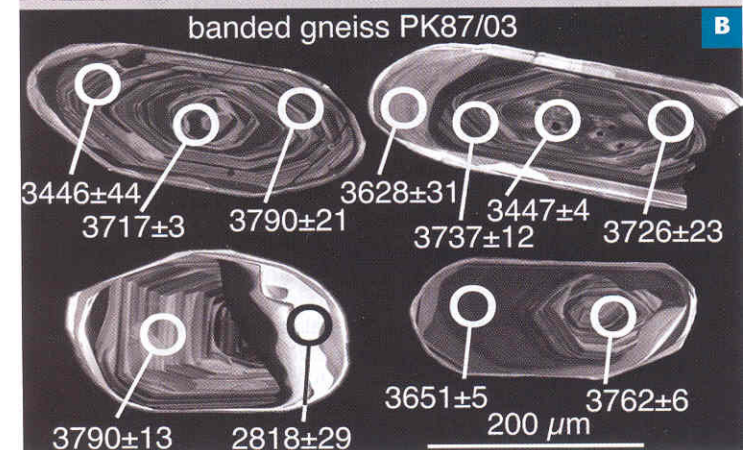
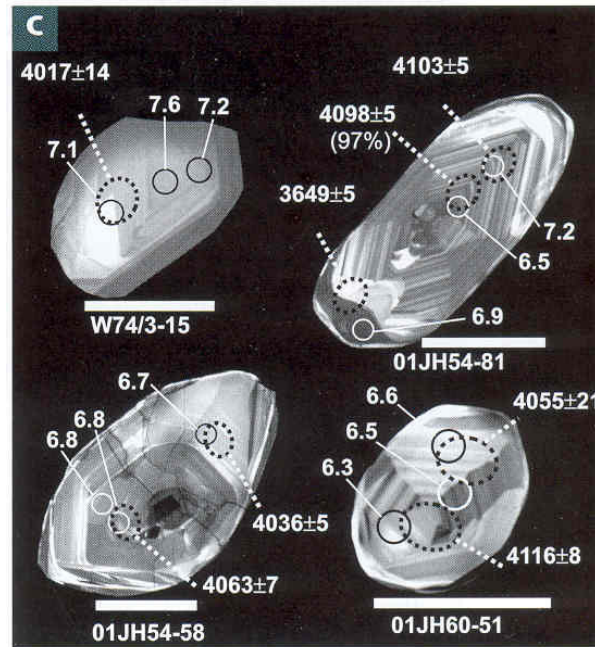
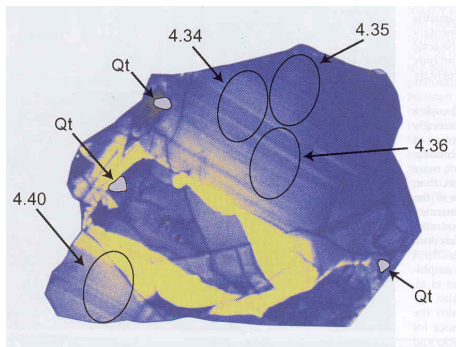
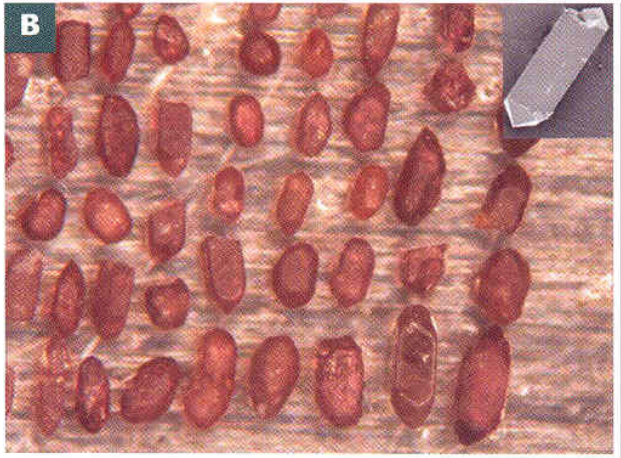
Valley: Elements 2, 2006

*Amîtsoq gneiss 110999
Angisorsuaq Island*



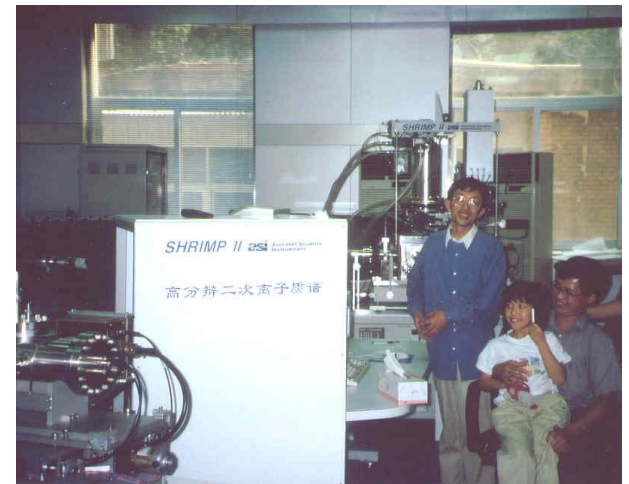
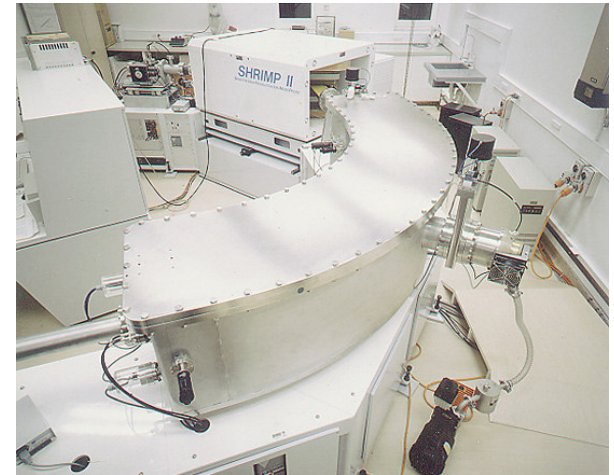
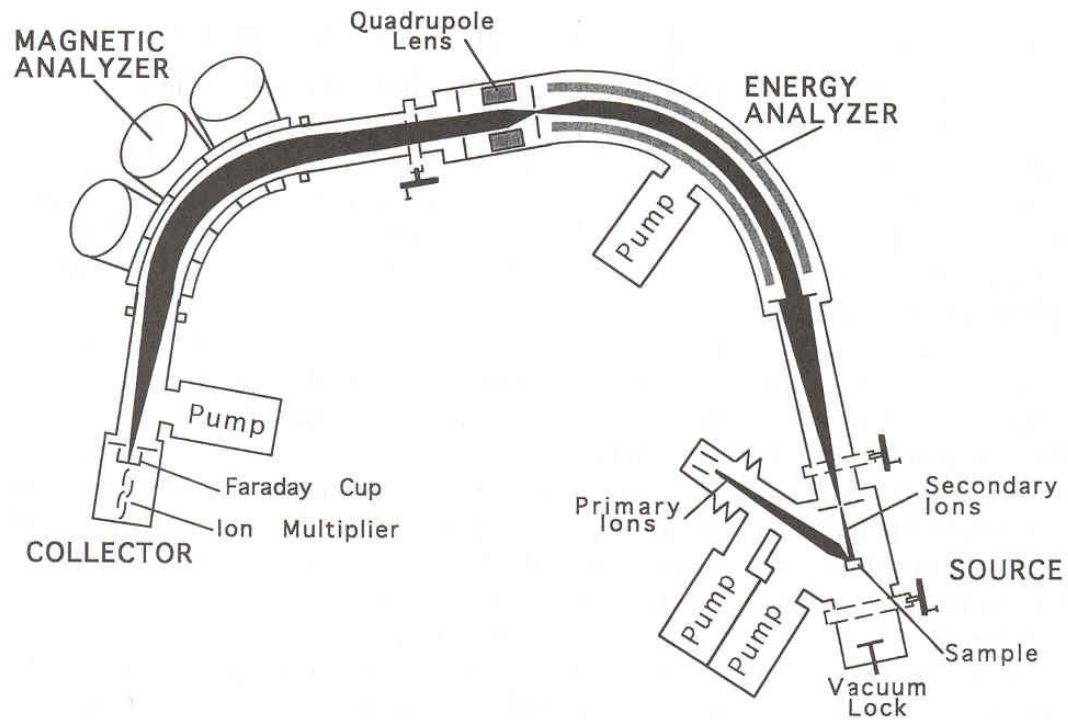
Scherer, Whitehouse, Münker: Elements 3, 2007

The early crust: evidence from zircon dating

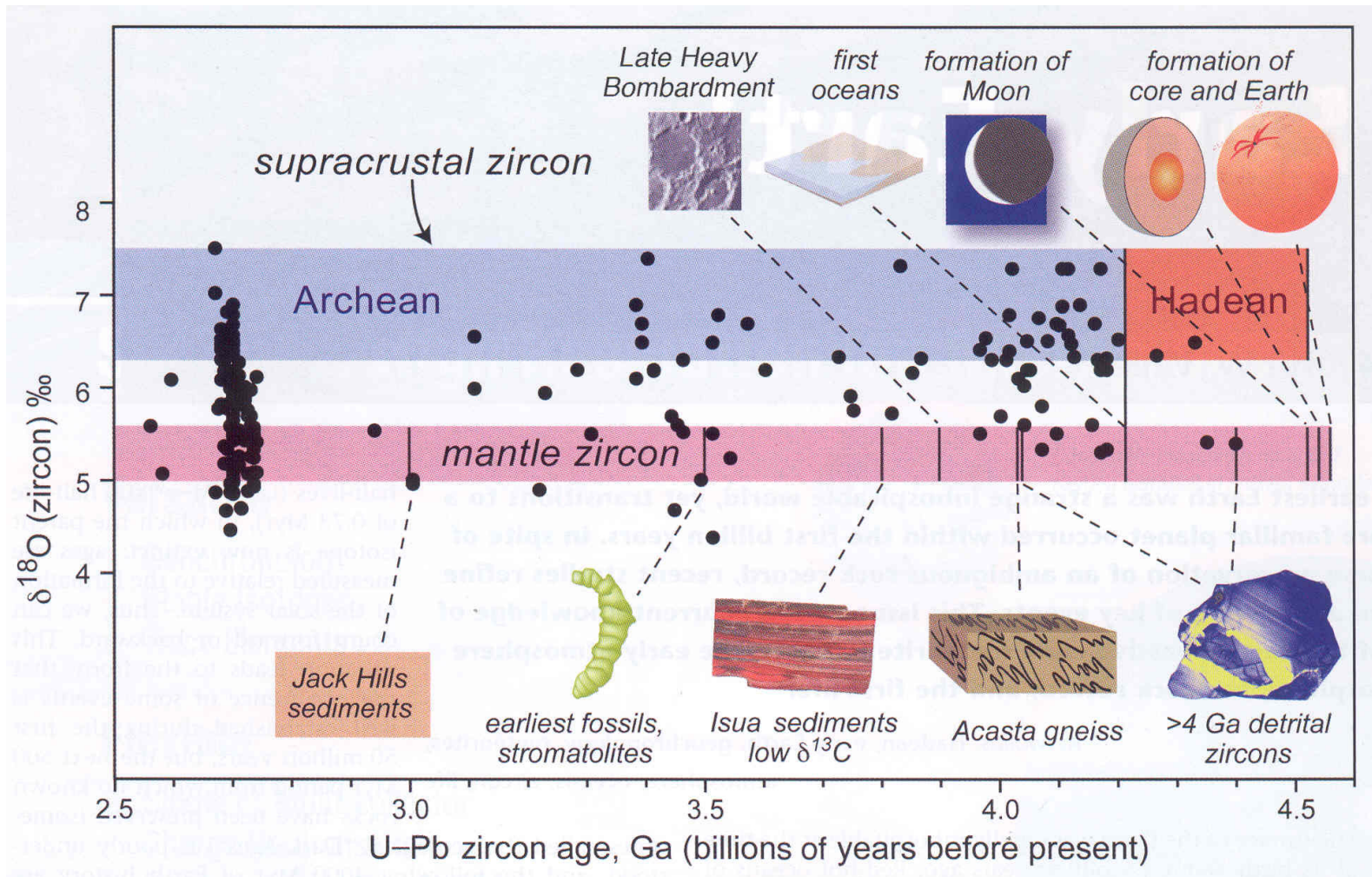


SHRIMP

(Sensitive High Resolution Ion MicroProbe)

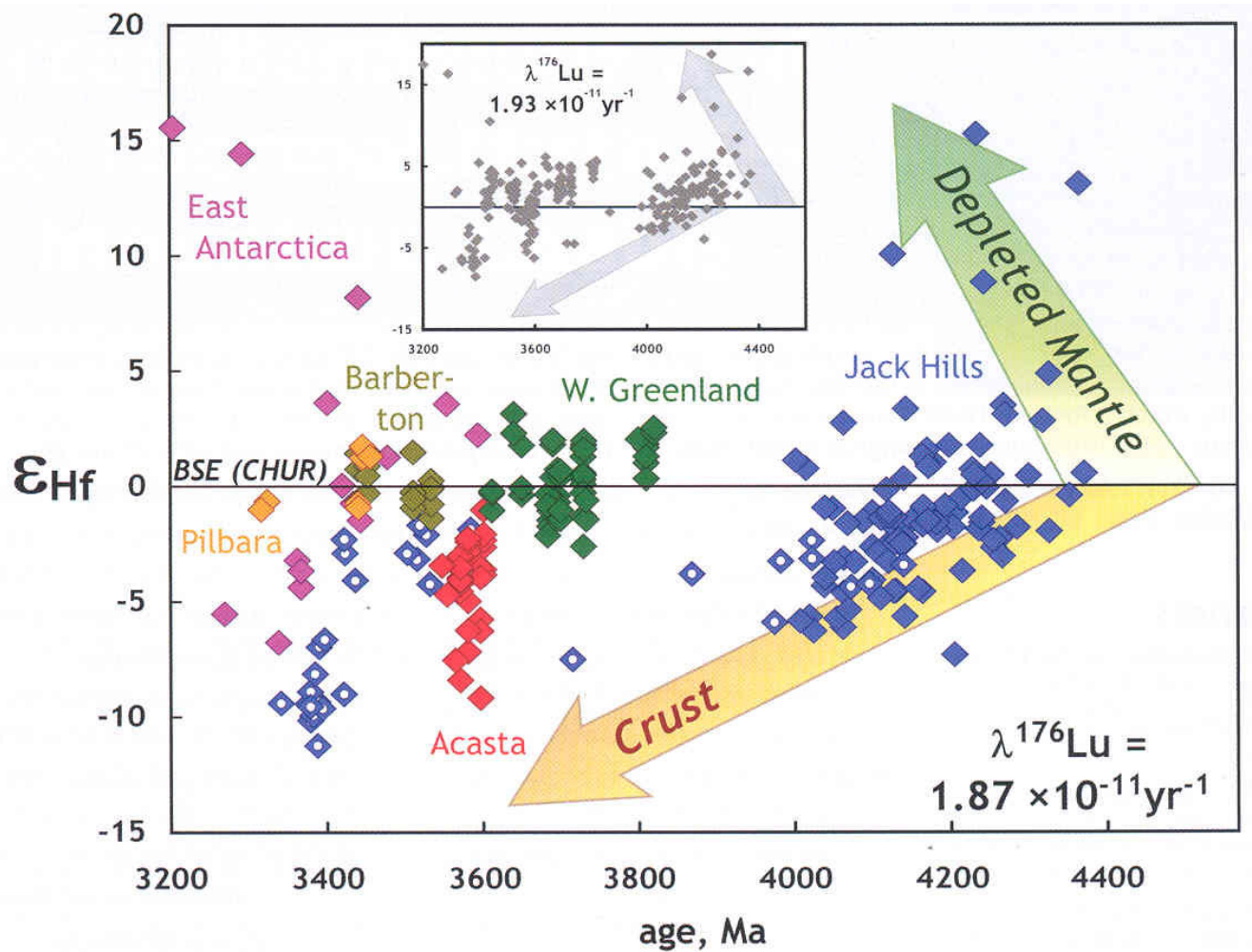


Key events in the first billion years of Earth history



Valley: Elements 2, 2006

The Earth early differentiation history



Scherer, Whitehouse, Münker: *Elements 3*, 2007

Crustal growth events

The most dramatic shift in the generation of continental crust began 2.8-2.5 by ago. This crust formation period was followed by additions of continental crust from:

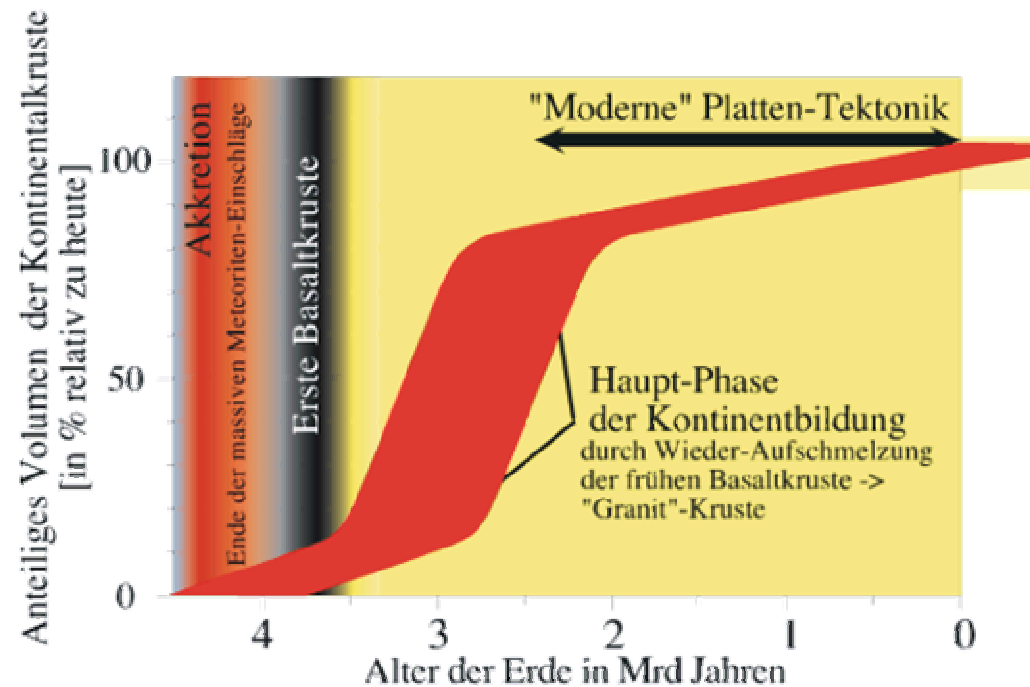
2.0 – 1.7 by

1.3 – 1.1 by

0.5 – 0.3 by

One cause of episodic crustal growth might be convergence of the Earth's crustal plates to form supercontinents every ~600 years.

- Break apart of supercontinent
- Higher subduction rates
- Formation of new continental crust



The Archean crust

During the Archean oceanic crust was being rapidly cycled by possibly ~100 separate crustal plates.

The Archean crust was composed of a mixture of basalt/komatiites and sodium-rich granites (TTG's – Tonalites, Trondhjemites, Granodiorites).

Crustal growth proceeded in an episodic fashion. The most important rapid growth occurred from 2.9 to 2.5 by ago. Widespread melting at this time formed much of the TTG's that constitutes much of the upper Archean crust.

Crust formation through Earth history

Basaltic crust generated by partial melting of mantle peridotite

1. Krustenbildungsschritt - Mantelabspaltung

This crust was locally hydrated and transferred (in greater depth) into amphibolites

Melting of basaltic crust during (1) subduction and/or (2) magmatic underplating (high heat flow) → generation of Tonalites, Trondhjemites and (differentiated) granodiorites *2. Krustenbildungsschritt – Trennung in differenzierte Ober- und residuale Unterkruste*

Melting of TTG's and of sedimentary rocks → granite production and enrichment of SiO_2 , Na_2O und K_2O in the Earth's crust *3. Krustenbildungsabschnitt – saure, moderne kontinentale Kruste*