扬子克拉通早期形成和演化

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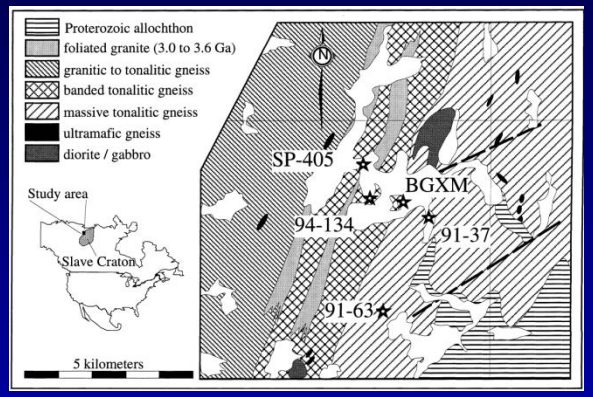
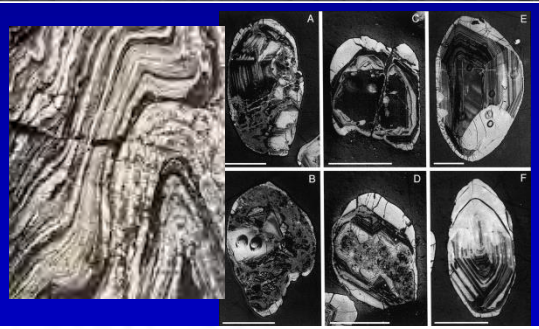
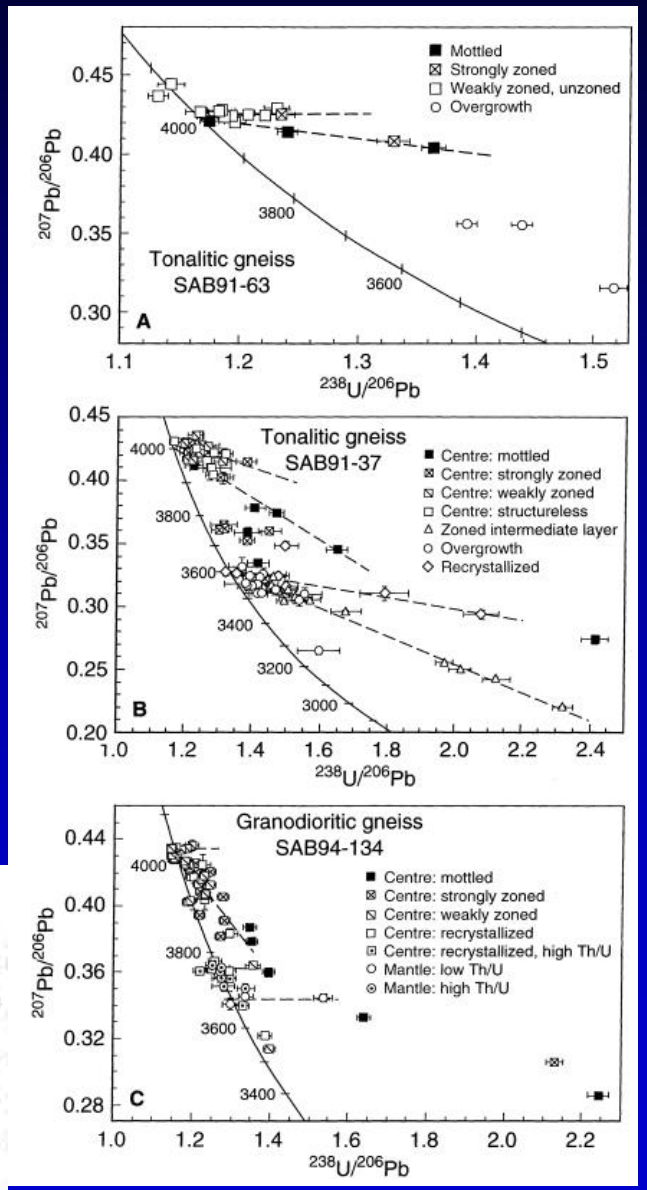
The Early evolution of the Earth

The oldest rocks on the earth: the Acasta Gneisses (Bowring and Williams, 1999)

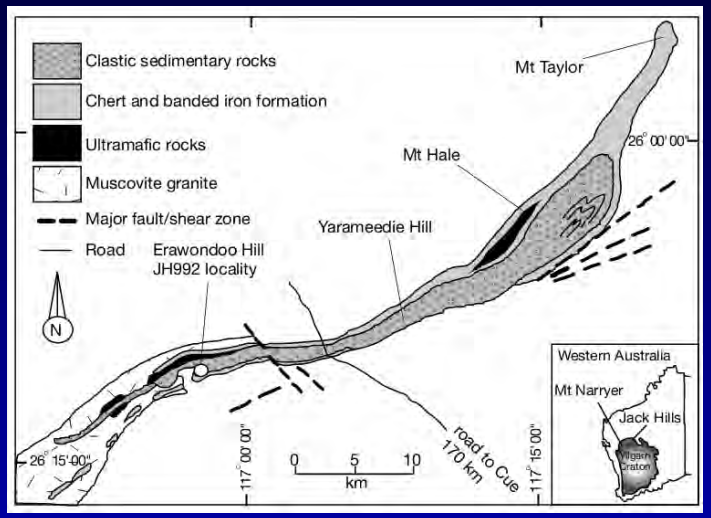


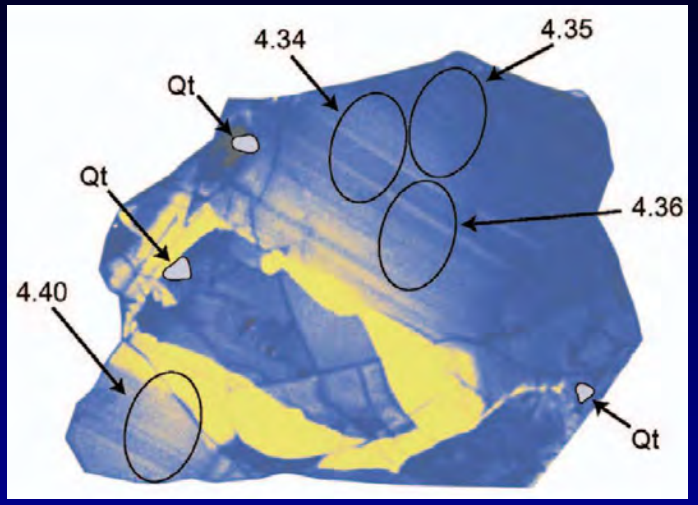


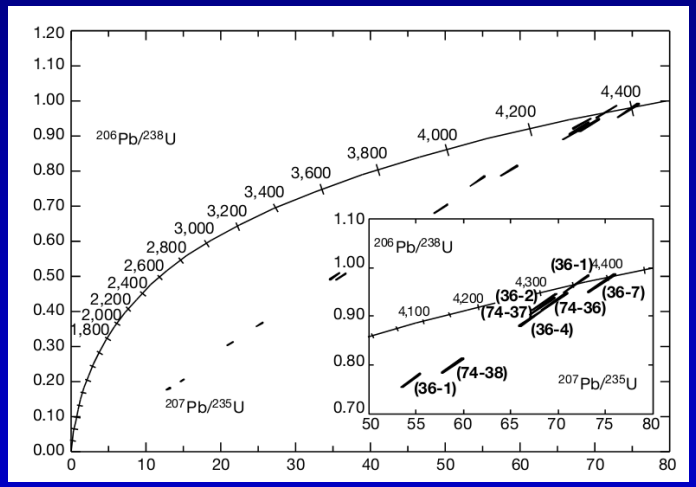


The Global 4.0–3.6 Ga Rock Record

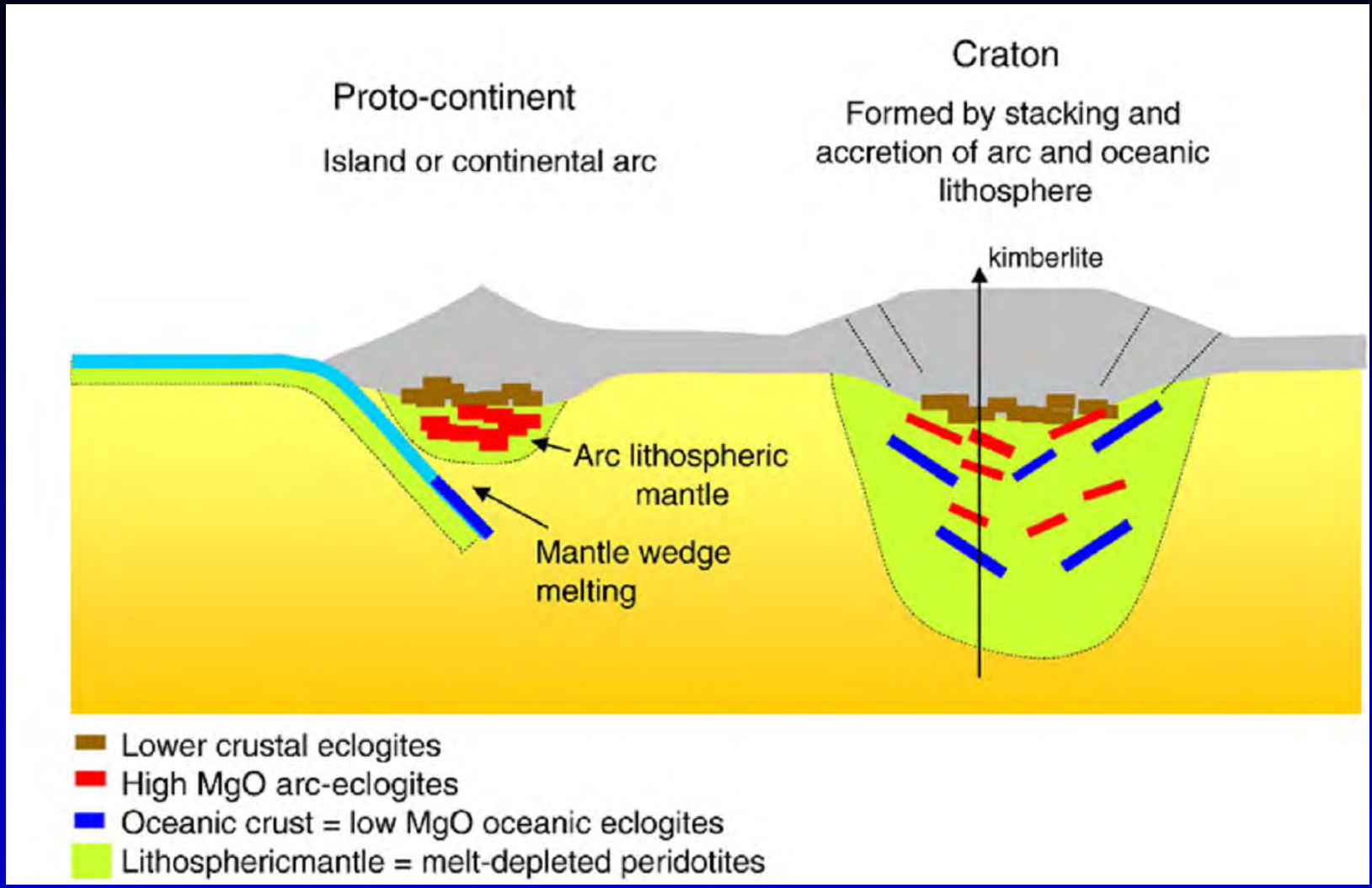
Rocks preserved from the 4.0–3.6 Ga period occupy about a millionth of Earth's crust; the remainder were destroyed by tectonic activity, melting and erosion over billions of years. These old rocks have been discovered in Greenland, Australia, Canada (three localities), Antarctica and China (summary in Nutman et al. 1996 apart from Stevenson et al.



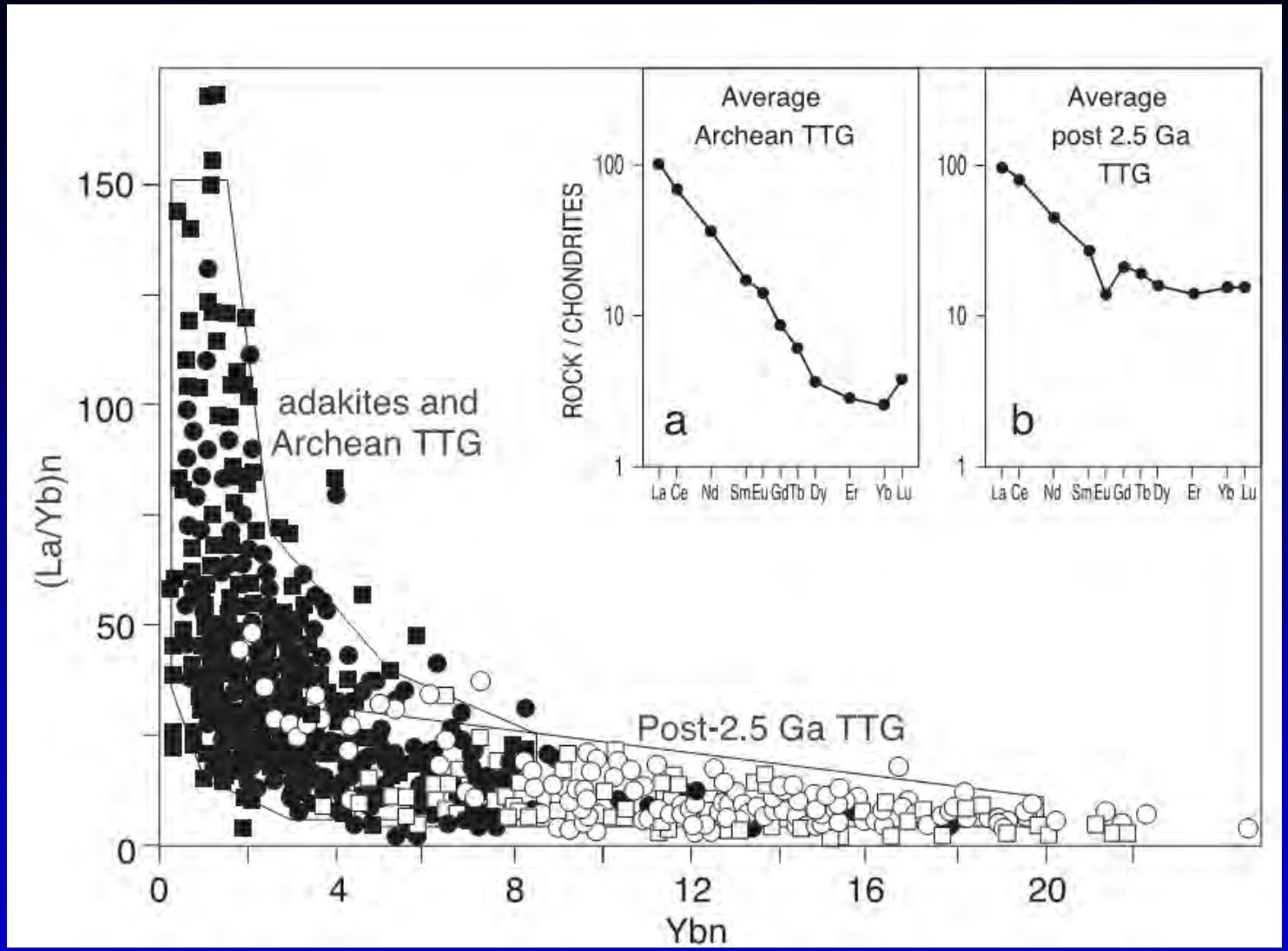




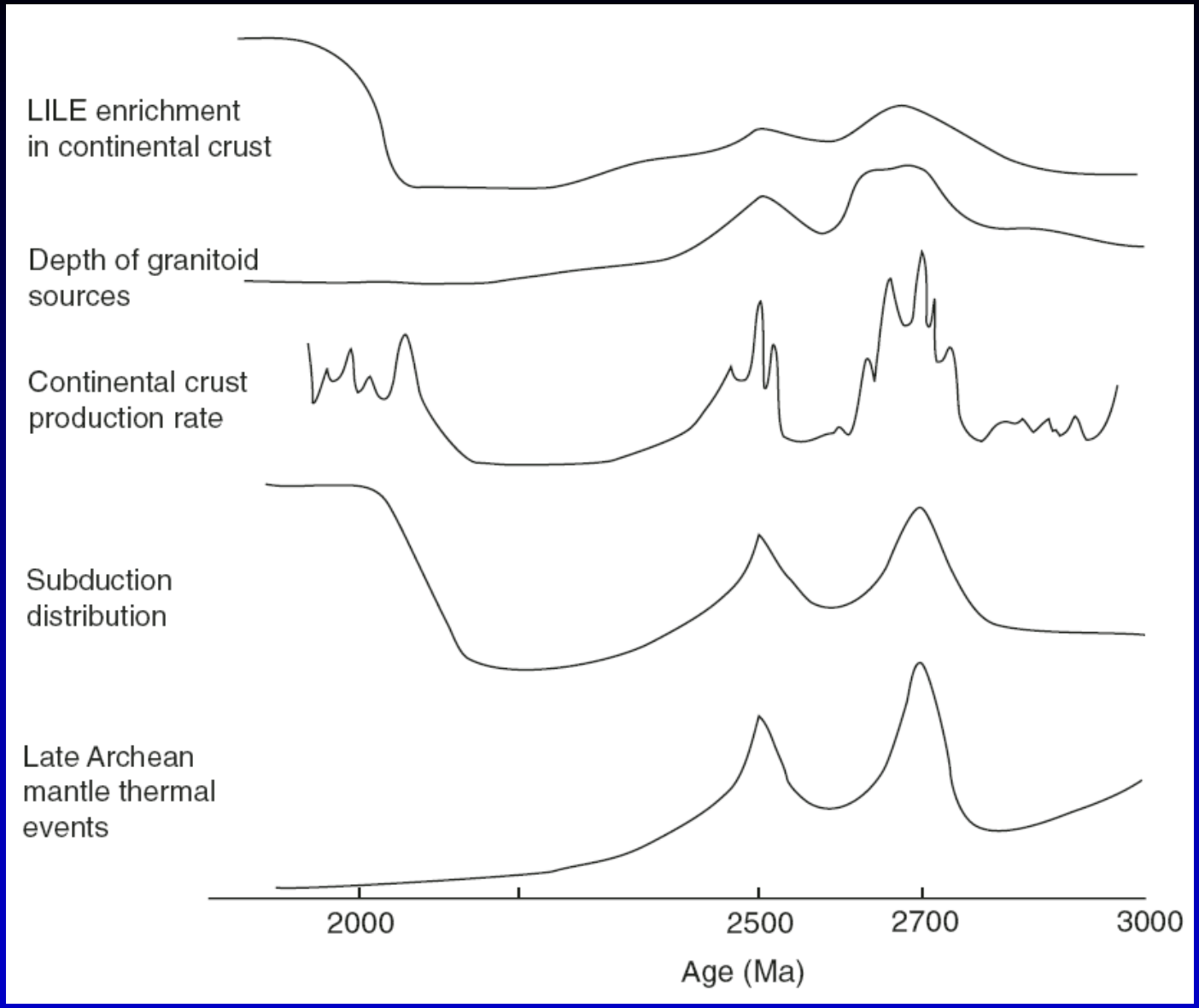
The oldest-known material of Earth (Wilde et al., 2001; Mojzsis et al., 2001)



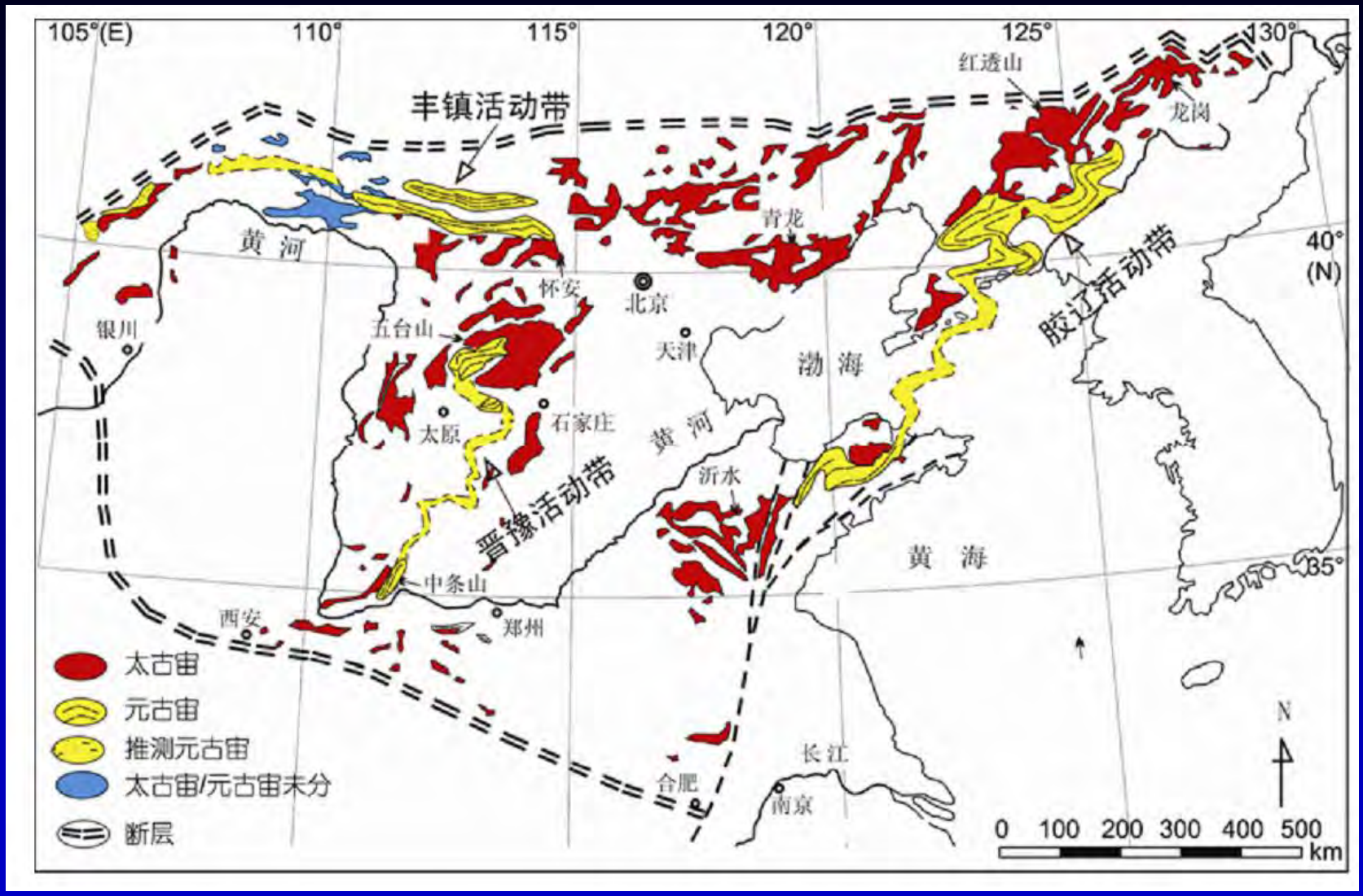
Cartoon illustrating the origins of the TTG in the Archean and the calc-alkaline granitoid in the early Paleoproterozoic (Modified after Horodyskyj et al., 2007)



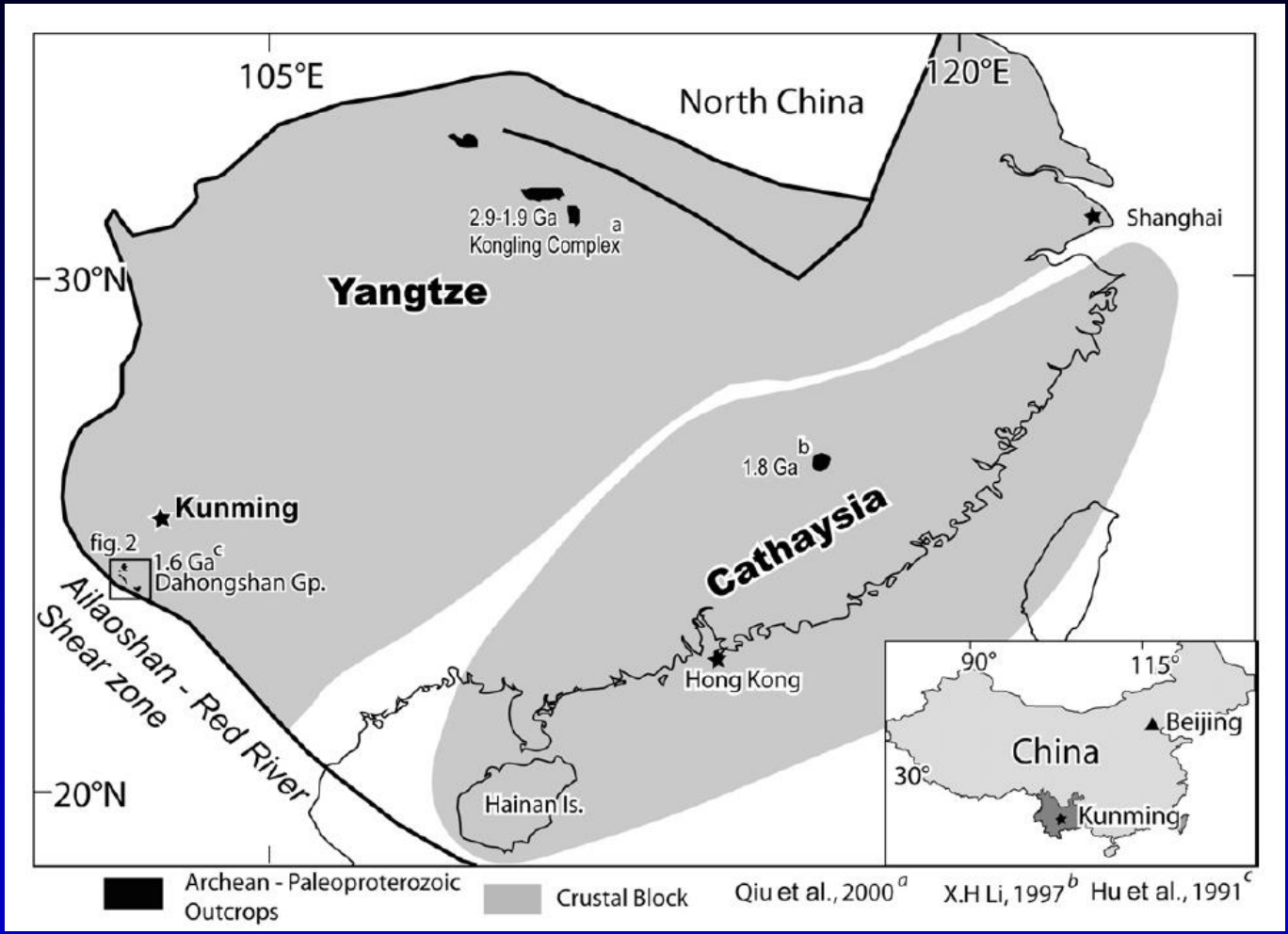
(La/Yb)n vs. Yb n graph showing distribution of adakites and TTGs (Condie, 2005)



Schematic representation of possible tectonic-thermal history on Earth between 3 and 2 Ga (Condie, 2008)

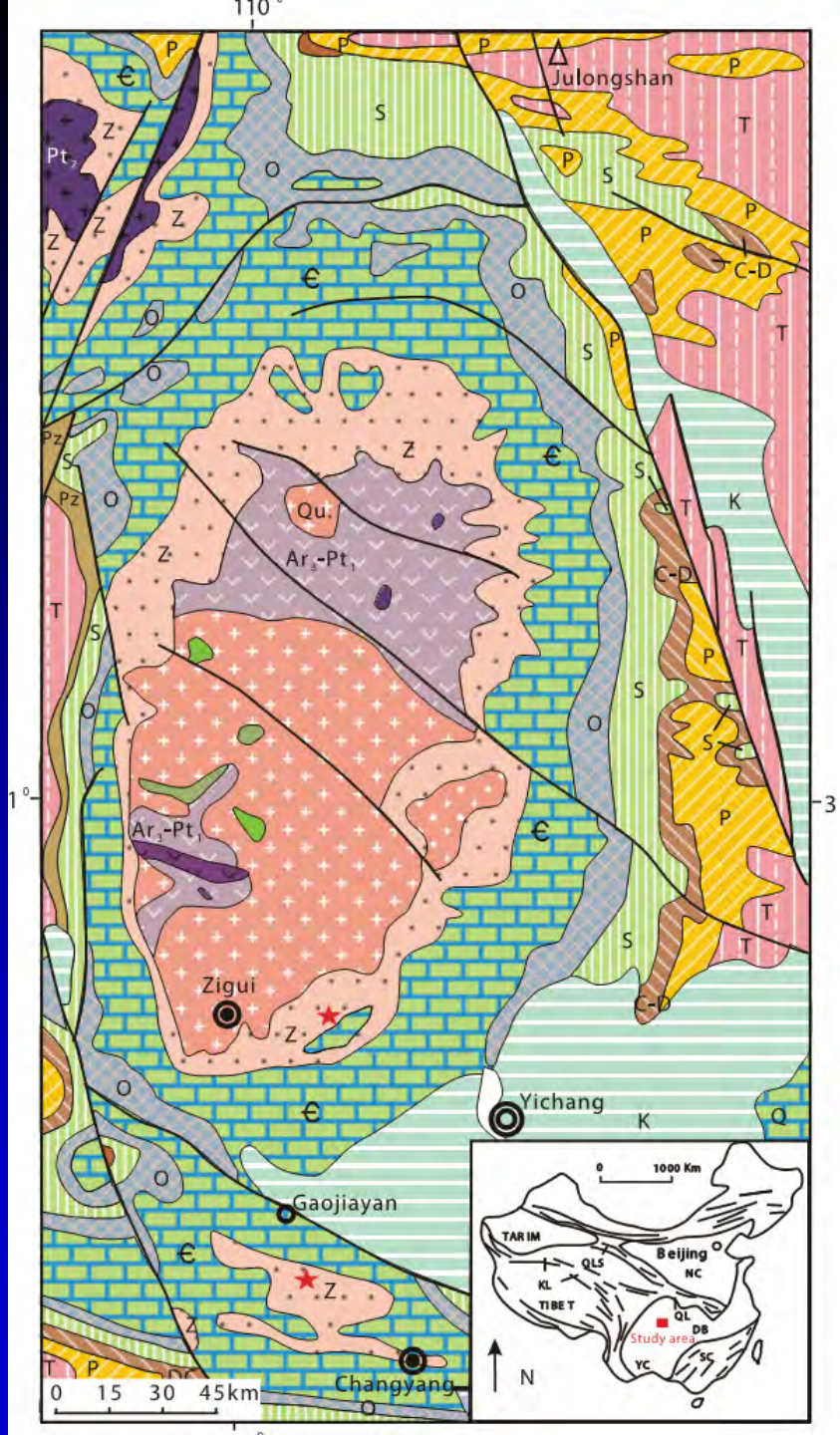


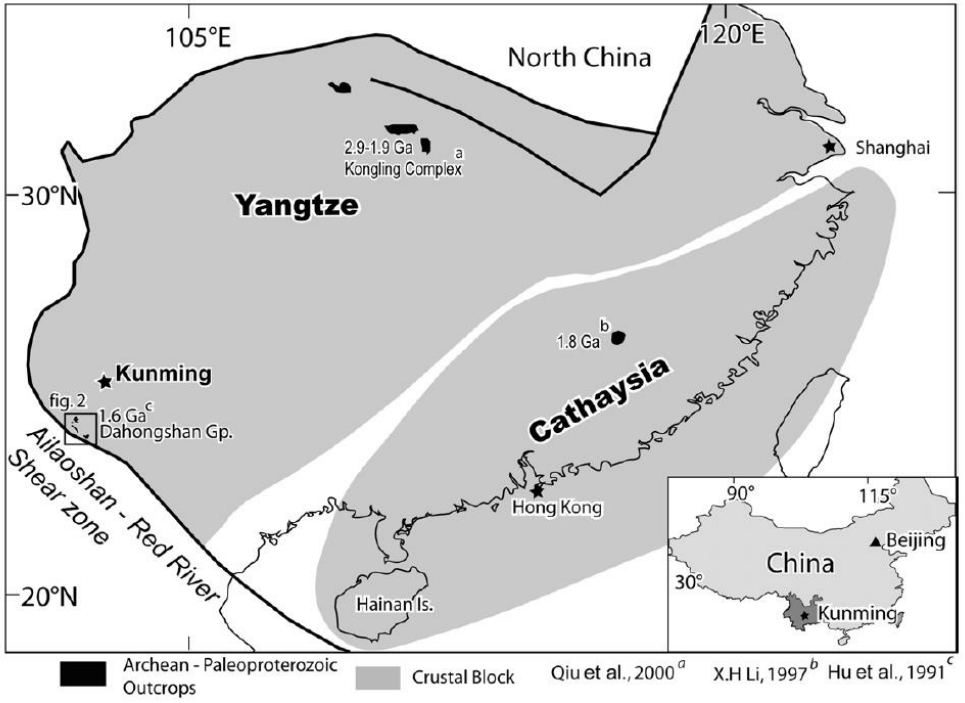
Old basement rocks in the North China Block (Zhai, 2011)

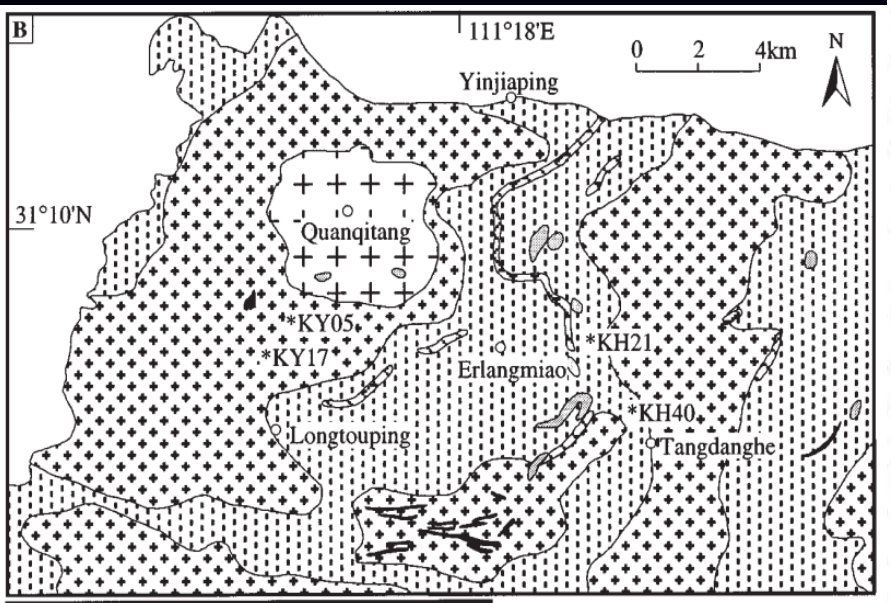


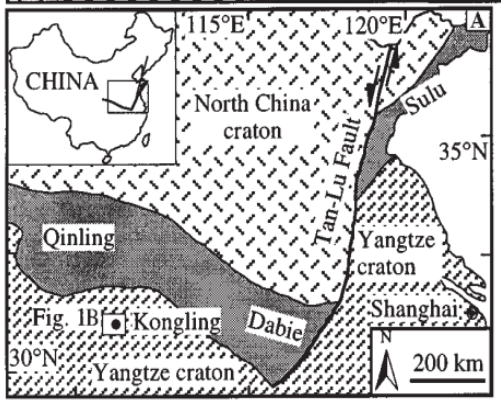
How about the Yangtze Craton? (Greentree and Li, 2008)

Detrital zircon recording the early evolution of the Yangtze Block


110°
Julongshan
Qu.
Ar3-Pt1
Zigui
Yichang
Gaojiayan
Changyang
0 15 30 45km
0 1000 Km
TARIM
Beijing
QLS
KL
NC
TIBET
QL
DB
Study area
YC
SC
N


105°E
120°E
North China
2.9-1.9 Ga a
Kongling Complex
Shanghai
30°N
Yangtze
1.8 Ga b
Kunming
fig. 2
1.6 Ga c
Dahongshan Gp.
Cathaysia
Ailaoshan - Red River
Shear zone
Hong Kong
20°N
Hainan Is.
90°
115°
Beijing
China
30°
Kunming
Archean - Paleoproterozoic
Outcrops
Crustal Block
Qiu et al., 2000 a
X.H Li, 1997 b
Hu et al., 1991 c

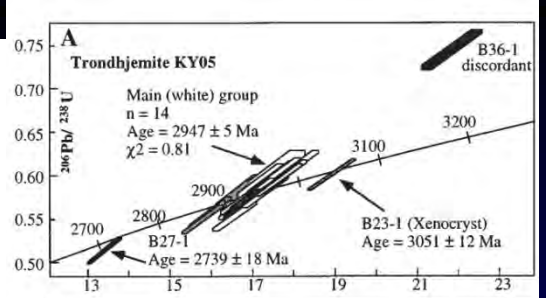


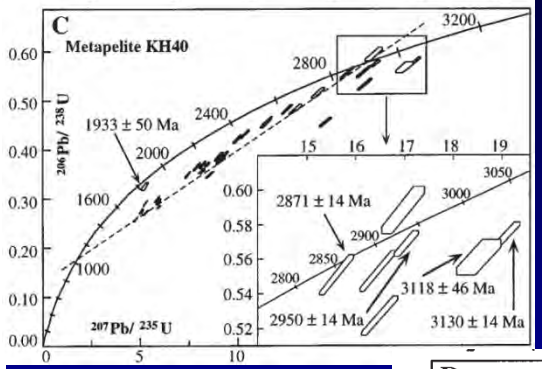


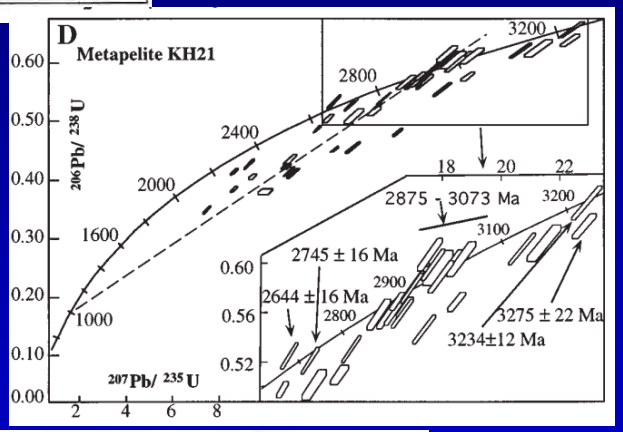
Stratigraphy
- Proterozoic-Phanerozoic sedimentary cover
- Archean marble marker horizon
- Archean metasedimentary rocks

Intrusions
- Proterozoic Quanqitang granite
- Precambrian ultramafic intrusion
- Precambrian diabase dike
- Archean granitoids

*KY05 Sample location and its number







First evidence of >3.2 Ga continental crust in the Yangtze craton of south China and its implications for Archean crustal evolution and Phanerozoic tectonics

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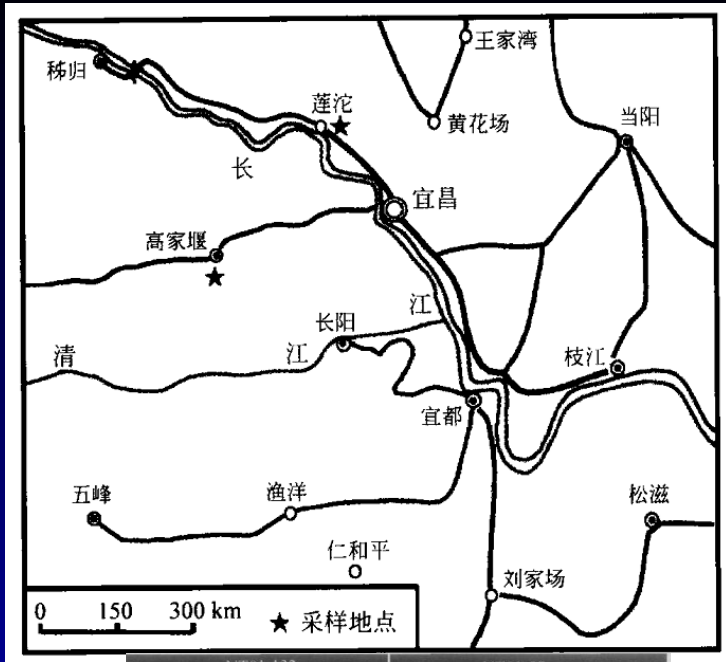
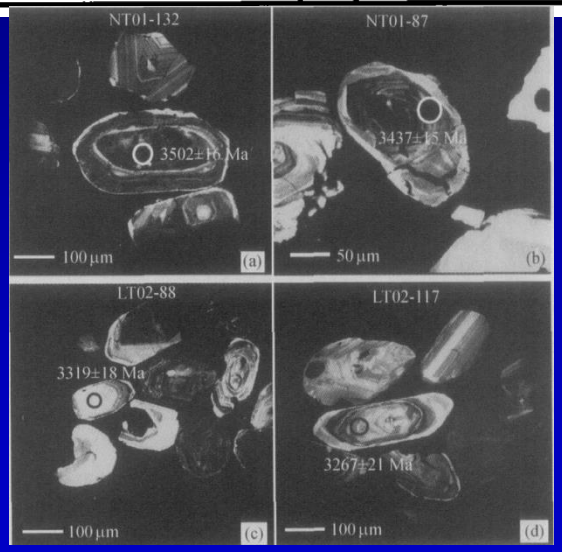
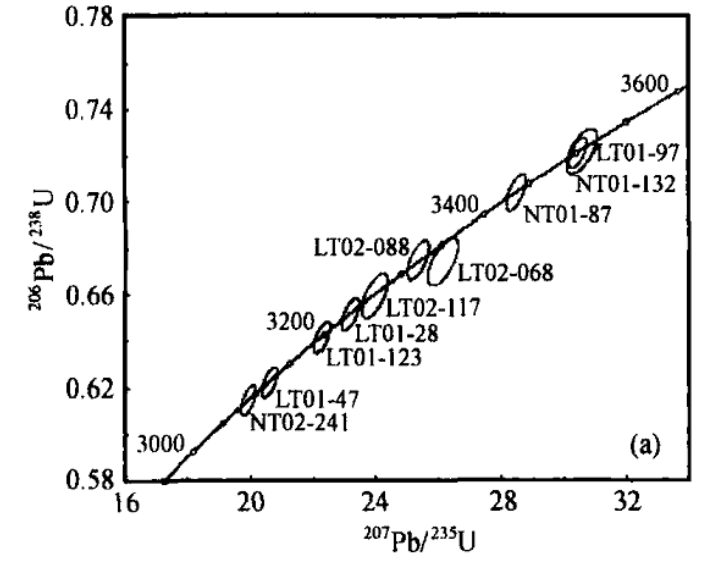
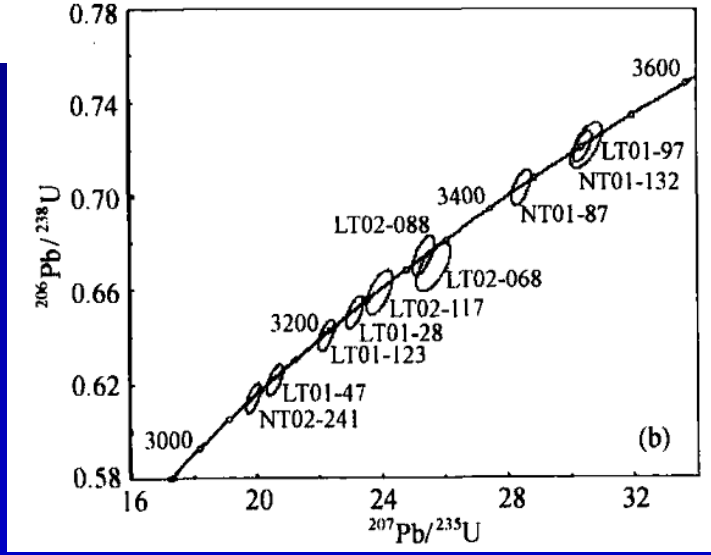
Shan Gao Department of Geology, Northwest University, Xi'an 710069, and School of Earth Sciences, China University of Geosciences, Wuhan 430074, China

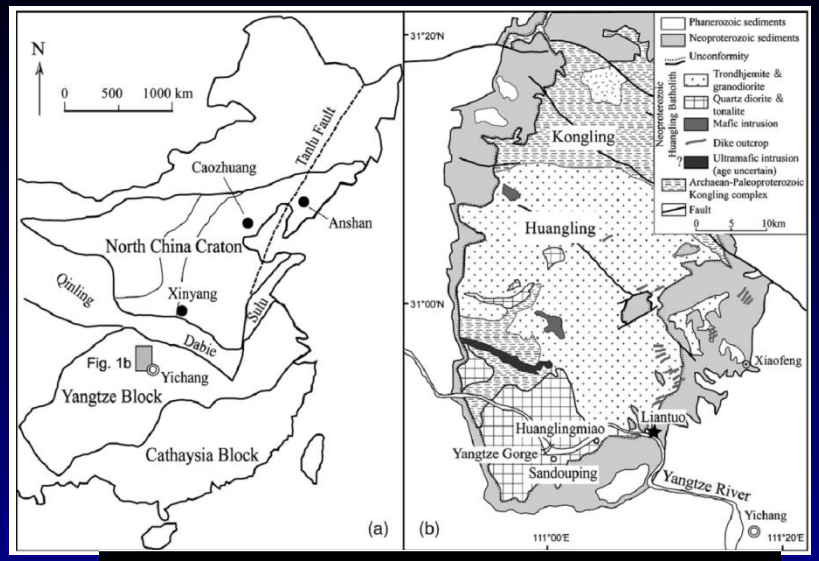


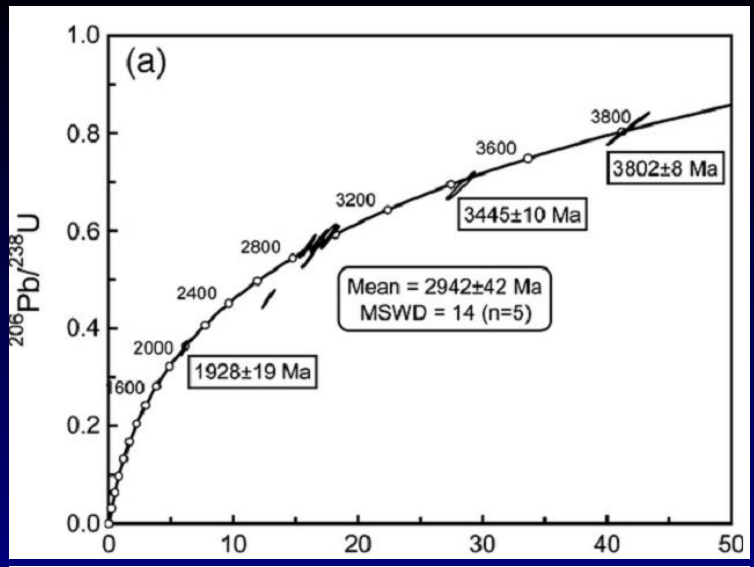


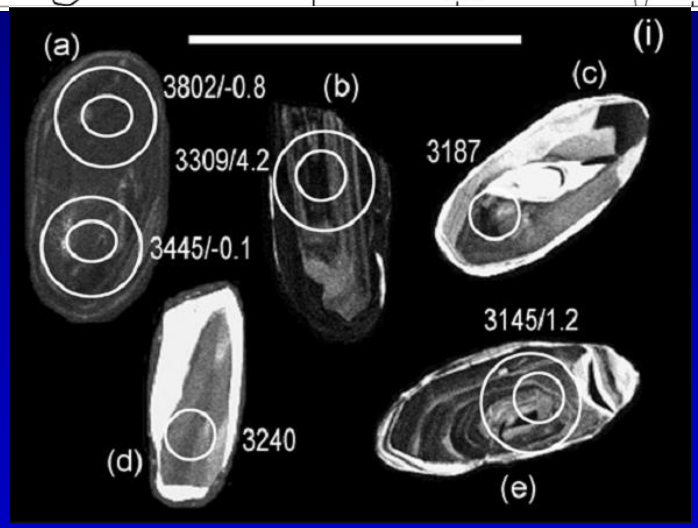


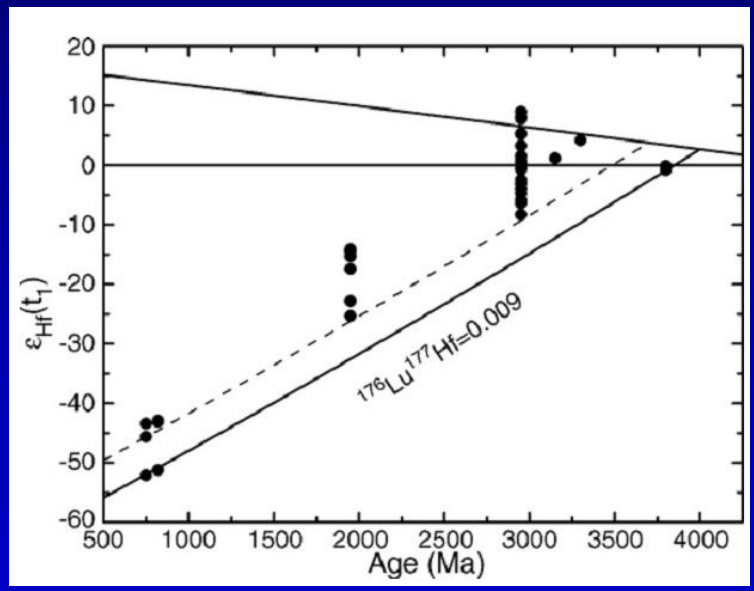


莲沱组砂岩中的>3.0 Ga的碎屑锆石 (柳小明等, 2005)

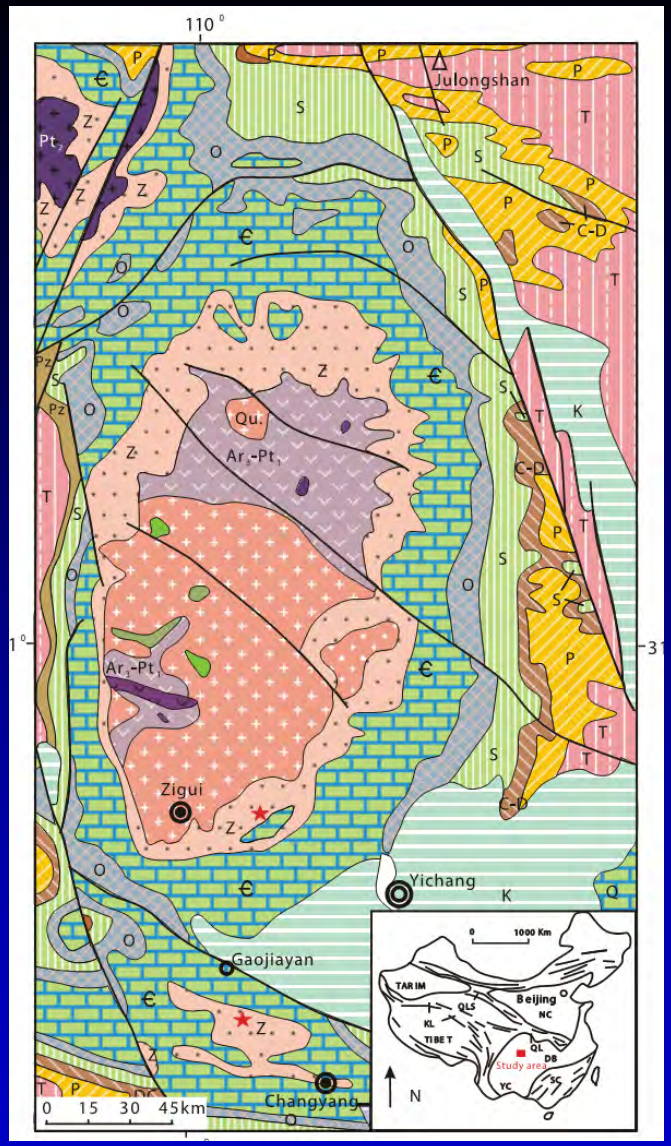


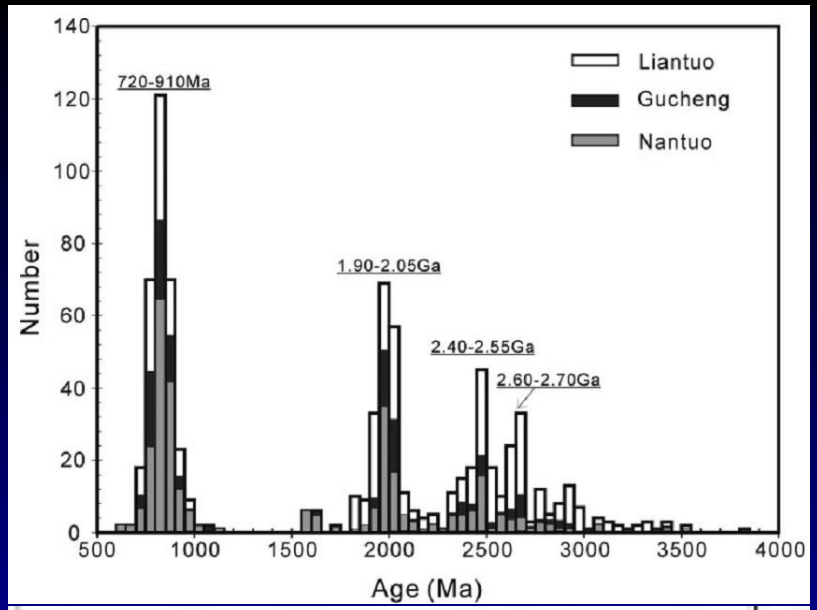


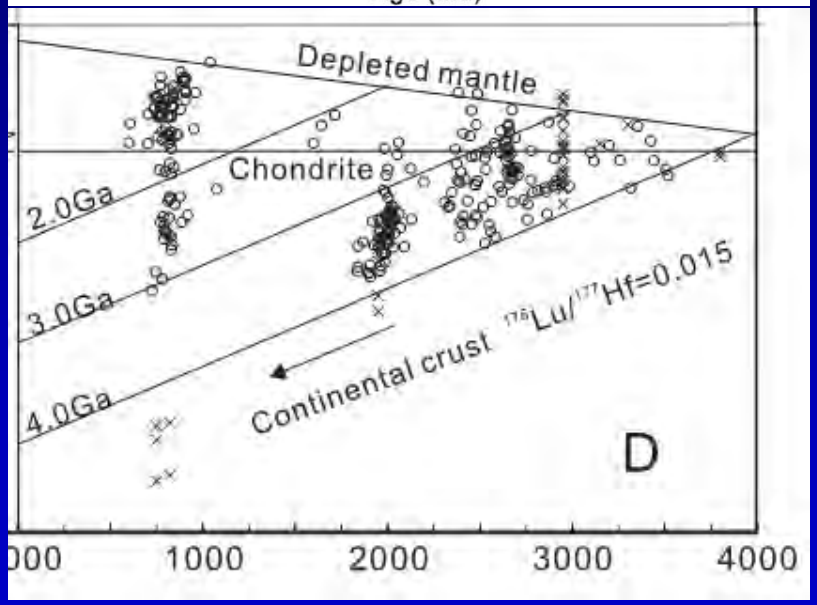




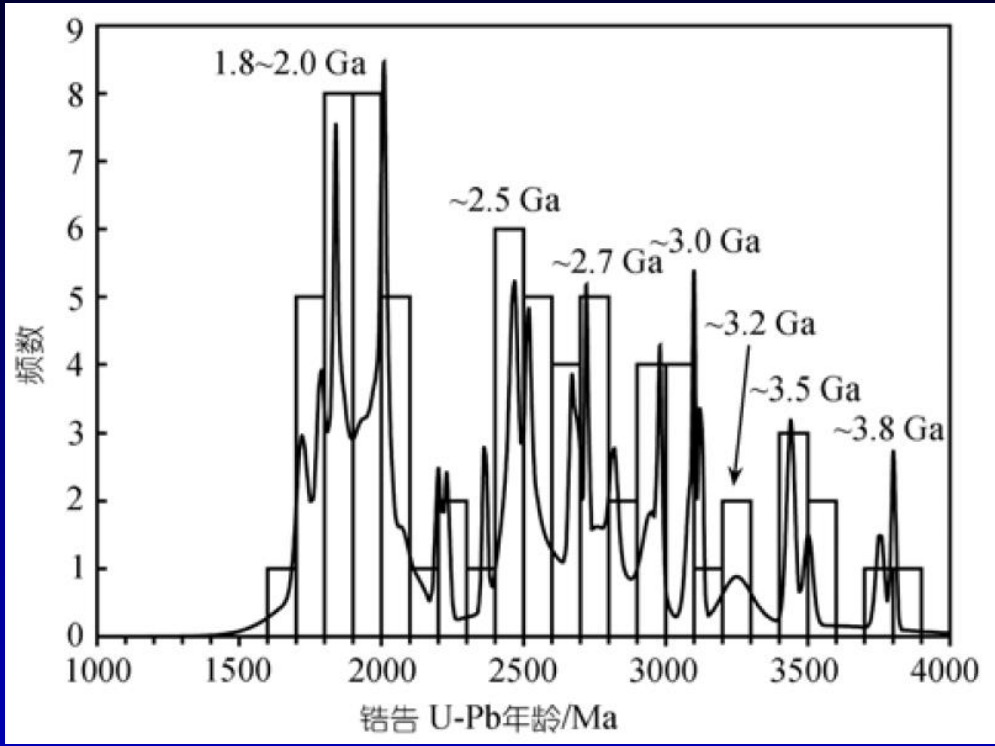
3.8 Ga crustal remnant and episodic reworking of Archean crust in South China (Zhang et al., 2006a)

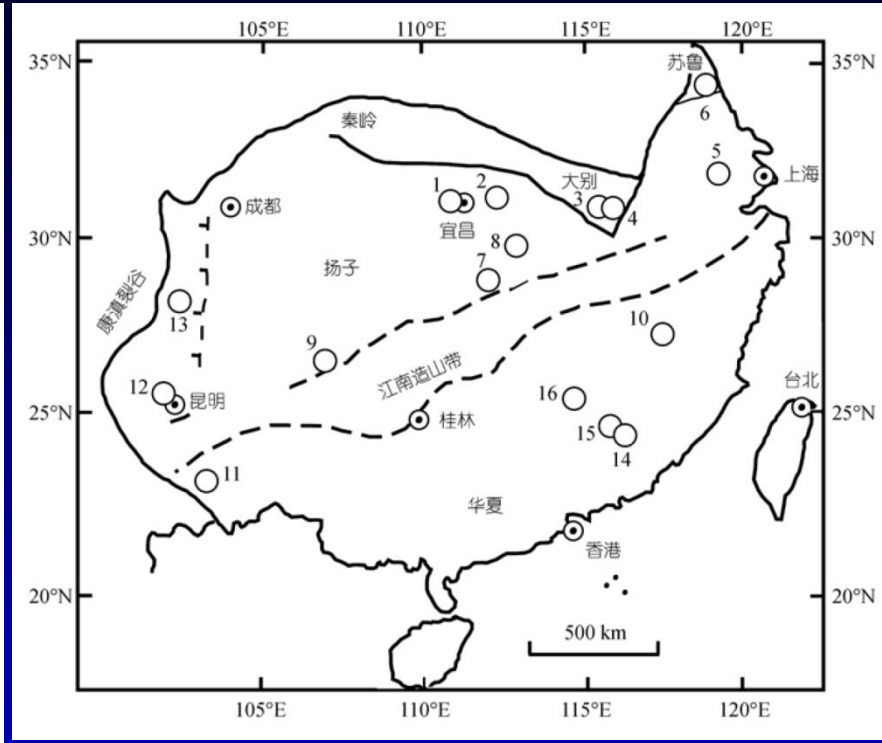






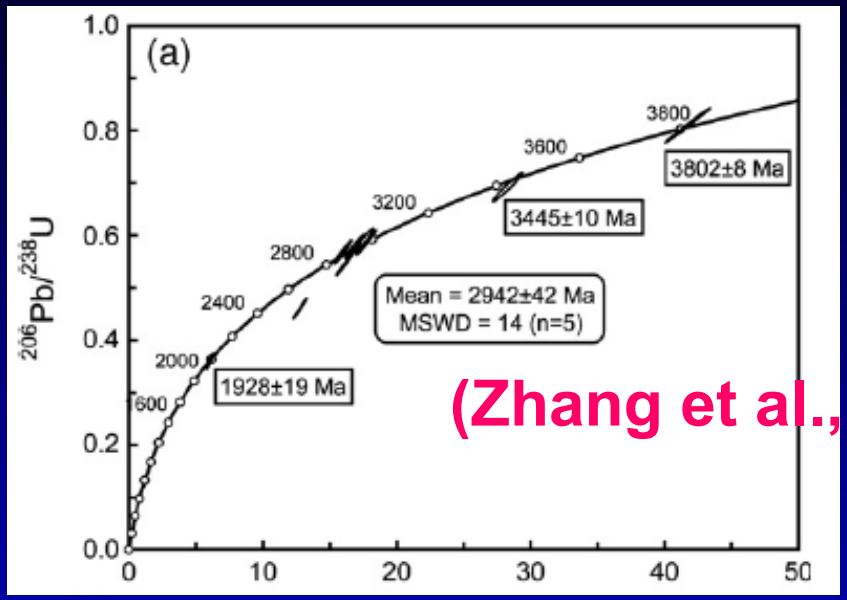
Precambrian crustal growth of the Yangtze Craton as reviewed by detrital zircon (Liu et al., 2008)



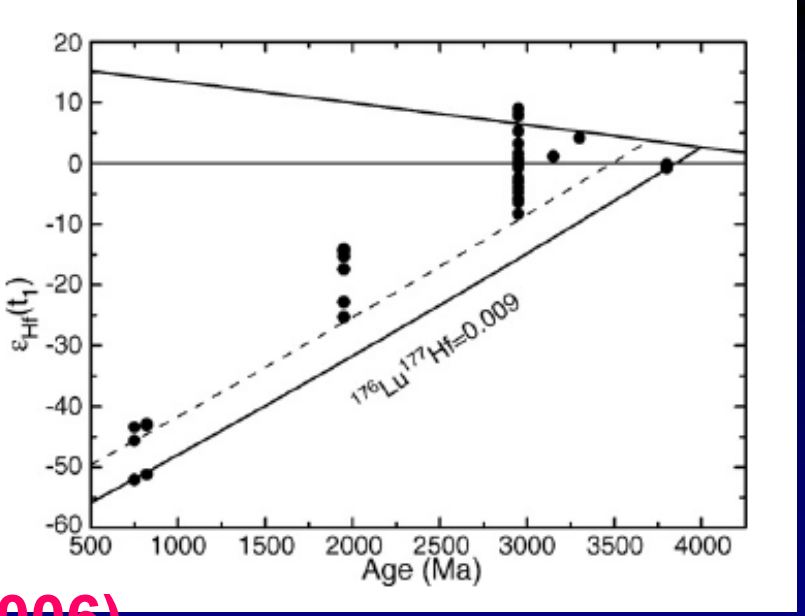


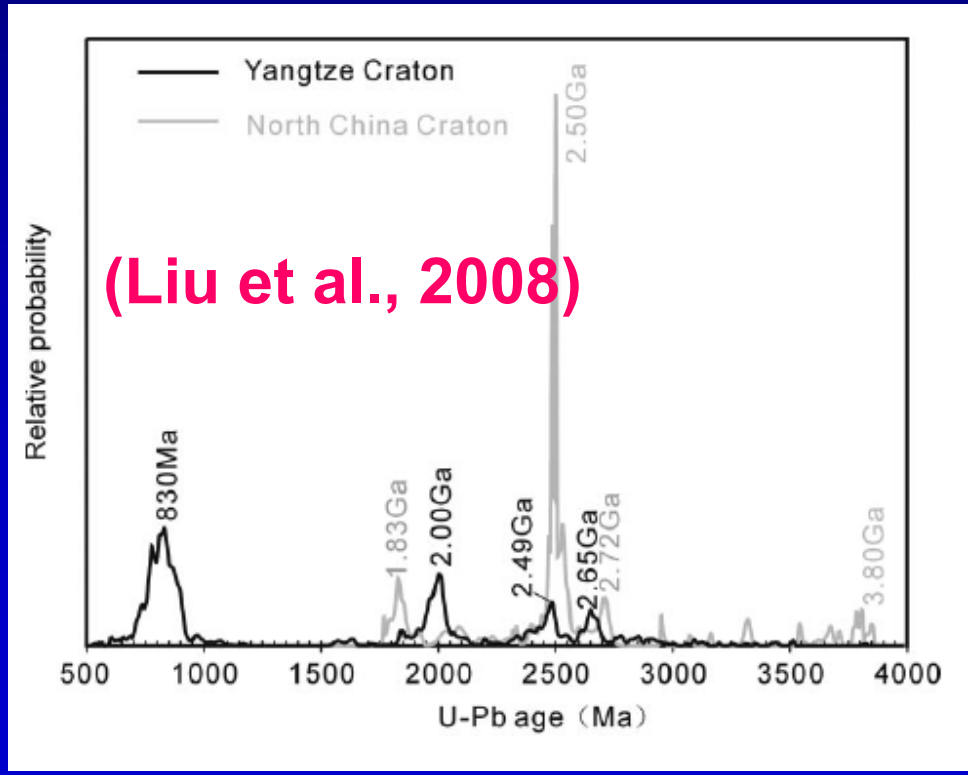
Detrital zircon ages of the Yangtze Craton (Zheng et al., 2008)

Detrital zircons in sedimentary rocks



(Zhang et al., 2006)

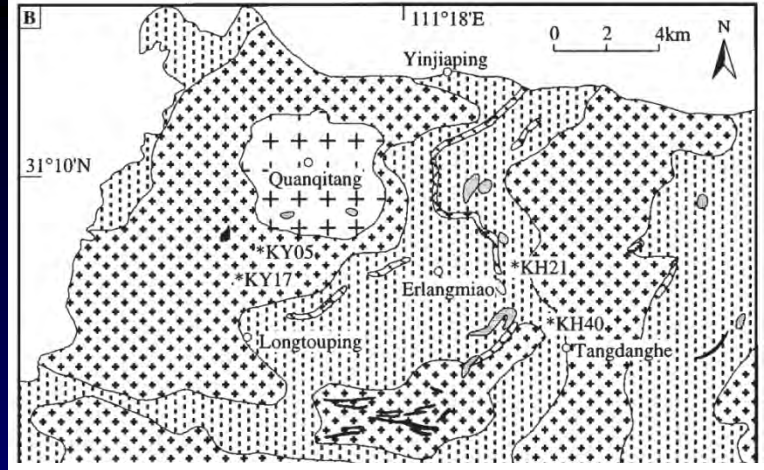


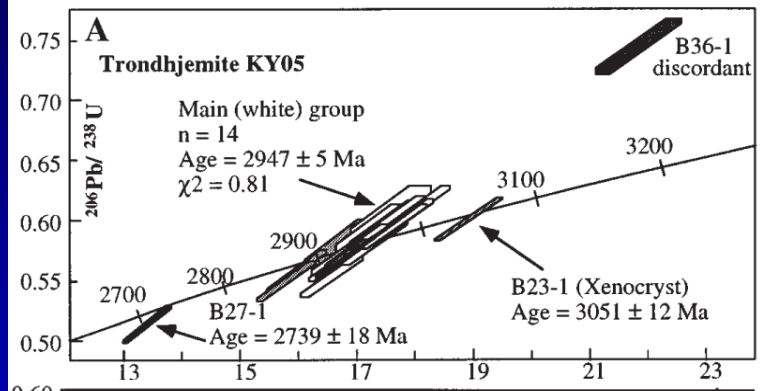


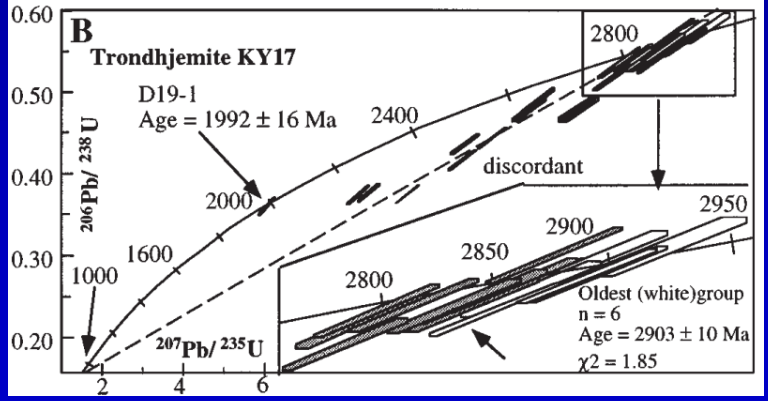
(Liu et al., 2008)

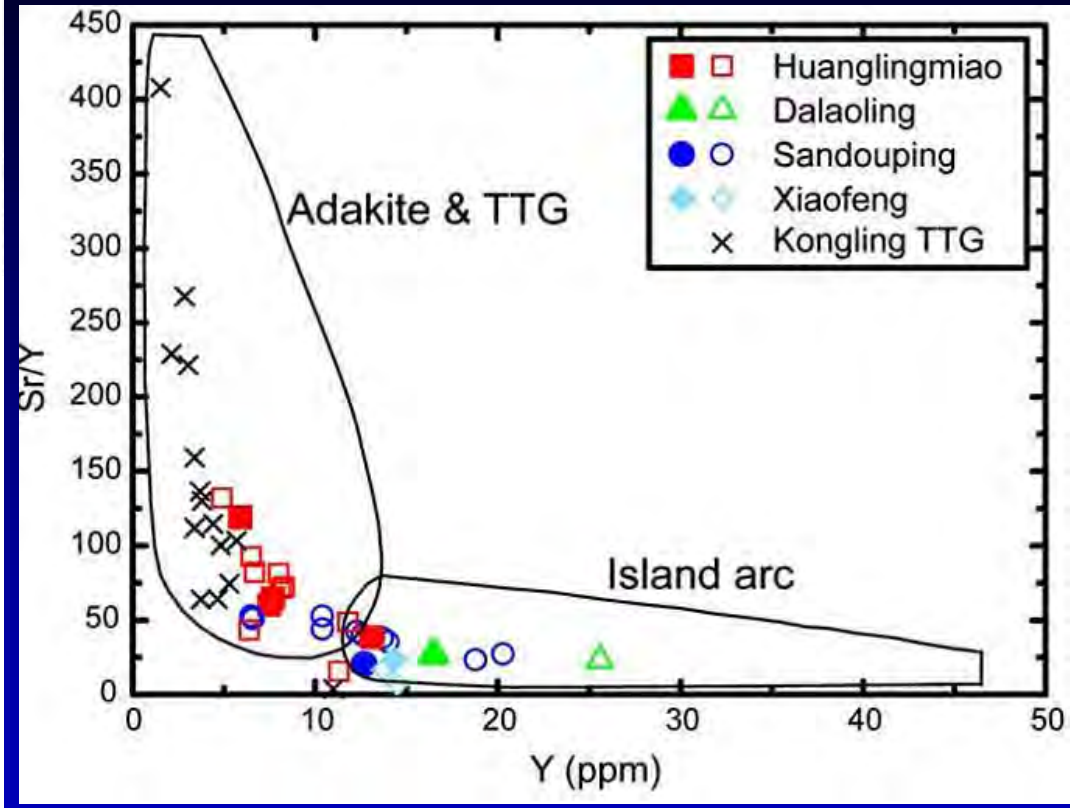
Where did these detrital zircons come from??

Basement rocks in the Yangtze Block

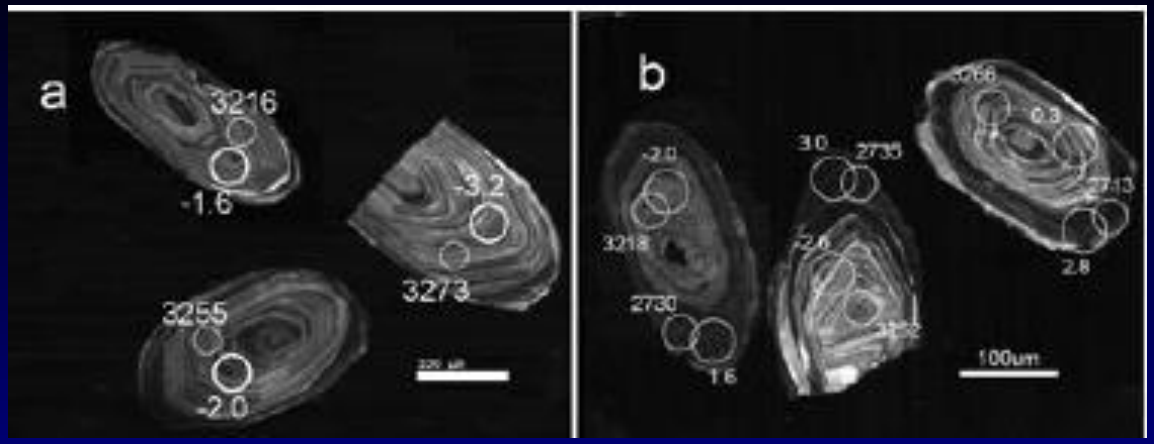


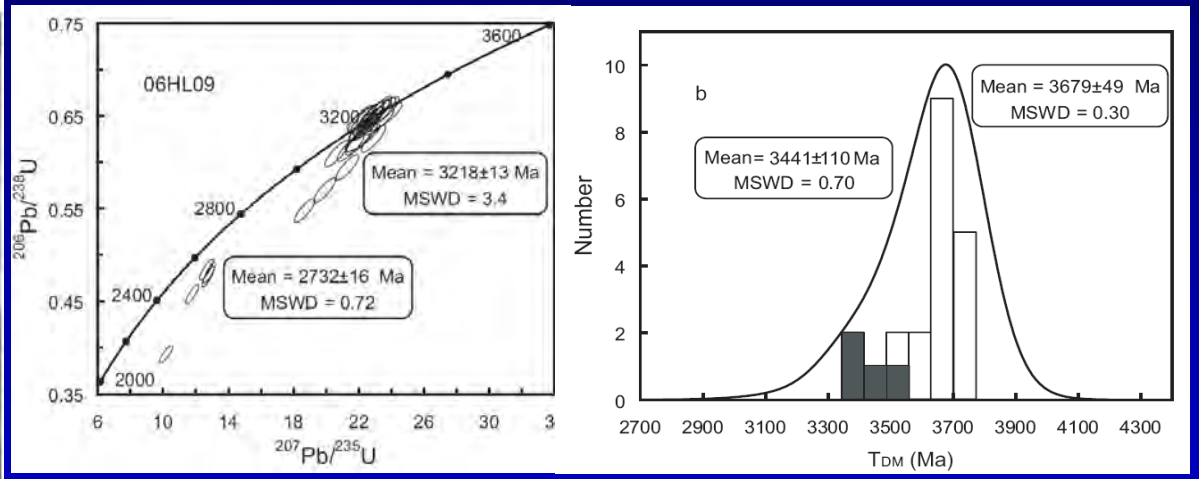




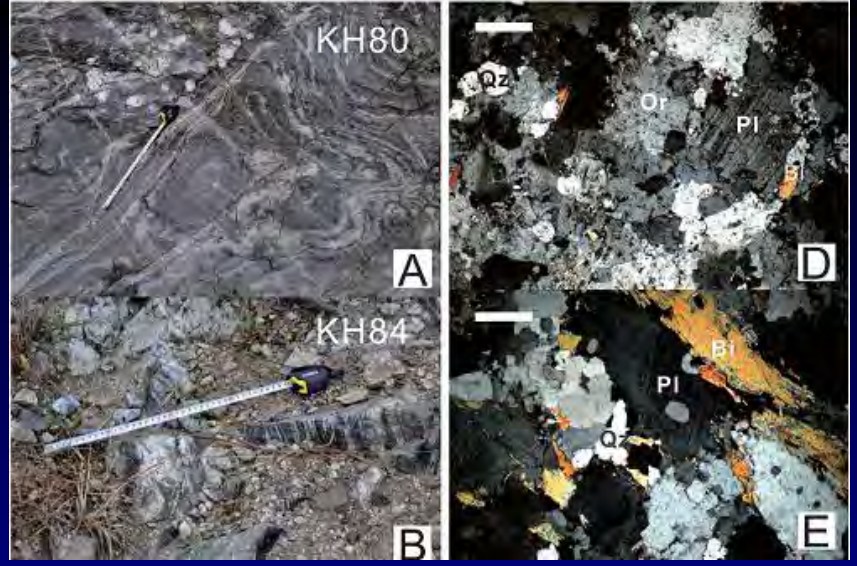


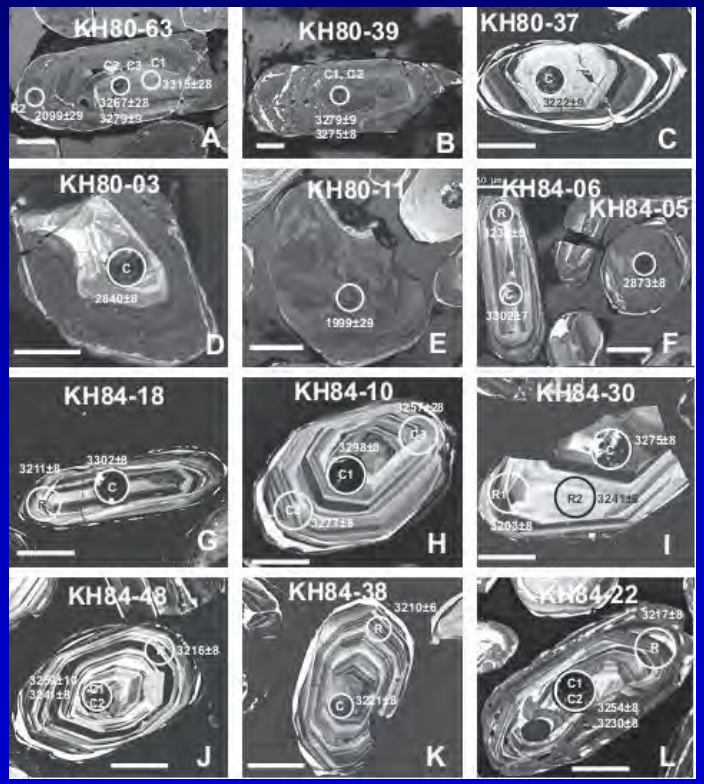
2.9 Ga TTG in the Kongling terrain (Qiu et al., 2000; Gao et al., 1999)

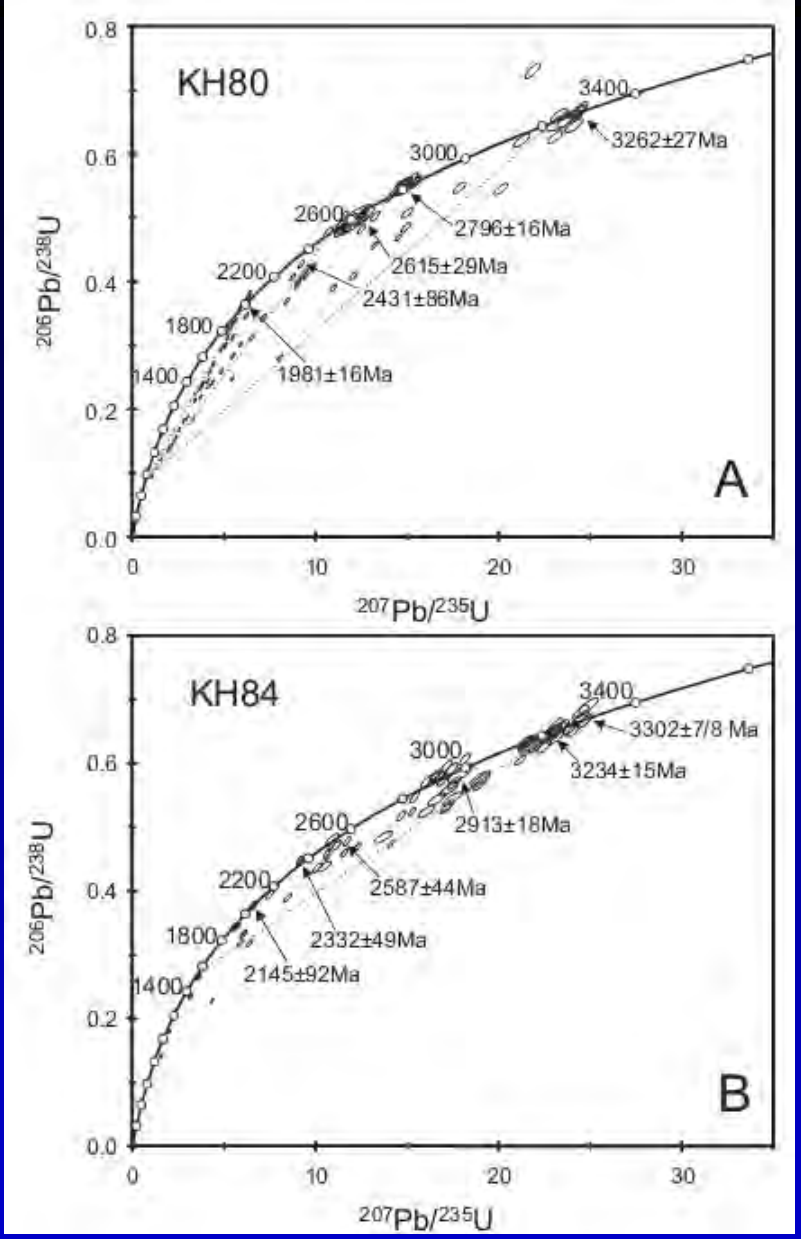




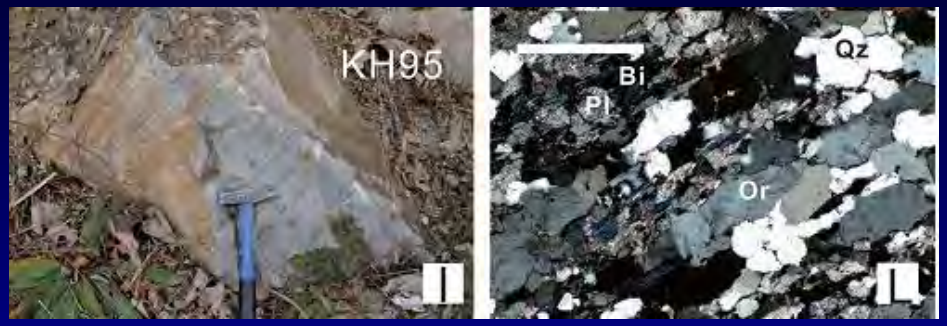
The oldest basement rocks in the Yangtze Block (Jiao et al., 2009)

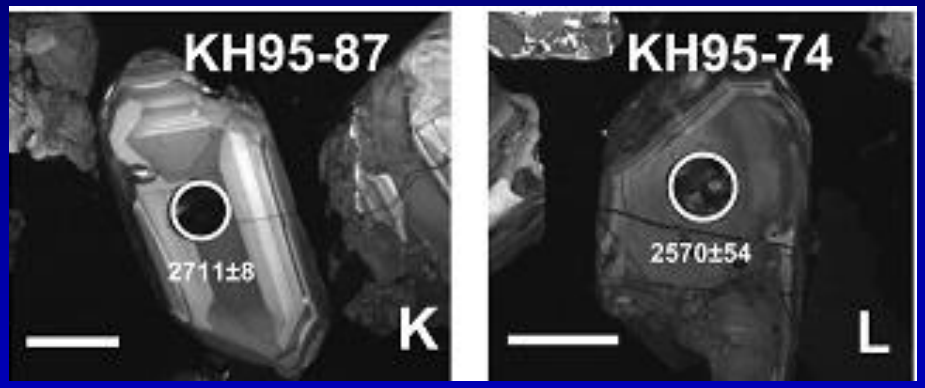


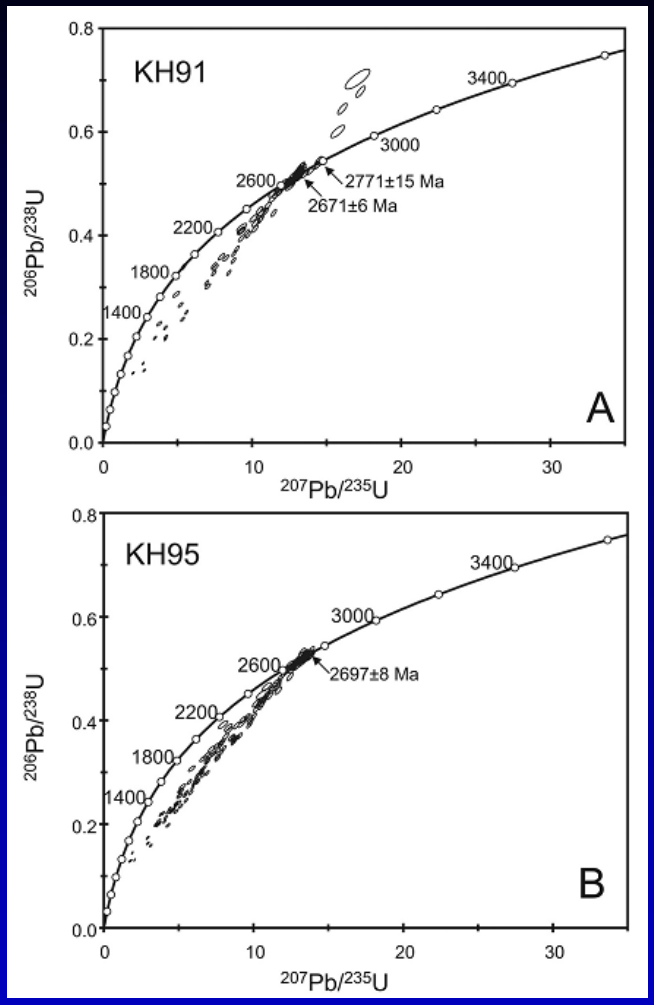




3.2 Ga gray gneisses in the Kongling terrain (Gao et al., 2011)

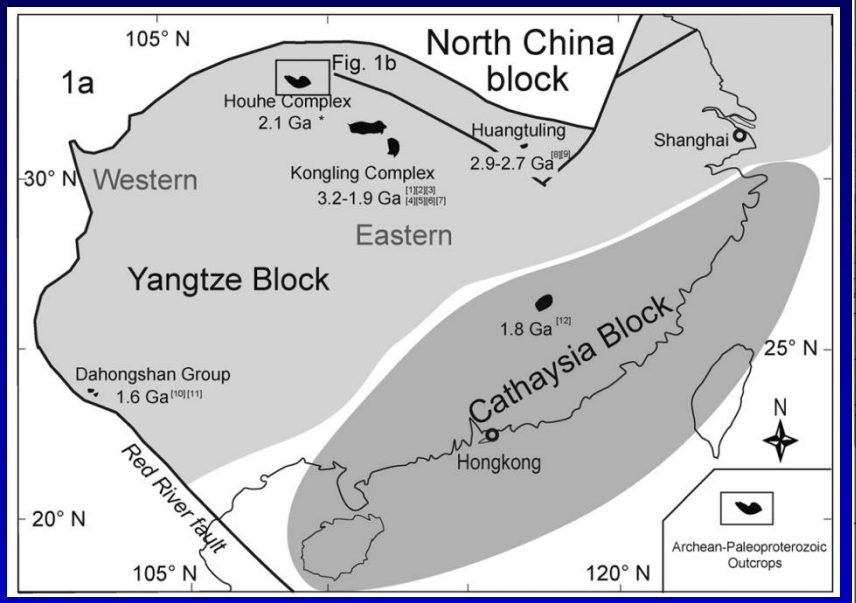


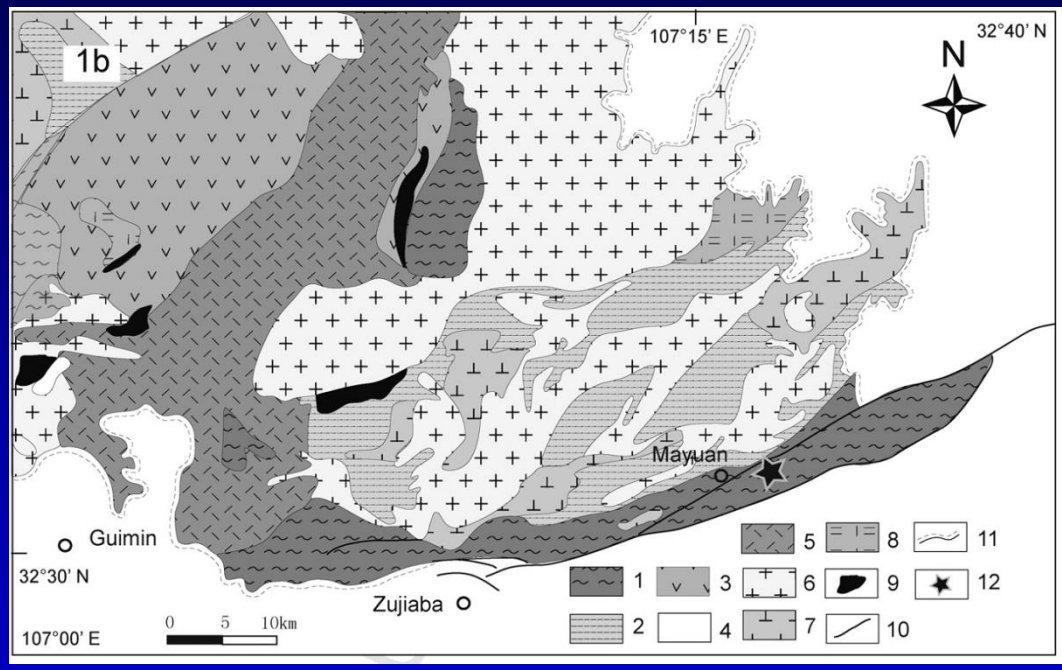




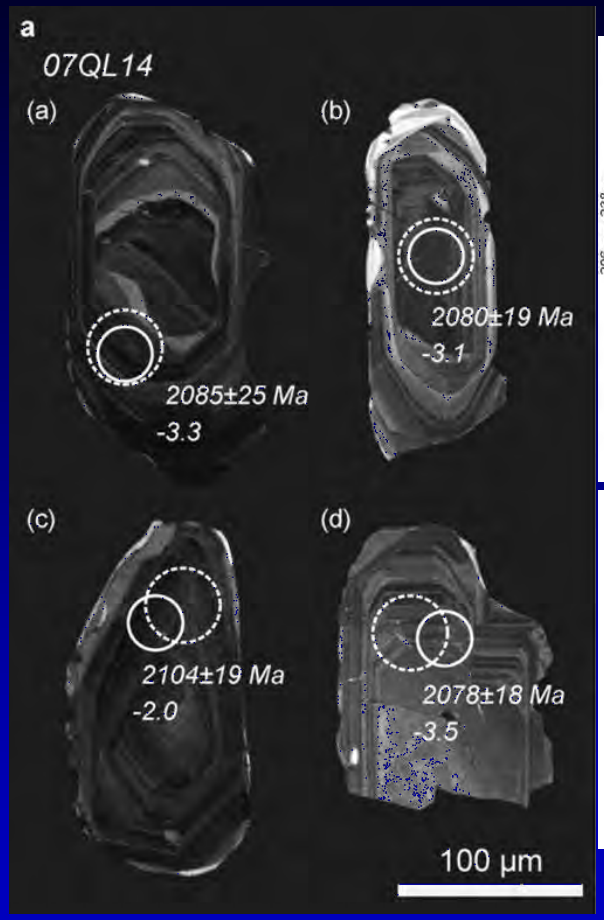
Zircon U-Pb concordia plots for 2.7 Ga gneisses in the Kongling terrain (Gao et al., 2011)

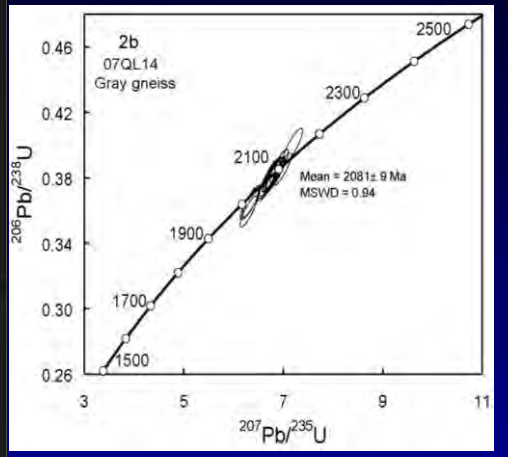
Paleoprotoeozoic magmatic rocks in the Yangtze Blcok

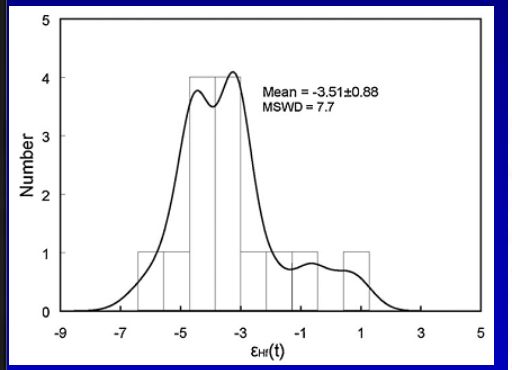


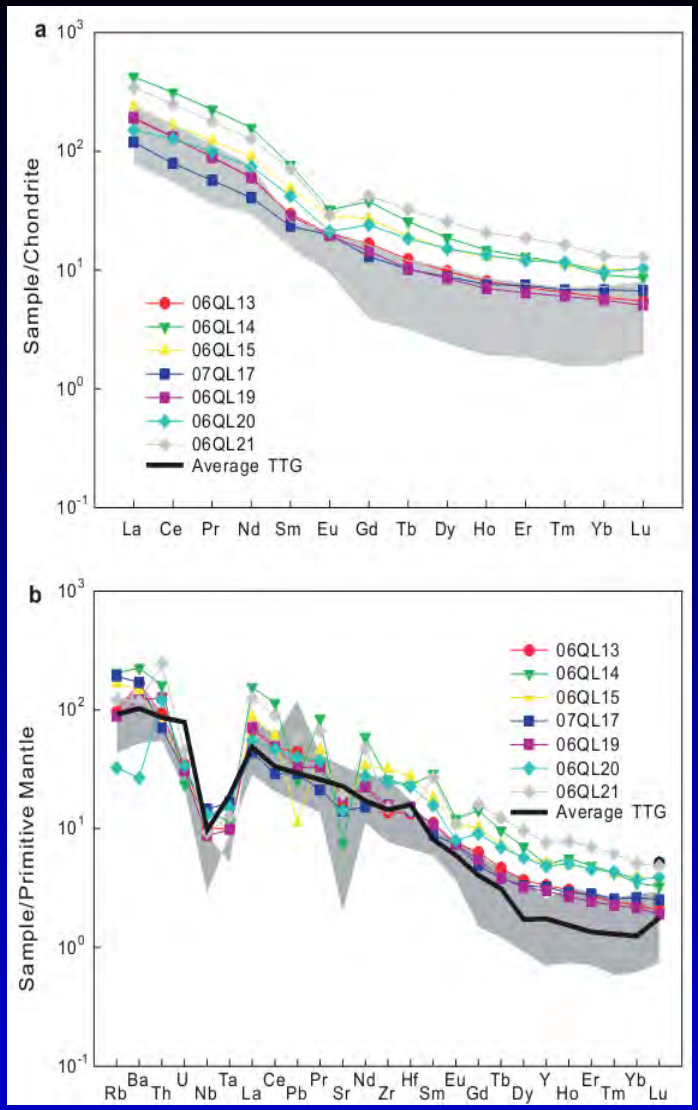


Sketch geological map showing the Houhe complex

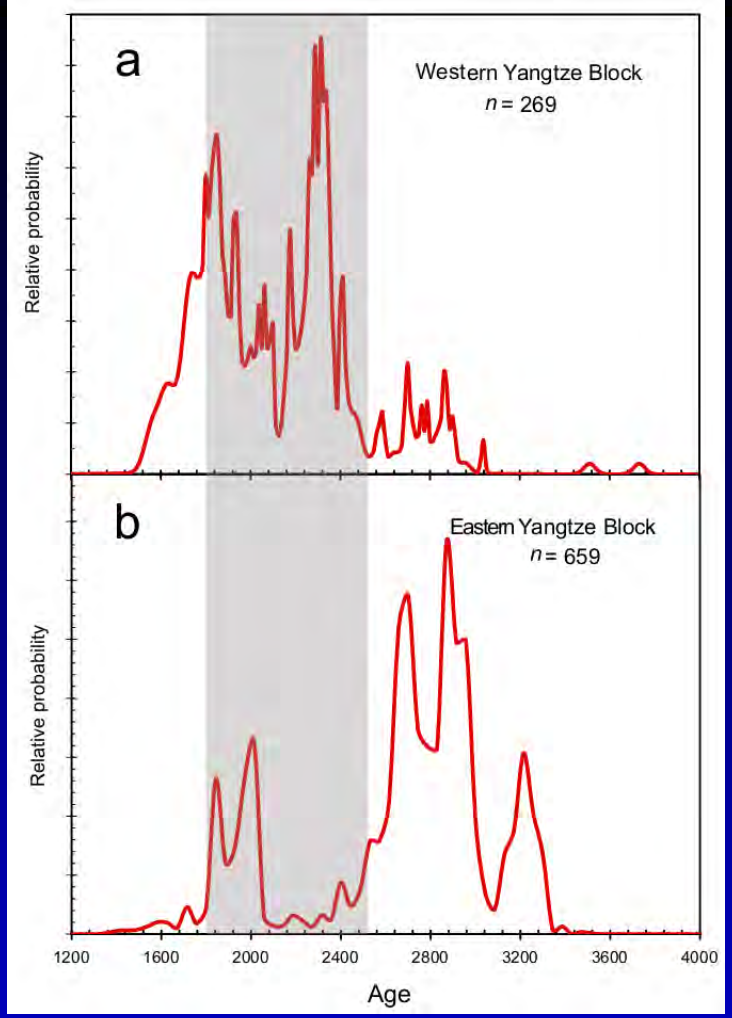


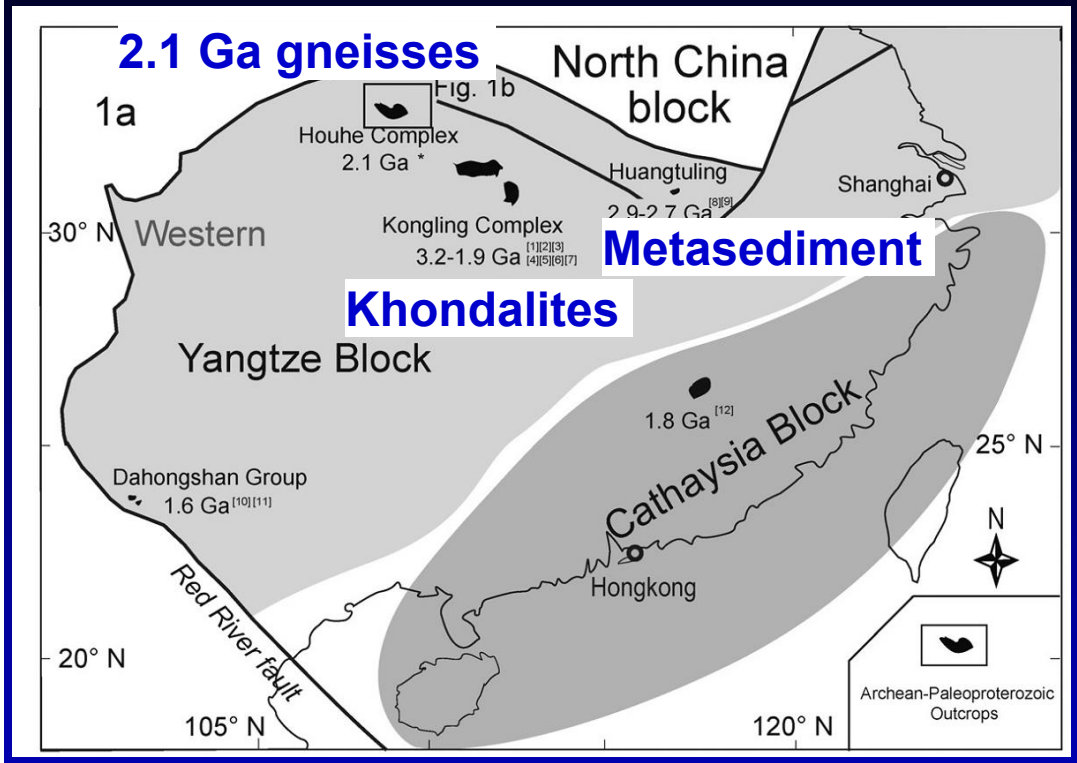




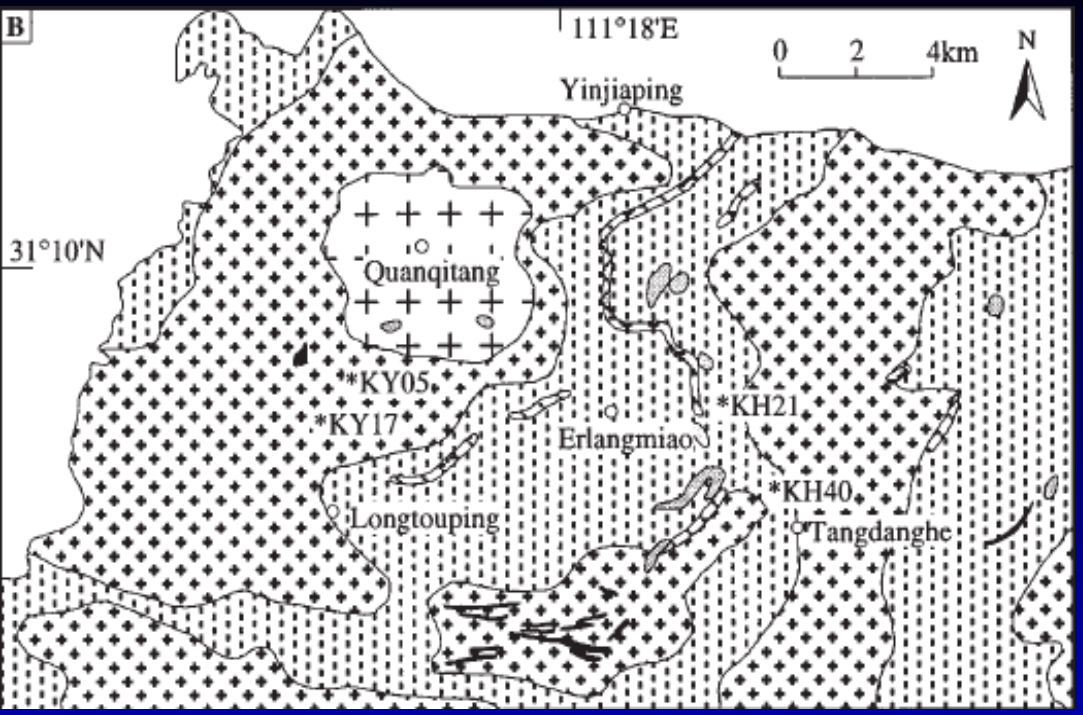


Zircon U-Pb dating and geochemical characteristics of the Houhe complex (Wu et al., 2012)

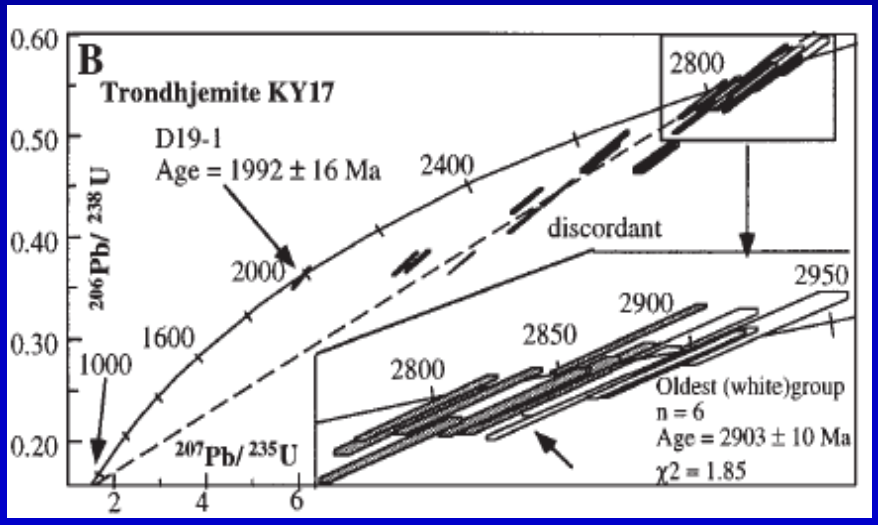


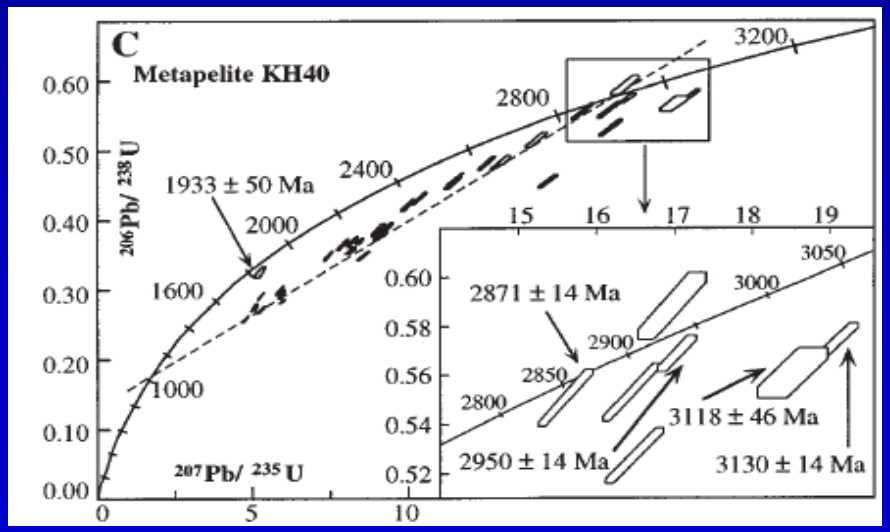


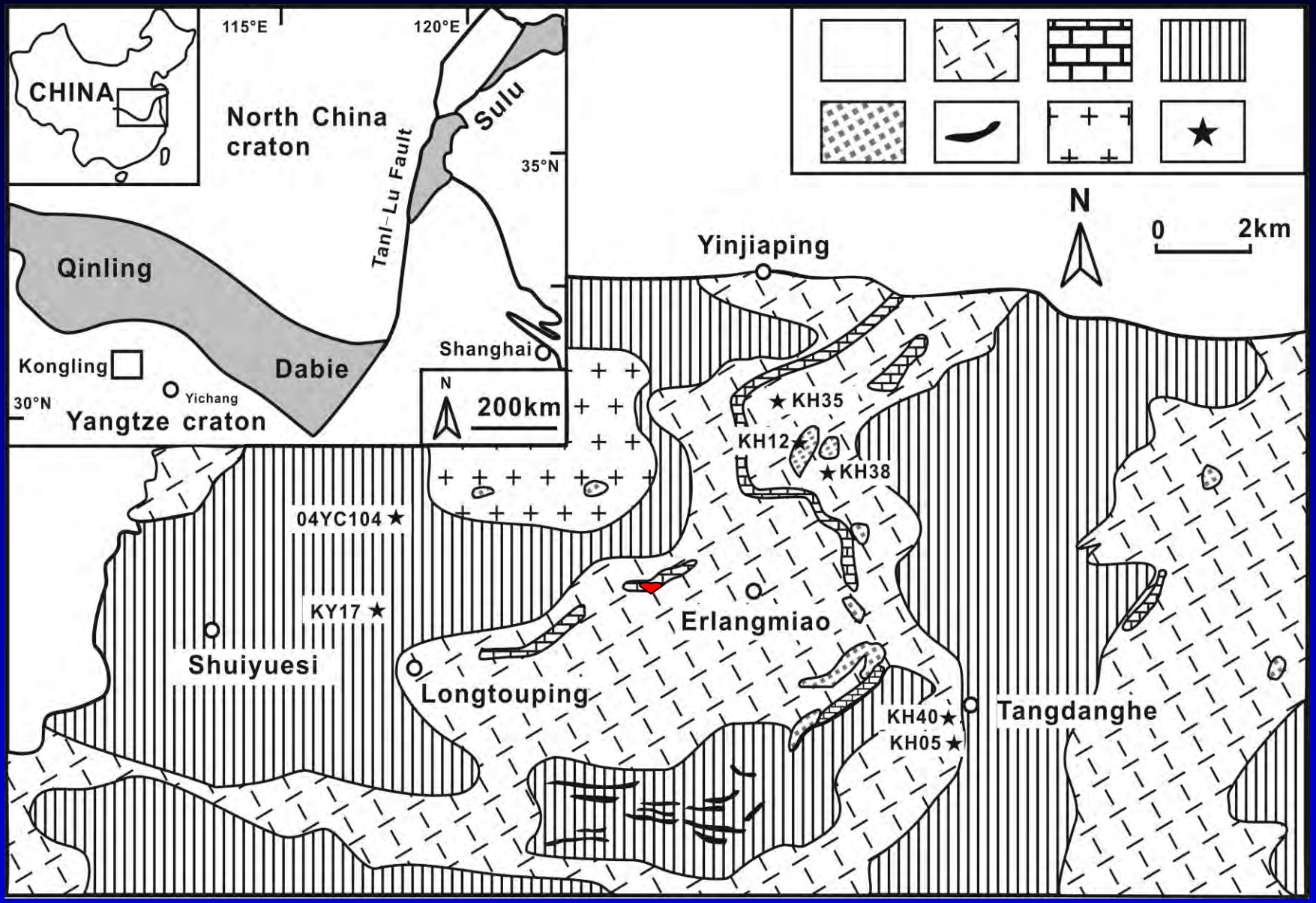
- The western part of the Yangtze Block might be a microcontinent with an active-type continental margin;
- There might be a passive-type continental margin in the eastern part of the Yangtze Block

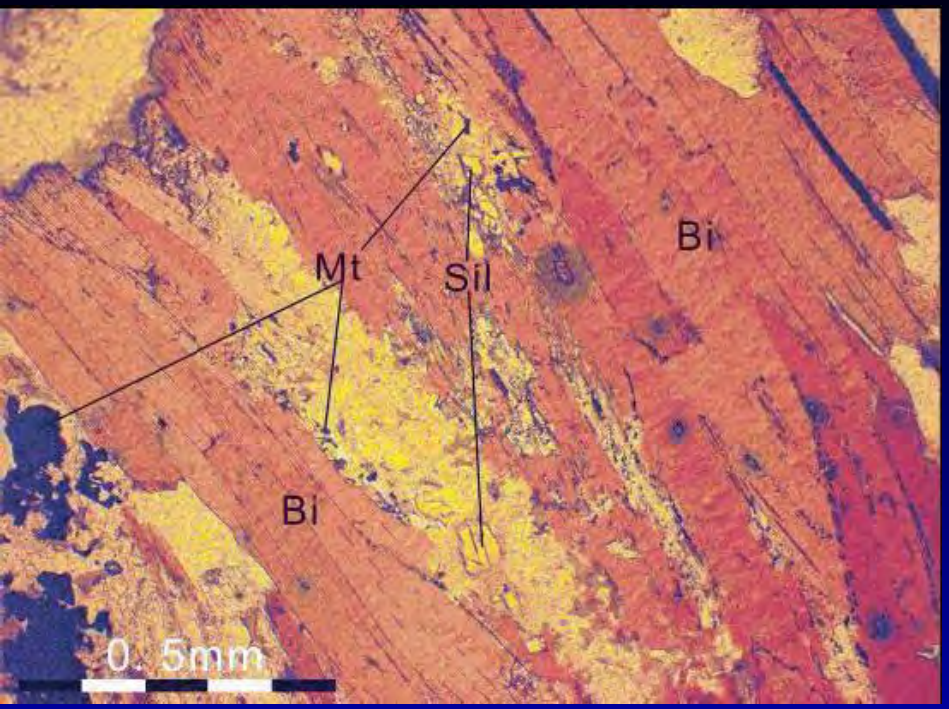


Paleoproterozoic high-grade metamorphism in the Yangtze Block (Qiu et al., 2000)



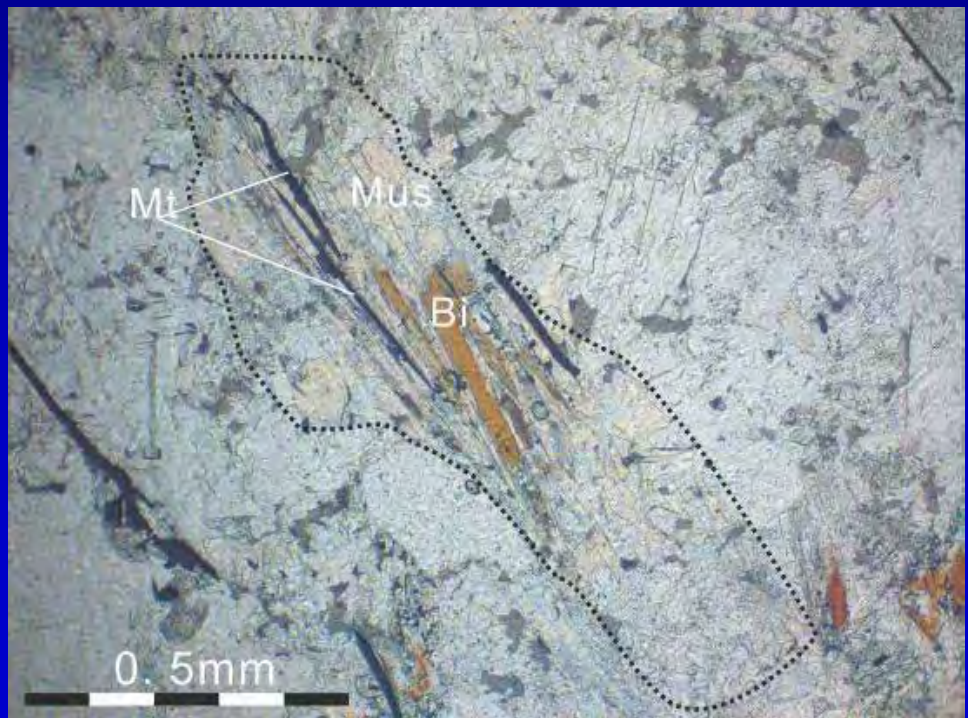


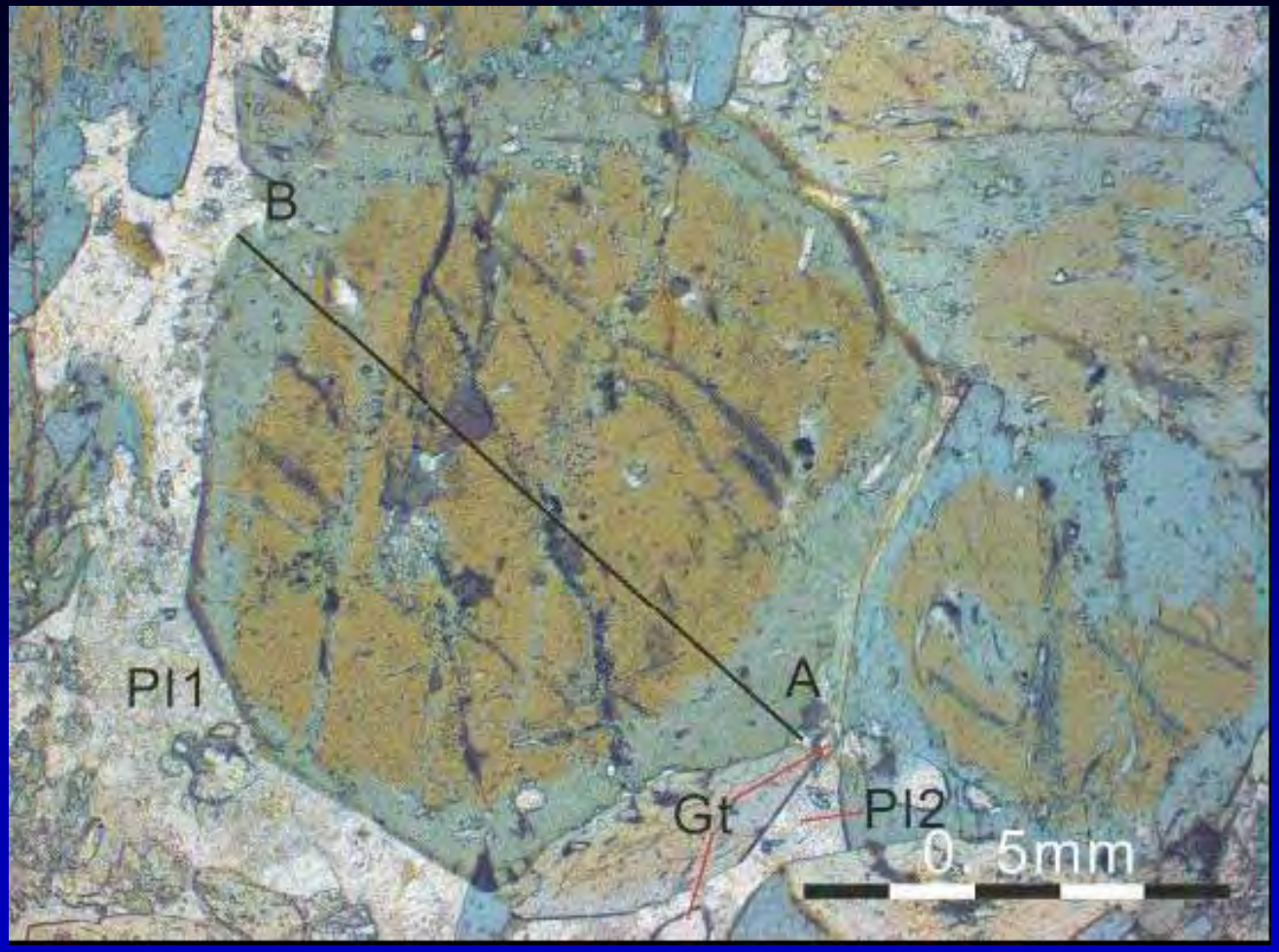

CHINA
115°E
120°E
North China craton
Tanl-Lu Fault
Sulu
35°N
Qinling
Dabie
Kongling
Yichang
30°N
Yangtze craton
Shanghai
N
200km
N
0
2km
Yinjiaping
KH35
KH12
KH38
04YC104
KY17
Shuiyuesi
Erlangmiao
Longtouping
KH40
KH05
Tangdanghe



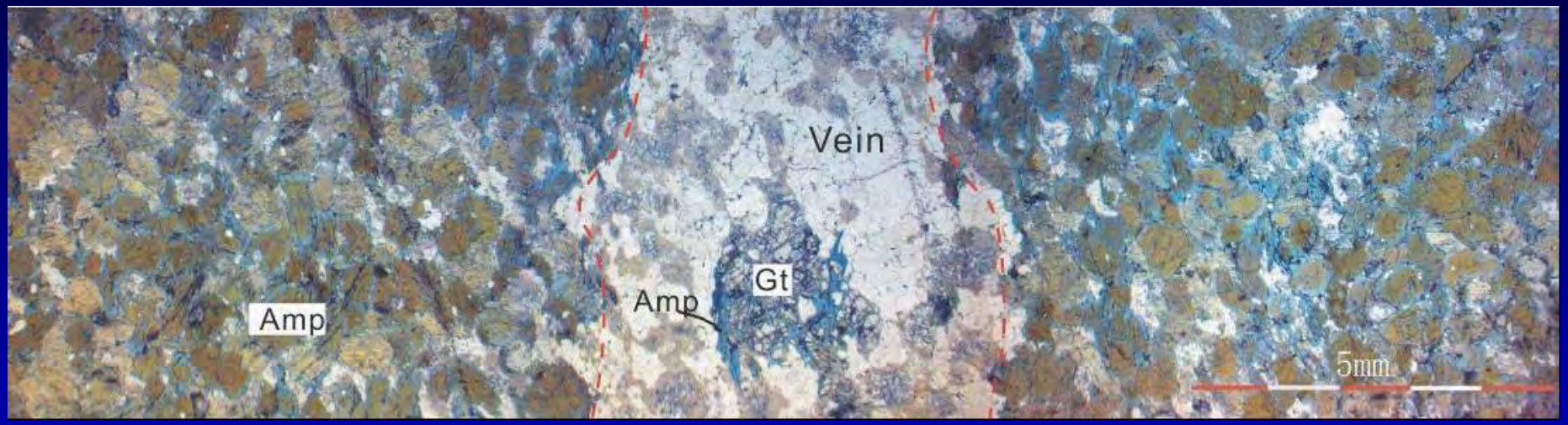
Biotite + sillimanite with accessory mineral of magnetite of 06HL21

Biotites have been replaced by muscovite + magnetite of 06HL21

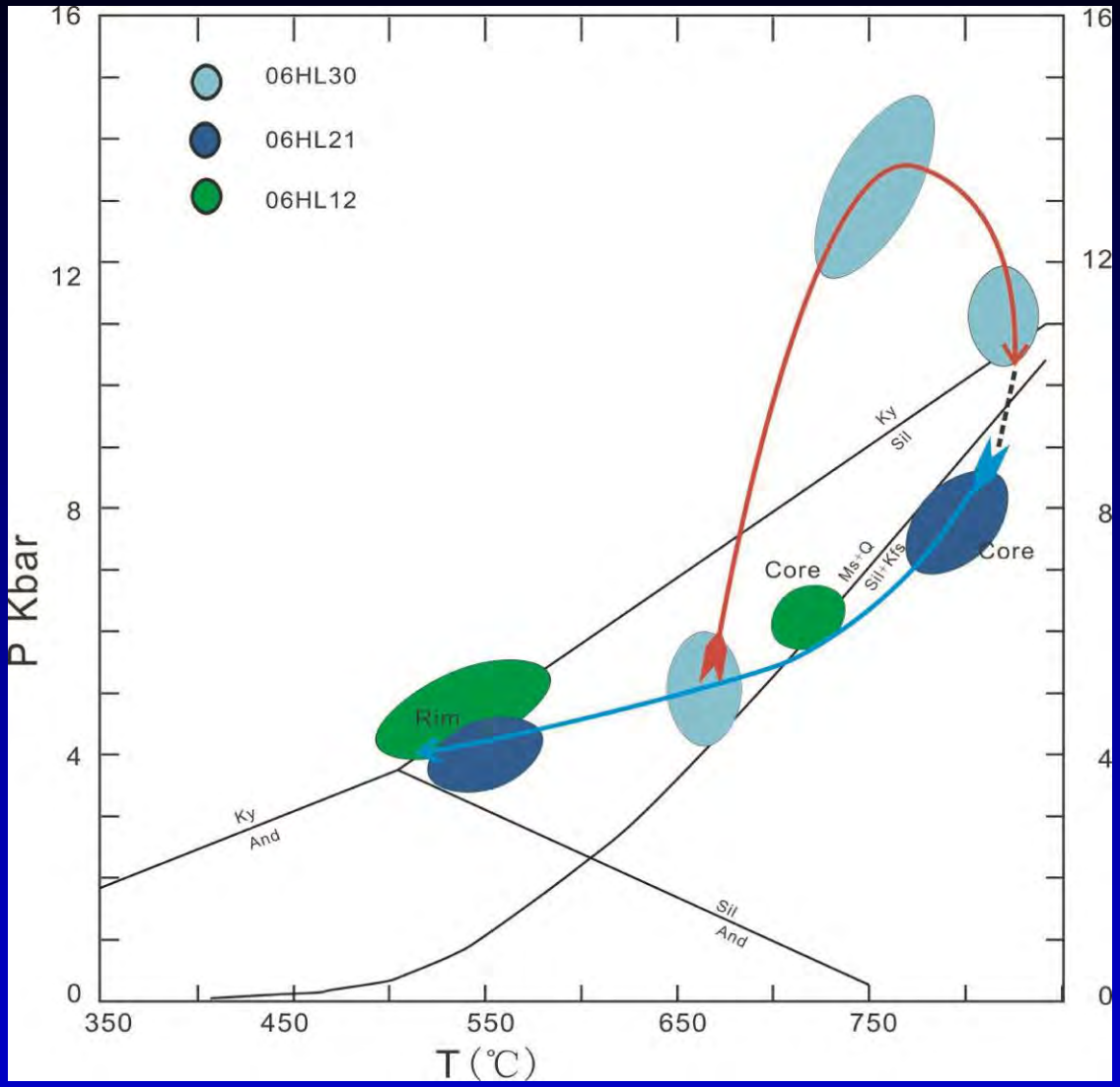




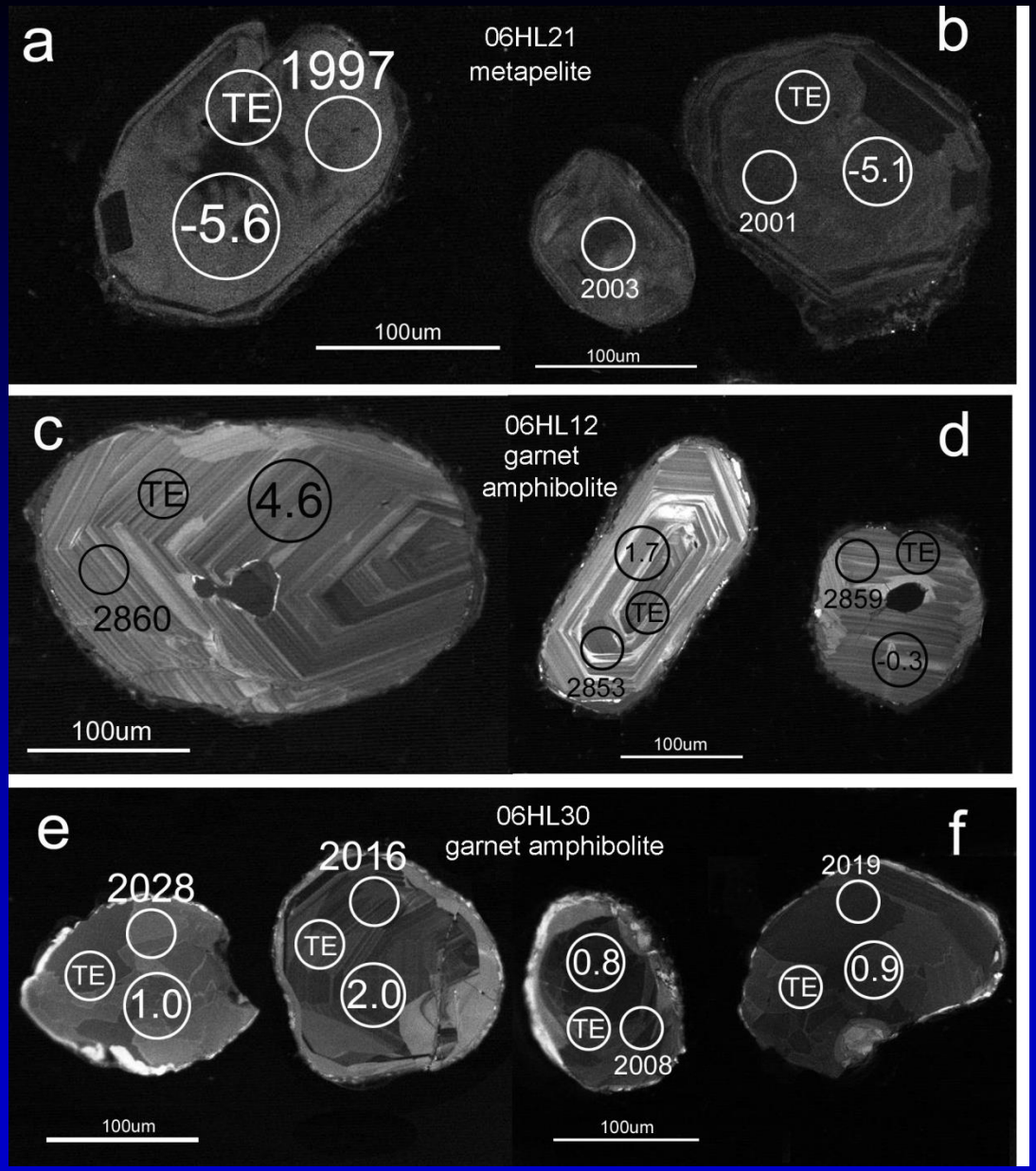
Composition zoning of hornblende in 06HL30



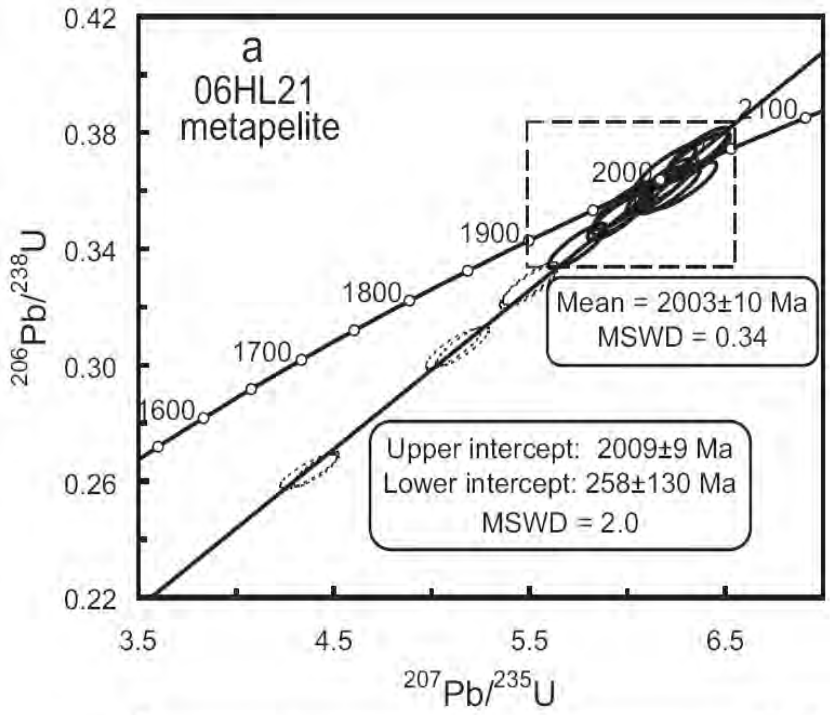
Felspathic vein containing garnet and hornblende in 06HL30

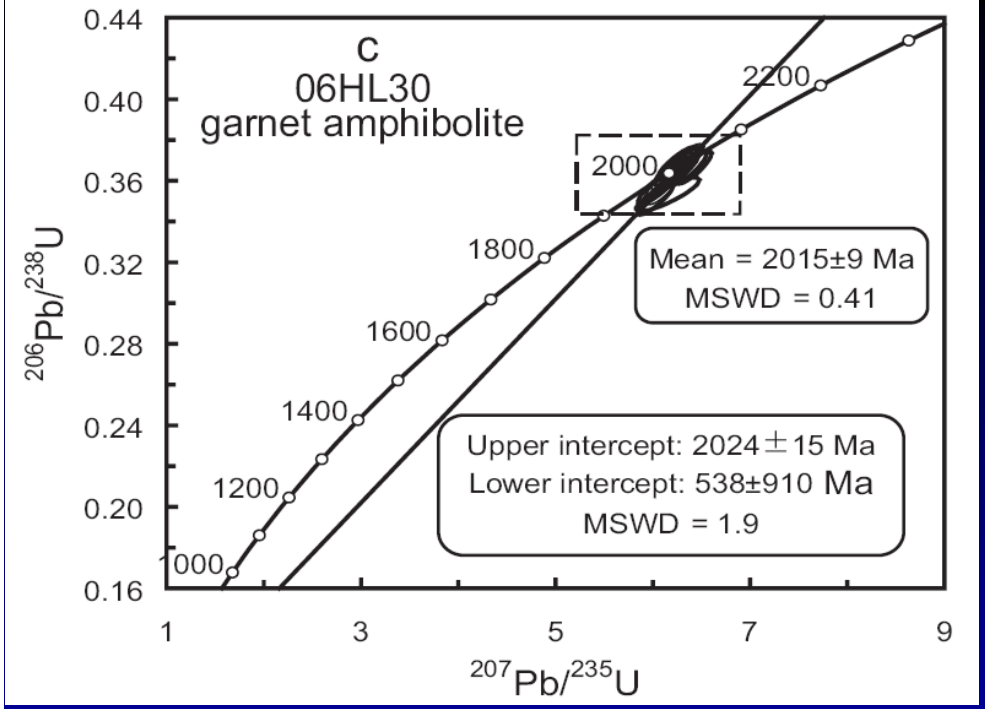


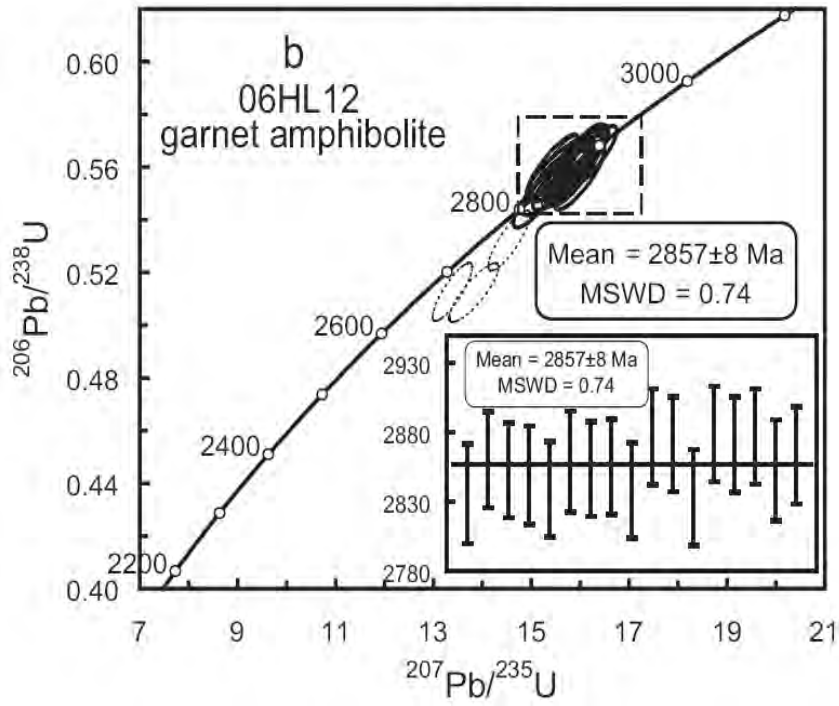
Results of P–T calculations obtained from samples 06HL21, 06HL12, and 06HL30



Typical CL images of 06HL21, 06HL12 and 06HL30

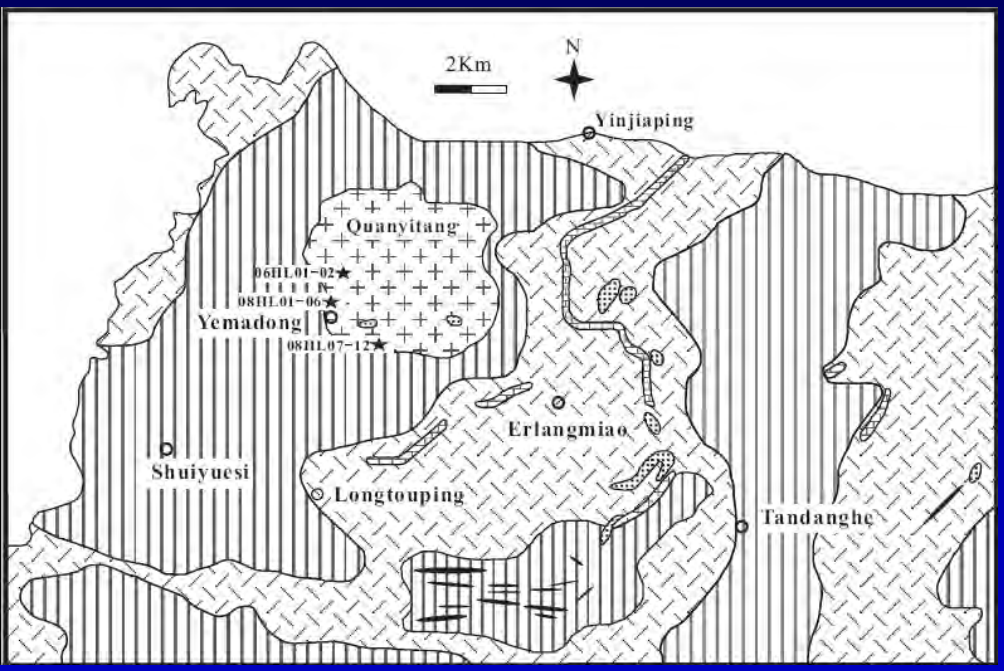


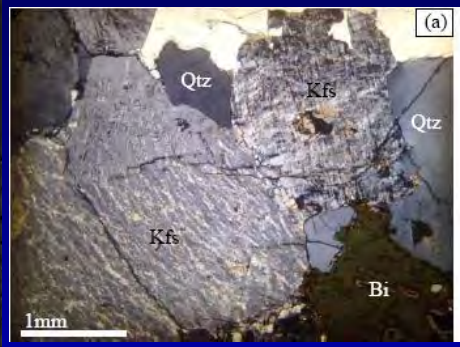


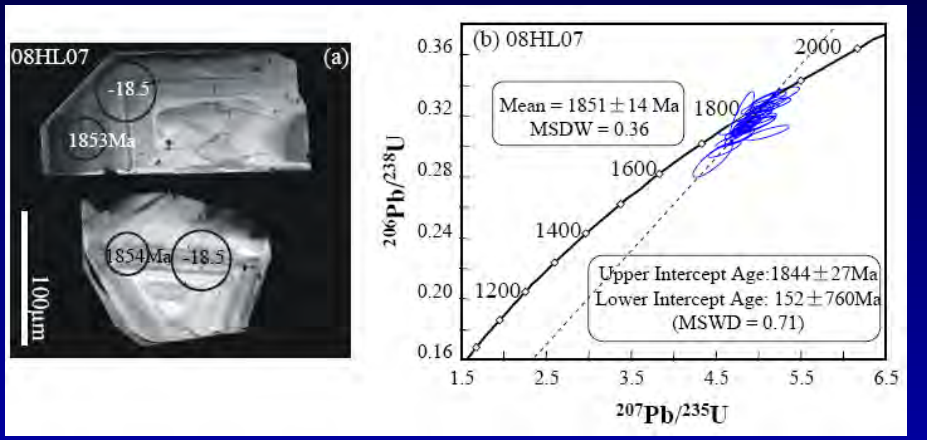


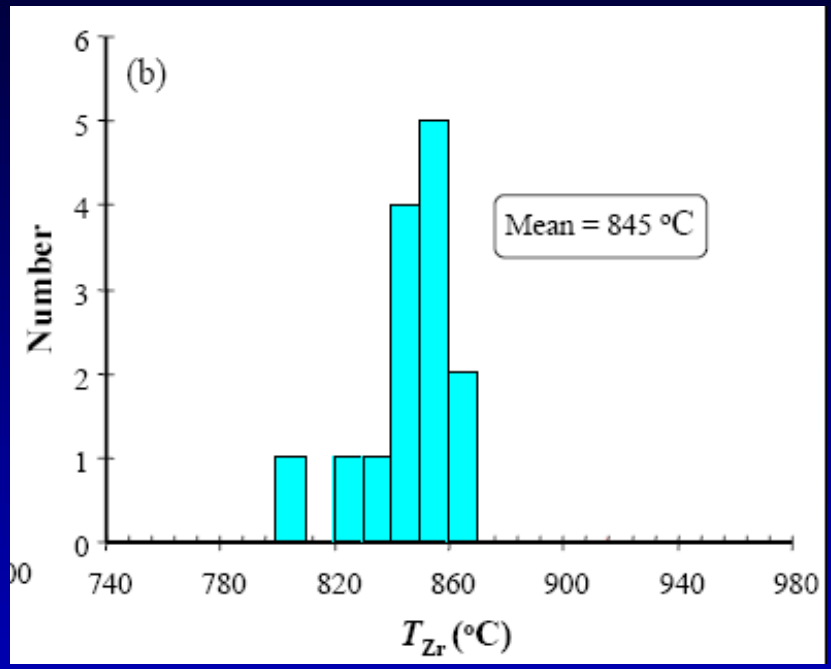
Concordia diagrams of LA-ICPMS zircon U-Pb dating of samples 06HL21 (a), 06HL12 (b), and 06HL30 (c) (Wu et al., 2009)

Paleoproterozoic A-type granite from the Kongling terrain

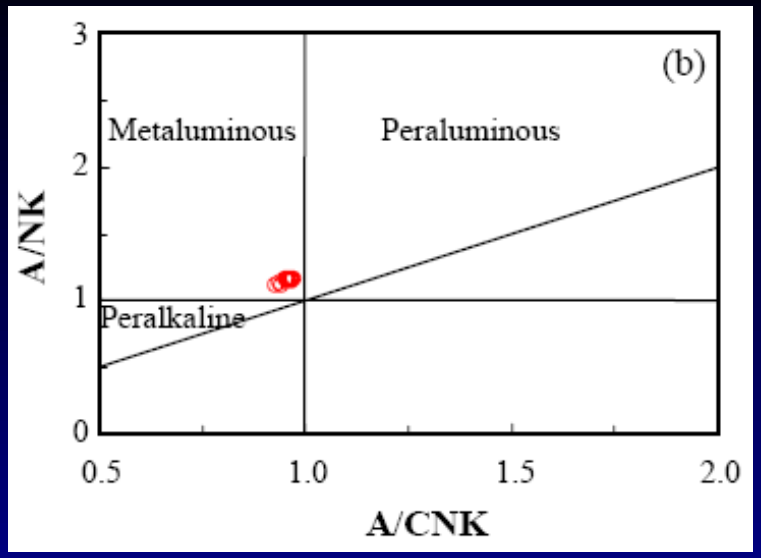


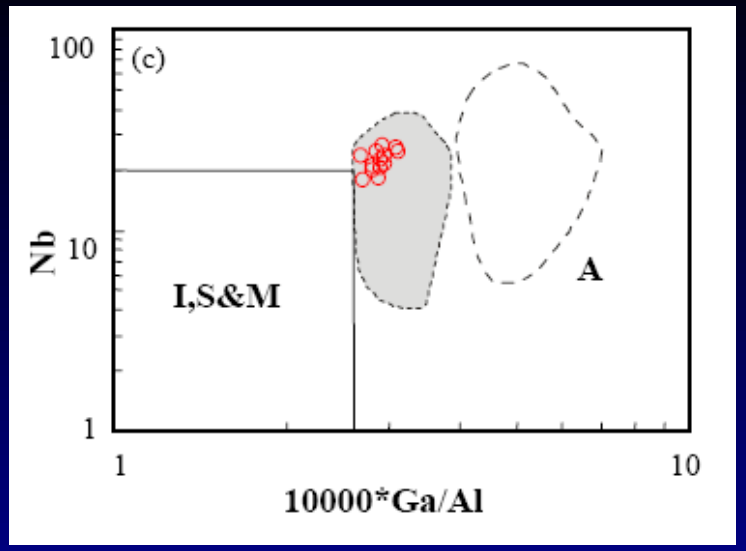


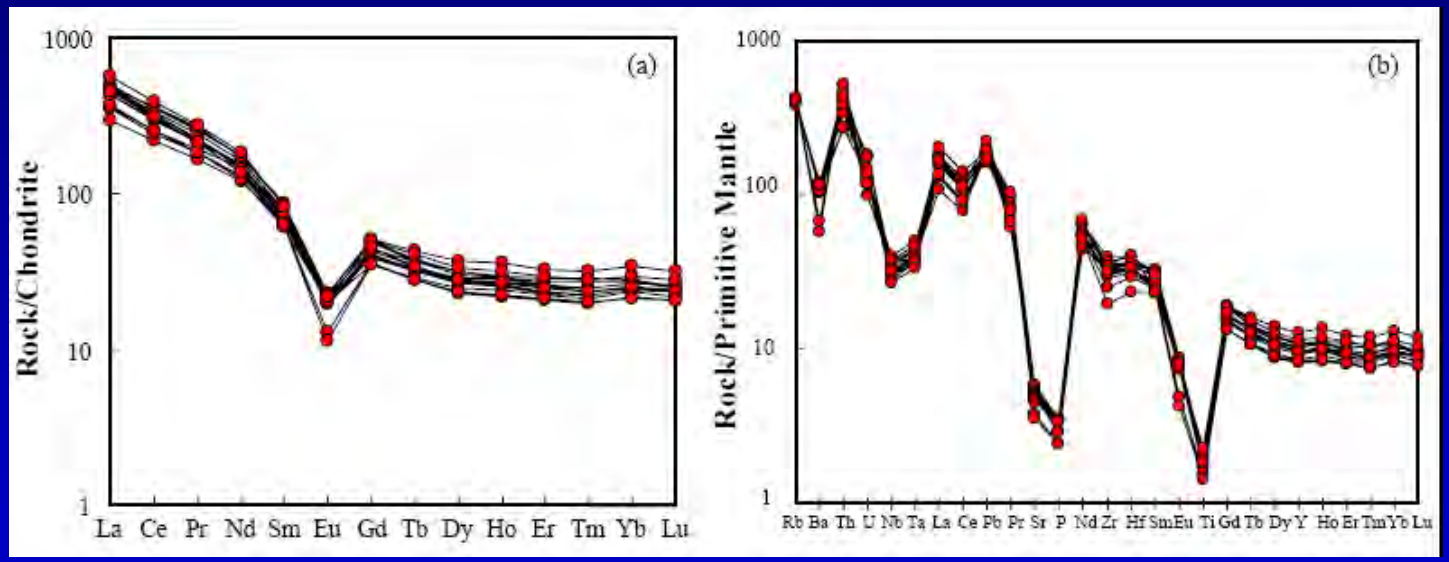




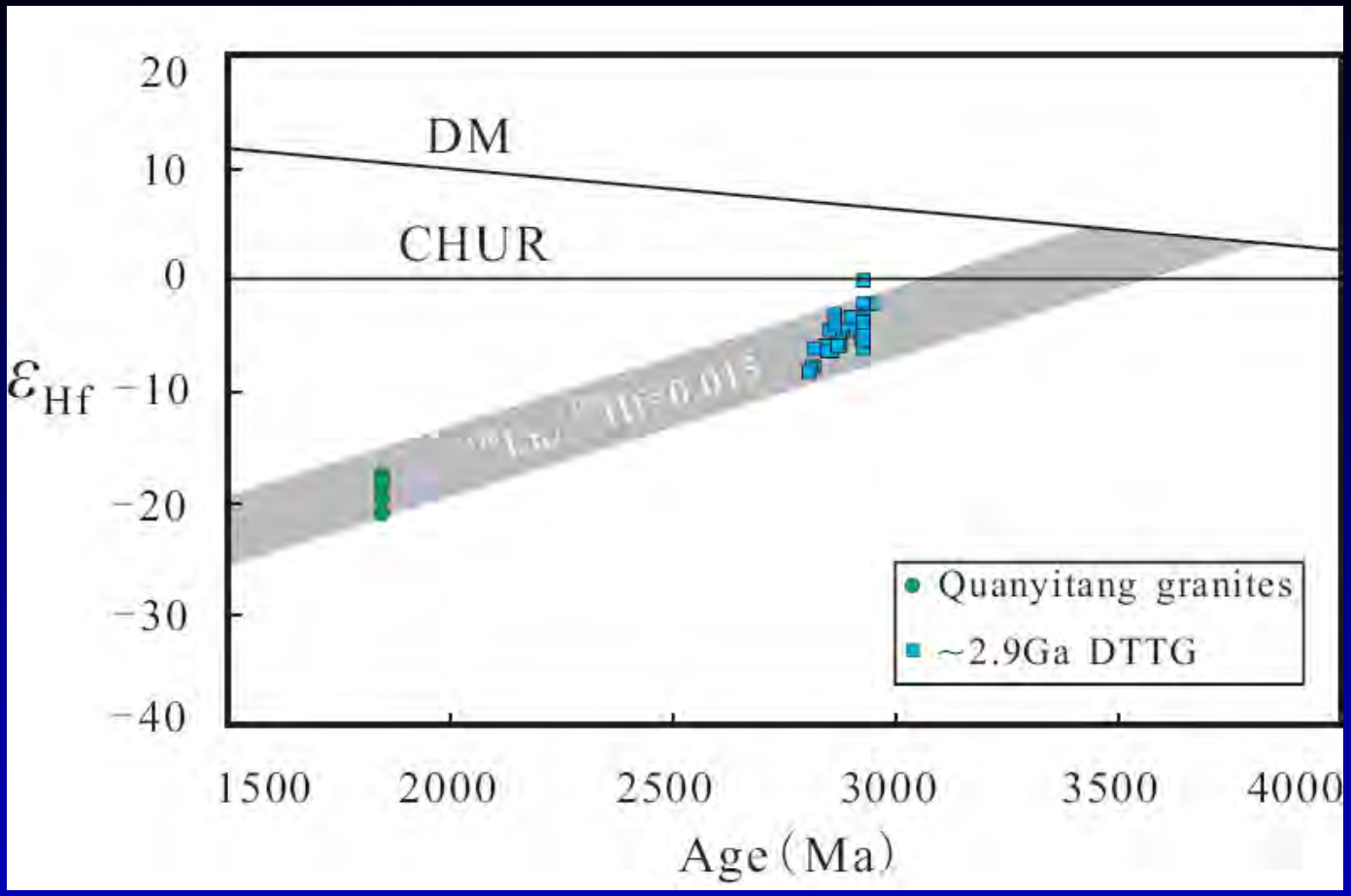
Zircon U-Pb age and formation temperatures



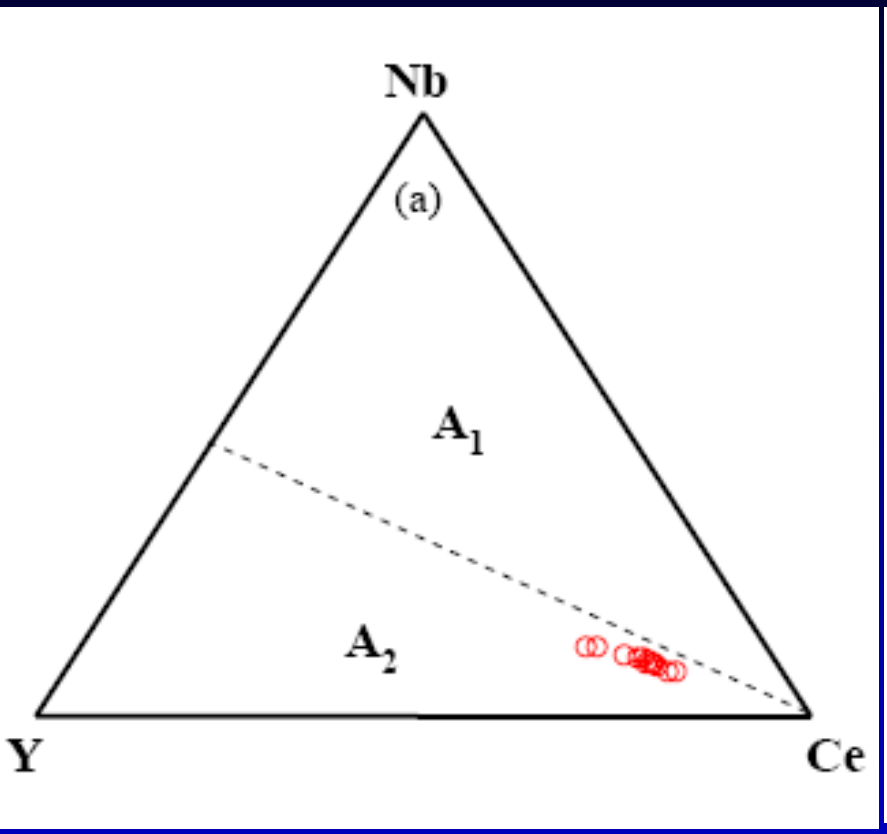


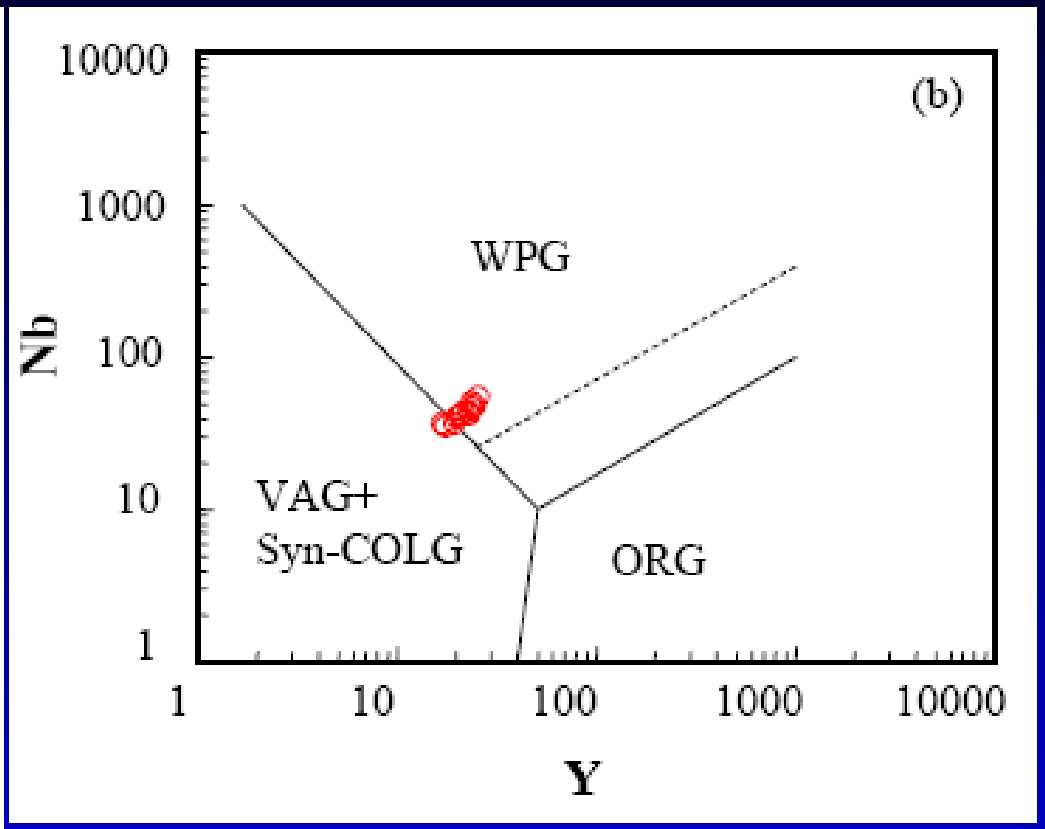


Major and trace element characteristics

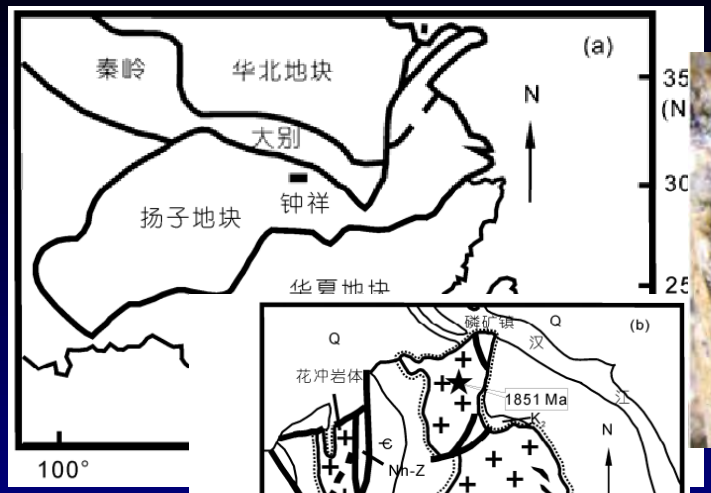


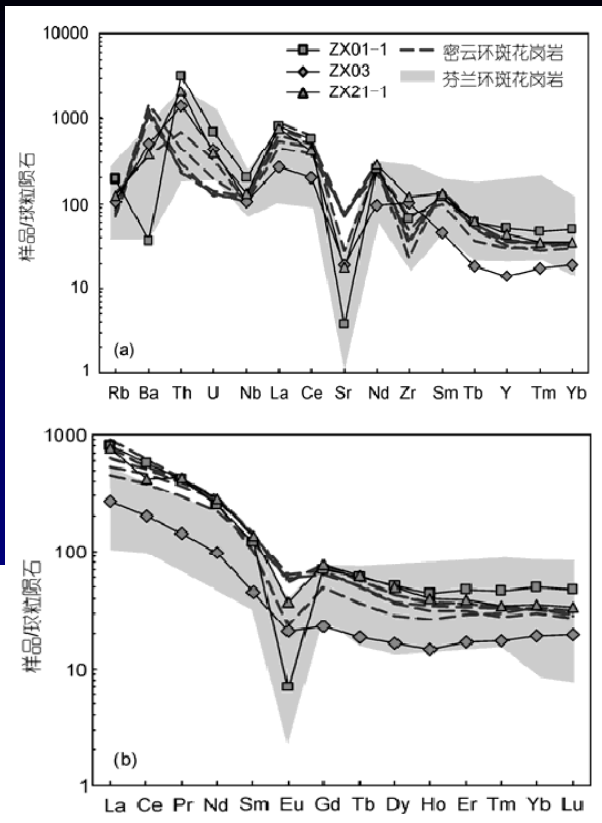
Hf isotope evolution diagram for the Quanqitang granite (Peng et al. 2012).

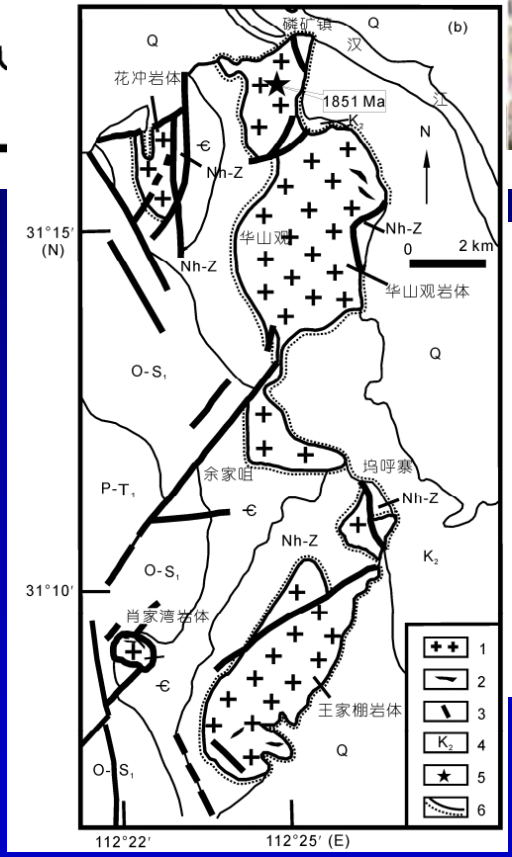


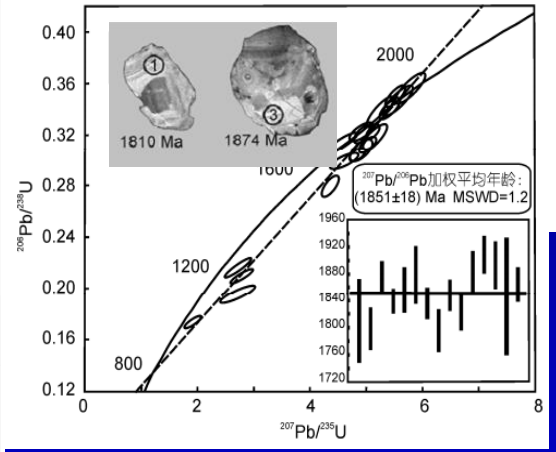


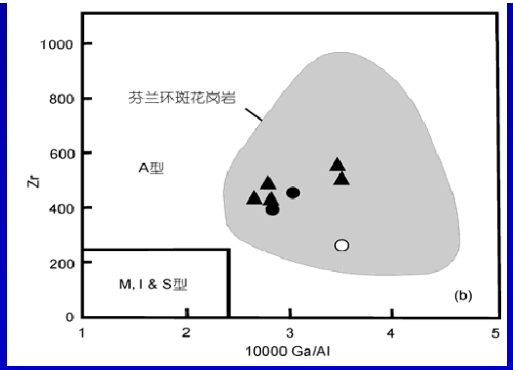
Generated in an extensional environment due to post-collisional extension



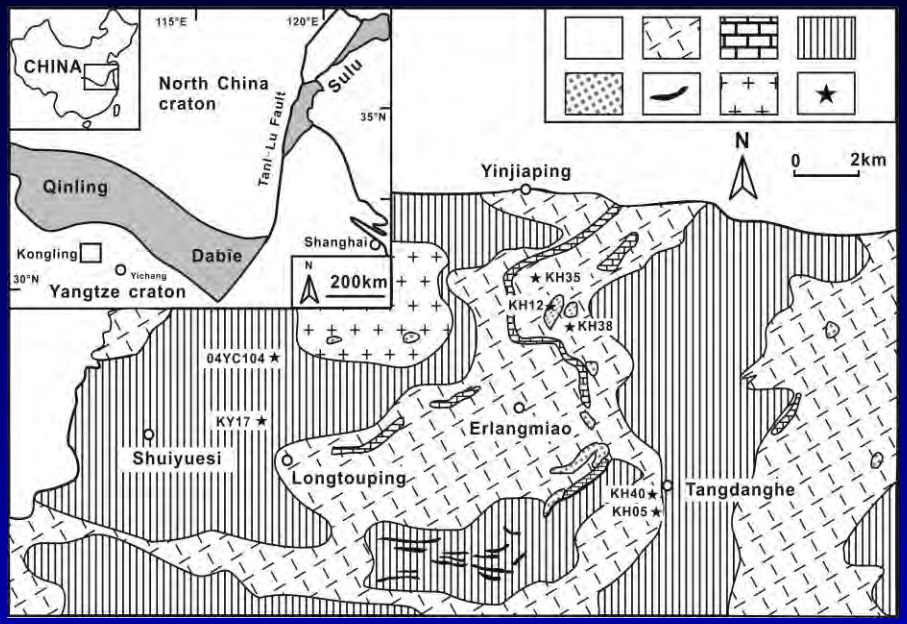


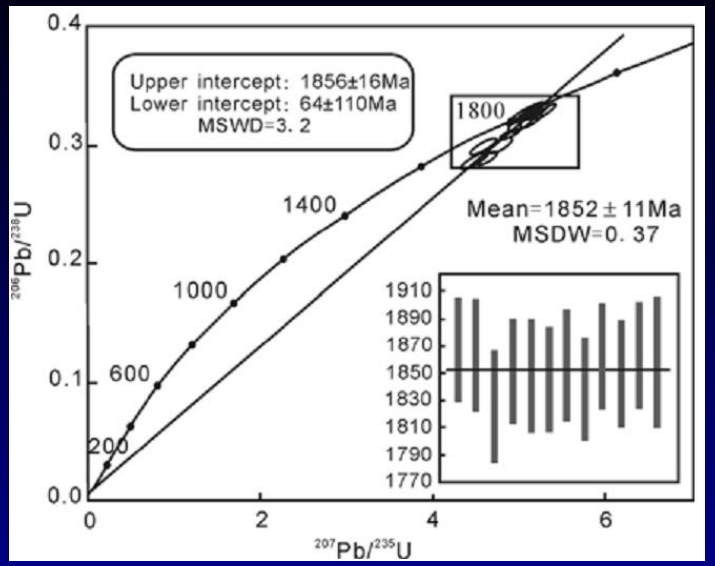


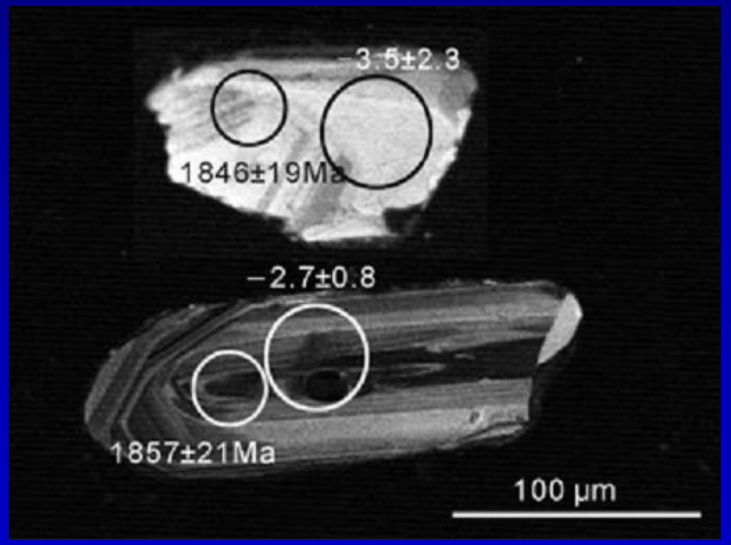




扬子地块北缘古元古代环斑花岗岩 (张丽娟等, 2011)







Paleoproterozoic mafic dykes in the Kongling terrain (Peng et al., 2009)

The occurrence of ca. 1.85Ga A-type granites and mafic dykes indicating:

- An extension environment in the Yangtze Block
- The Kongling microcontinental block or the Yangtze block has became a stabilized craton at ca. 1 .85 Ga

Conclusions

- The oldest crustal remnants and the oldest rocks ca. 3.7-3.8 Ga and 3.2 Ga in the Yangtze Blcok.
- The ca. 2.9 Ga and ca. 2.7 Ga gneisses were generated by melting of older materials.
- The west part of the Yangtze Block might be a microcontinent with arc-related magmatism at ca. 2.45-2.05;
- The ca. 2.0 Ga metamrophic ages might represent a collisional orogenic event related to the amalgamation and cratonization of the Yangtze Block;
- The occurrence of the 1.85 Ga A-type granite denoted an extension environment and the Yangtze Craton has become a stabilized craton;

Thanks for your attention!