

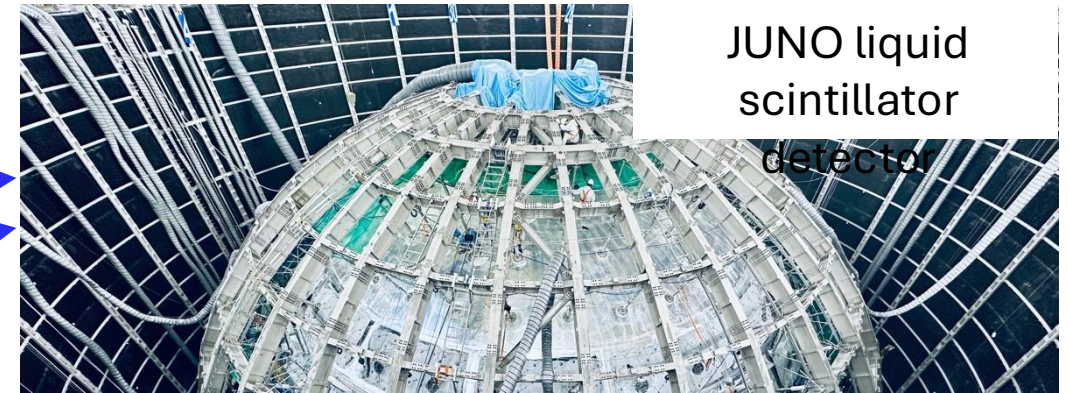
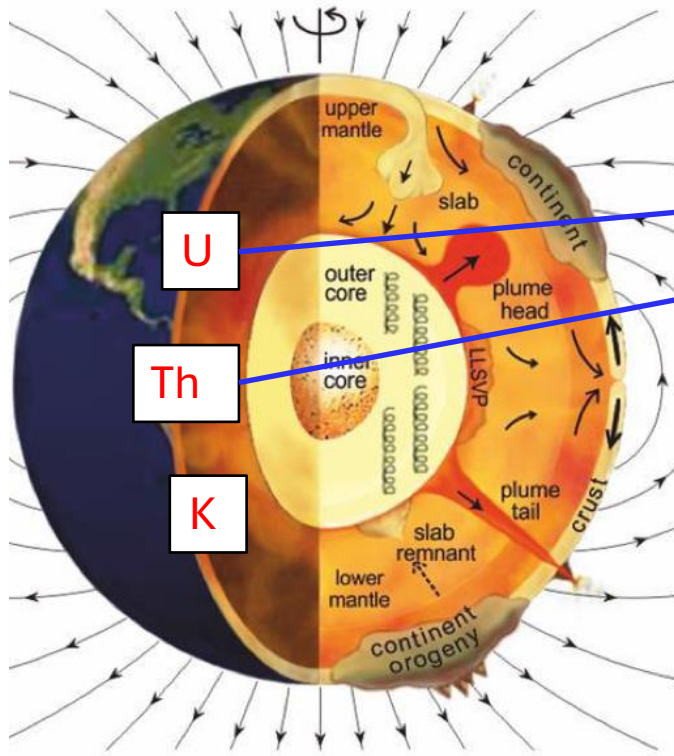


Constraining geo-models with geoneutrino measurements

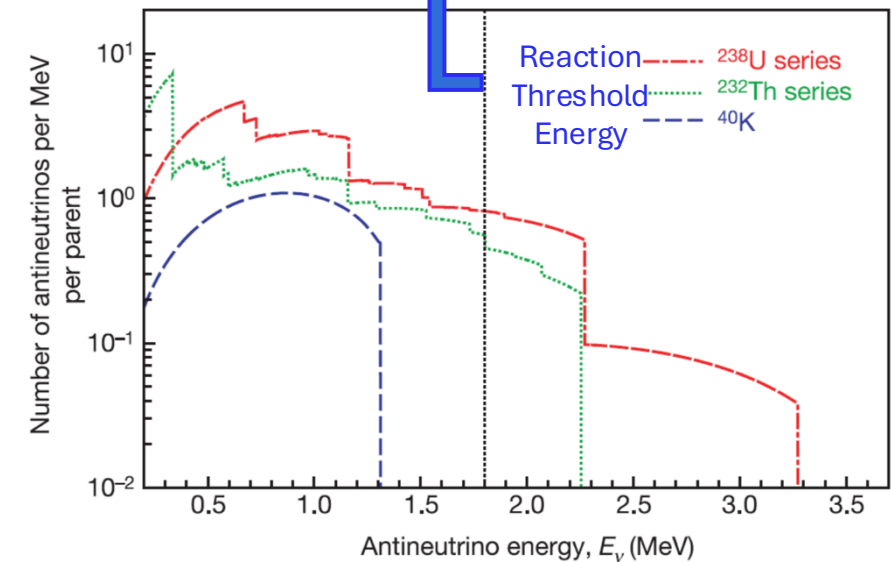
Ruohan Gao, Bo Tian, Yao Sun

China University of Geosciences, Beijing

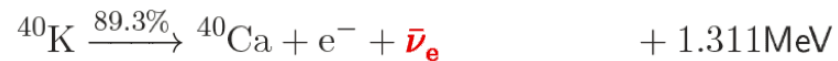
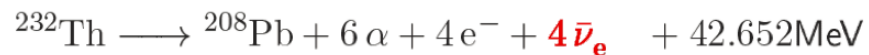
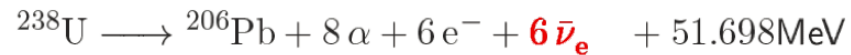
Probe Earth's interior with geo-neutrino



• Detection of Geo-neutrino

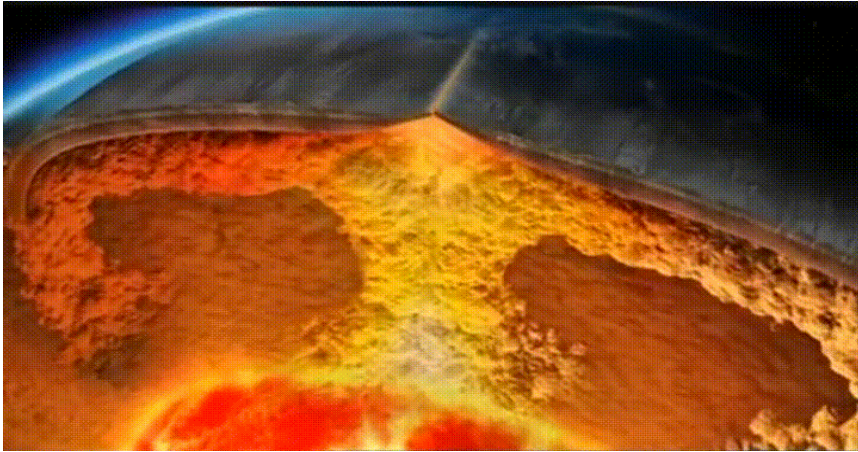


• Production of Geo-neutrino



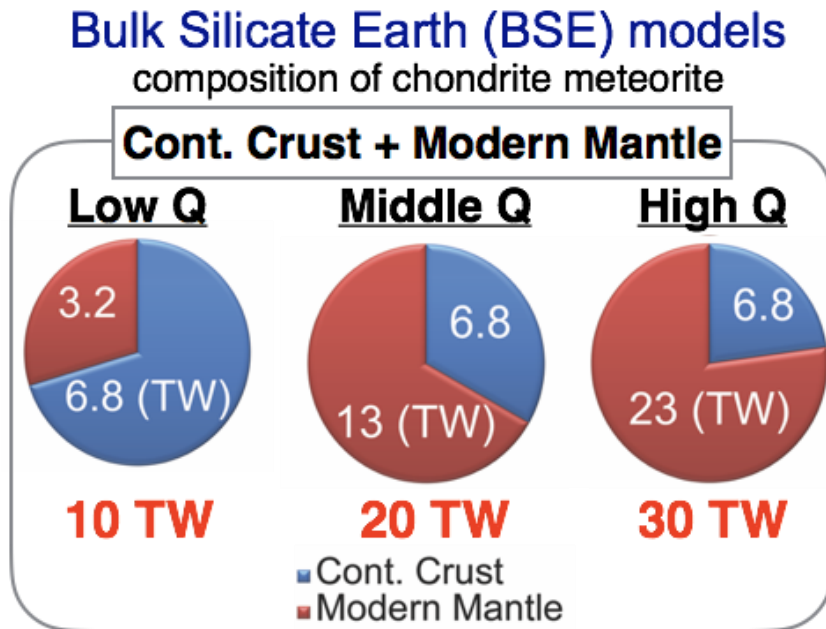
(from S.T. Dye)

The importance of detecting U and Th

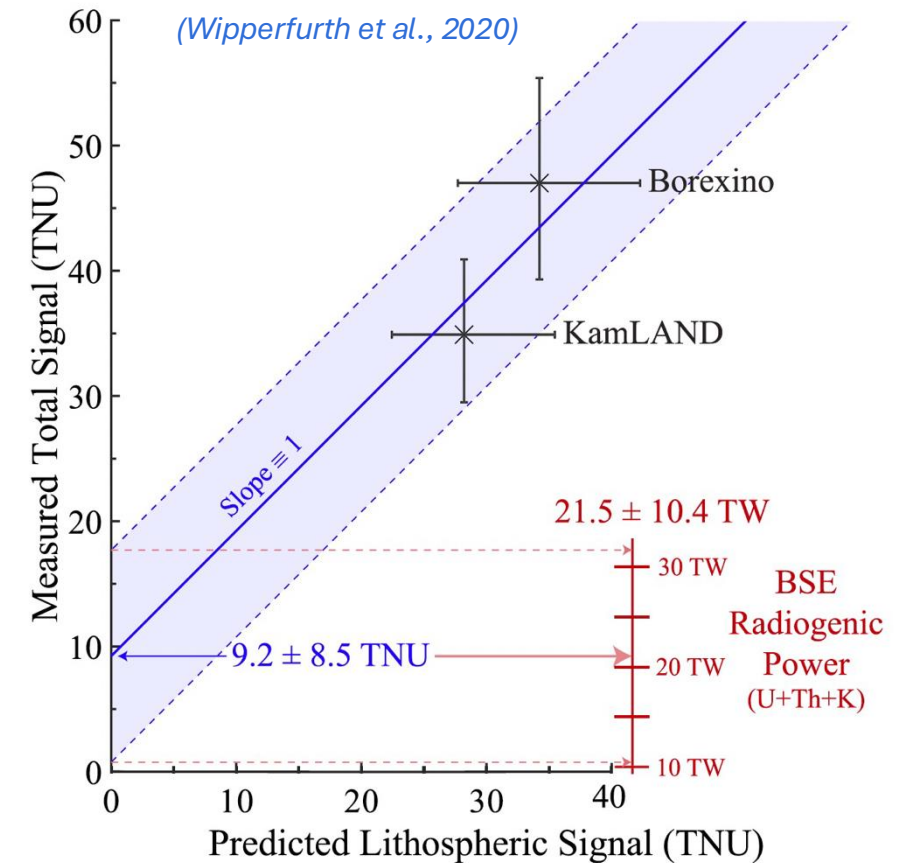


- Heat produced by the radiogenic decay of U and Th drives plate tectonics.

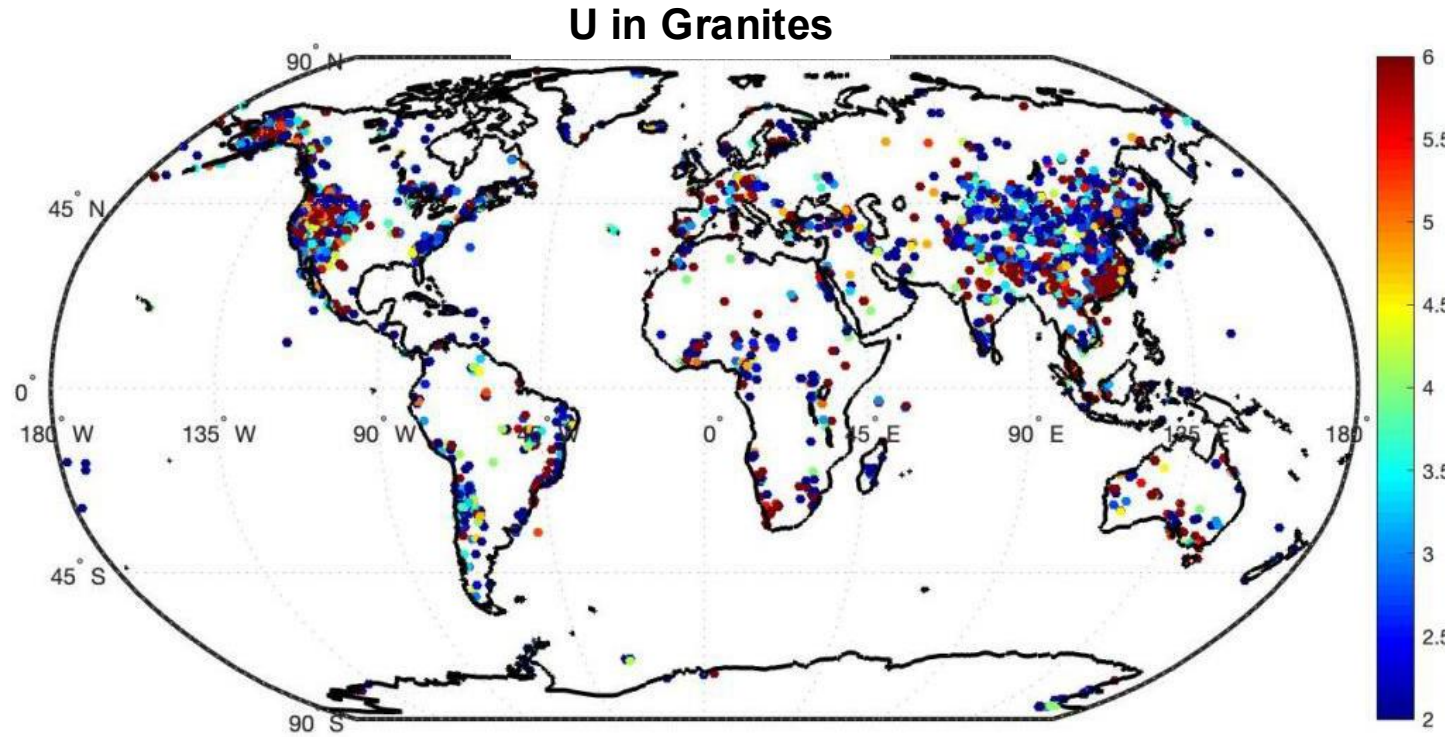
Examine BSE models using geoneutrino



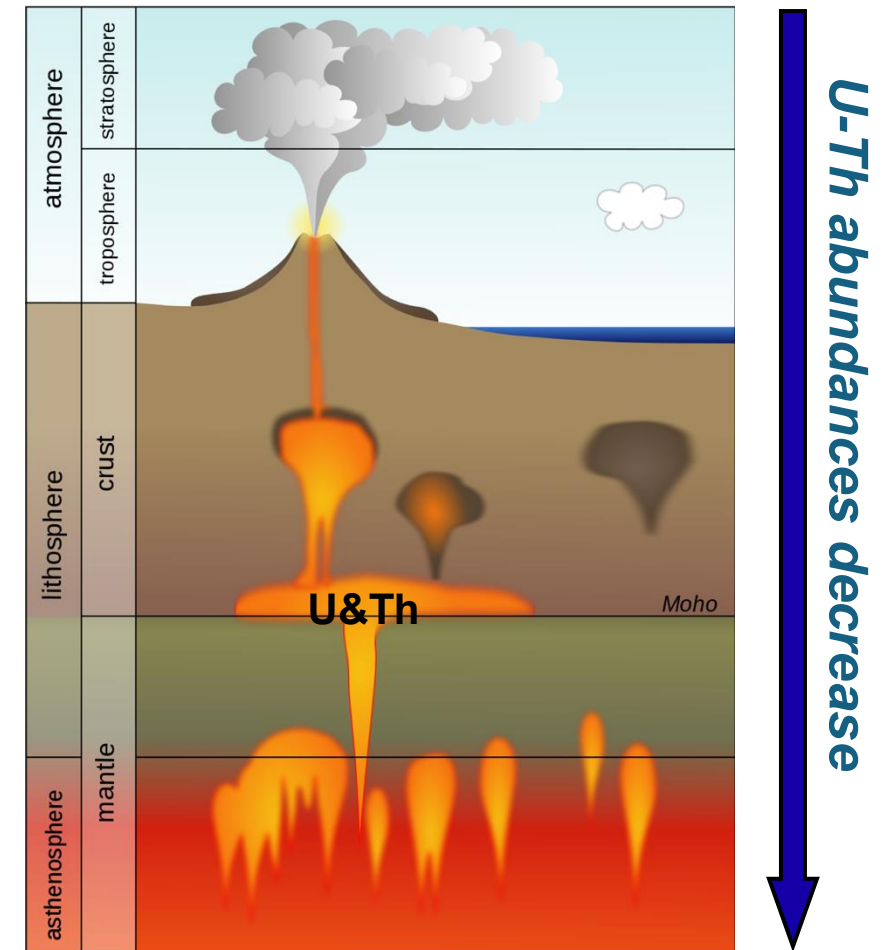
High Q →
Middle Q →
Low Q →



The importance of detecting U and Th



**Examine other
geoscience models
using geoneutrino**

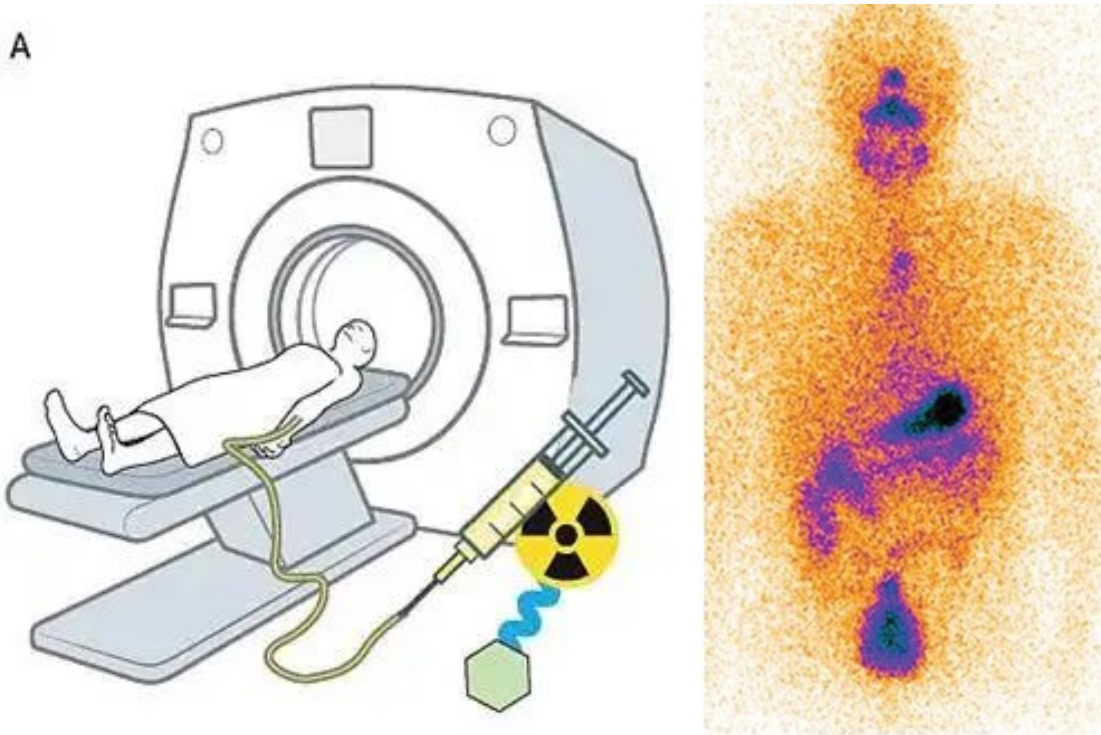


- Geologic processes redistribute U and Th in Earth's crust and mantle.

How does it work?

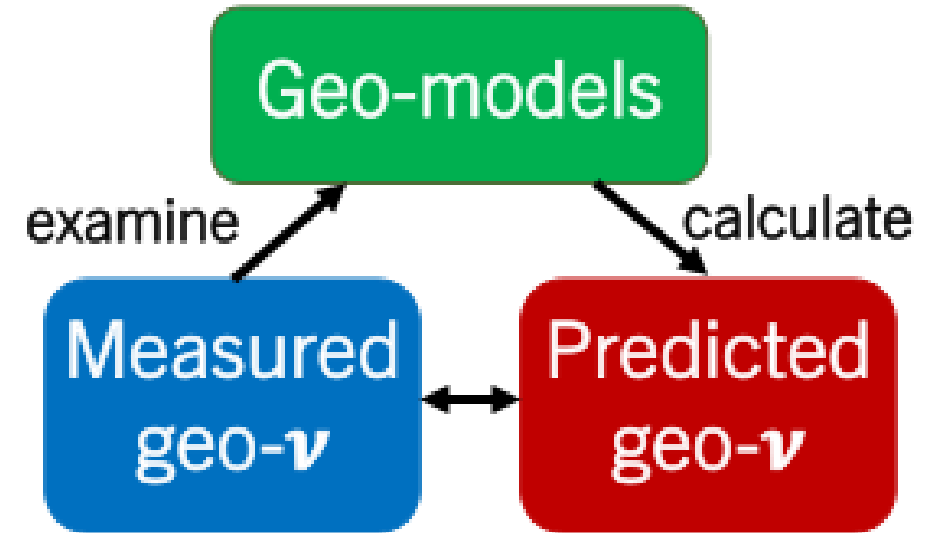
Ideal

➤ Tomography



Reality

➤ Forward modeling



Inputs for geo-neutrino signal prediction

$$\Phi_i = A_i \cdot n_i \cdot P_{\nu_e - \bar{\nu}_e}(E_\nu, |\vec{L}|) \cdot \int_V \frac{a_i(\vec{L}) \cdot \rho_i(\vec{L})}{4\pi |\vec{L}|^2} dV$$

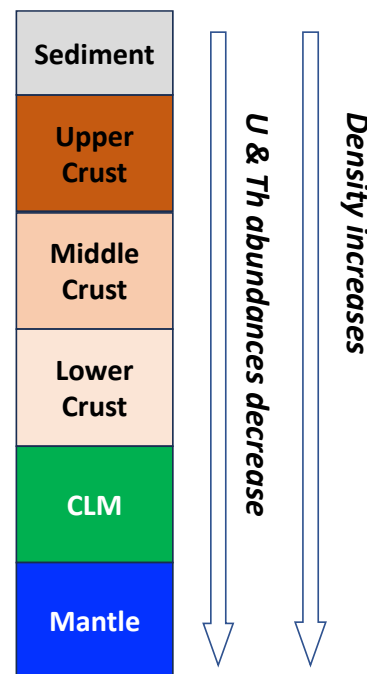
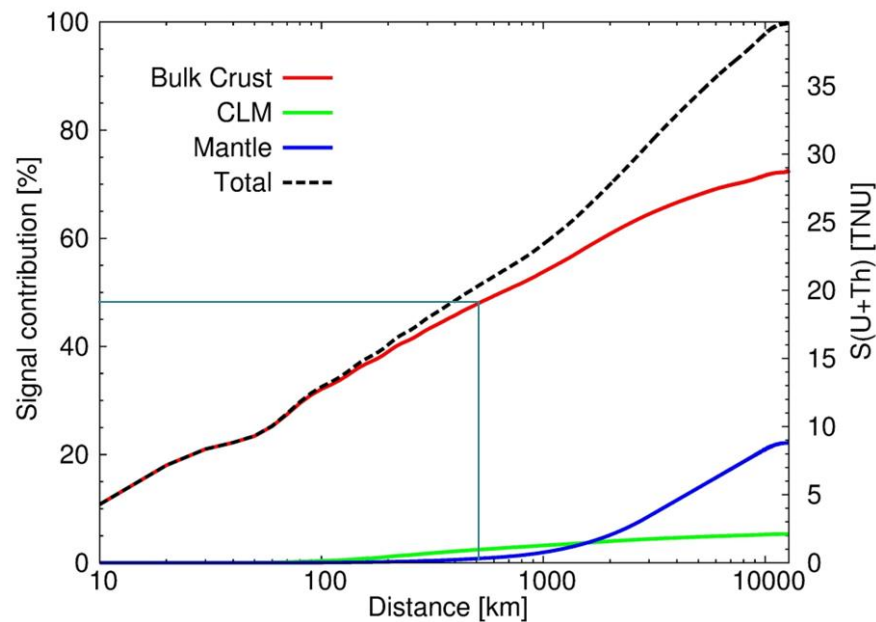
Activity and number of produced geoneutrinos

Volume of source unit

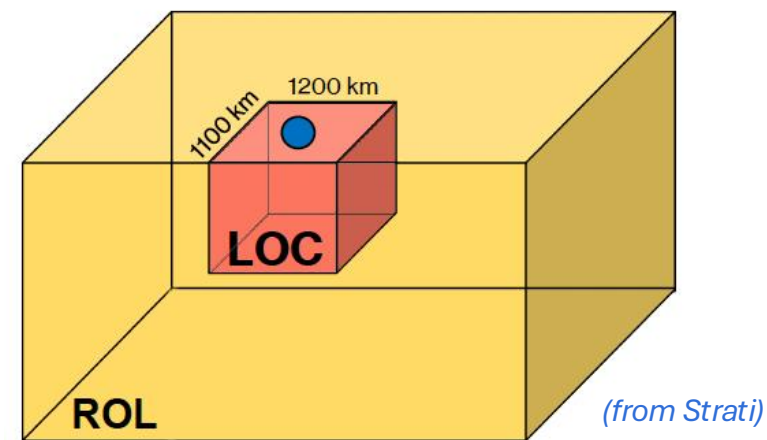
Survival probability function

Abundance and density of the source unit

Distance between source unit and detector

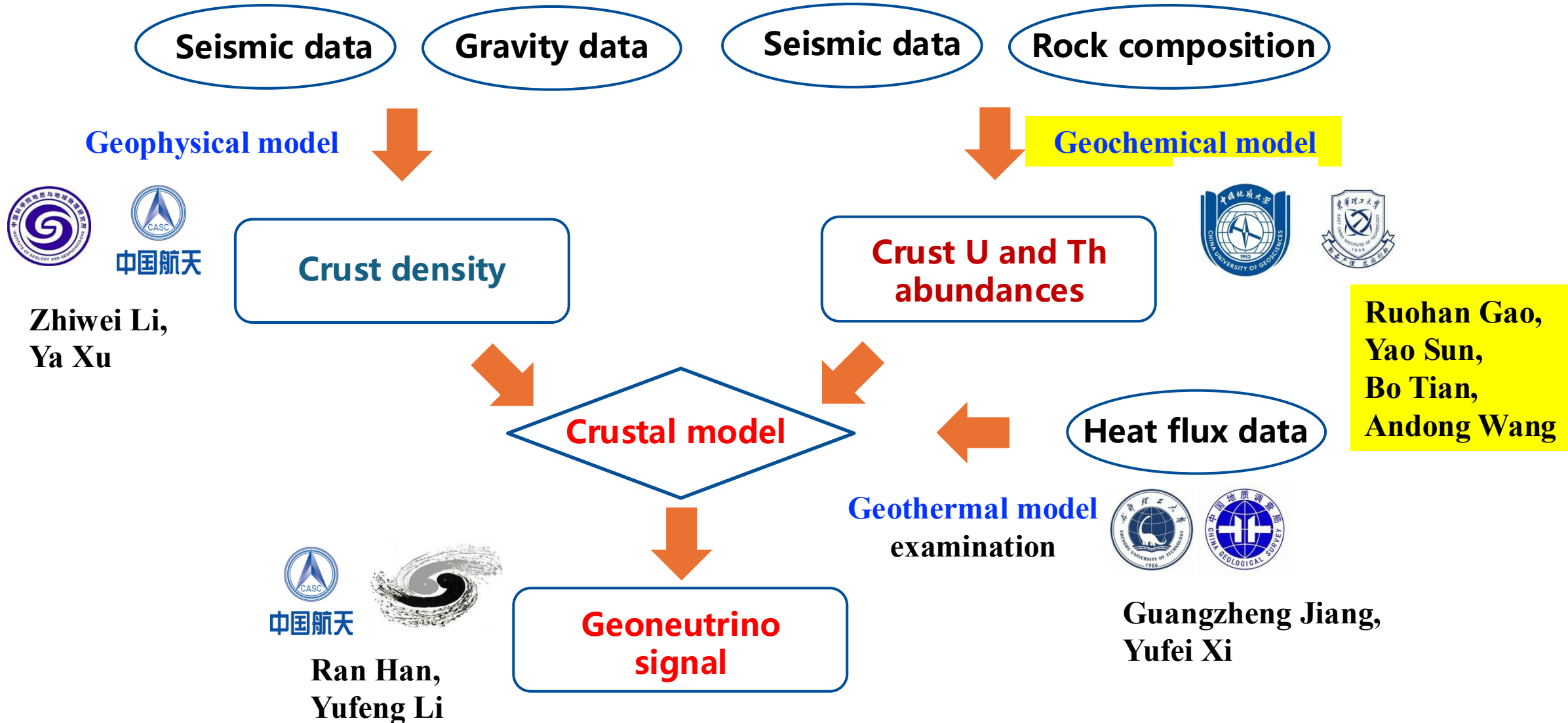


- **Geophysical models**
 - Density of source unit
 - Crustal structure
- **Geochemical models**
 - U and Th abundances of source unit



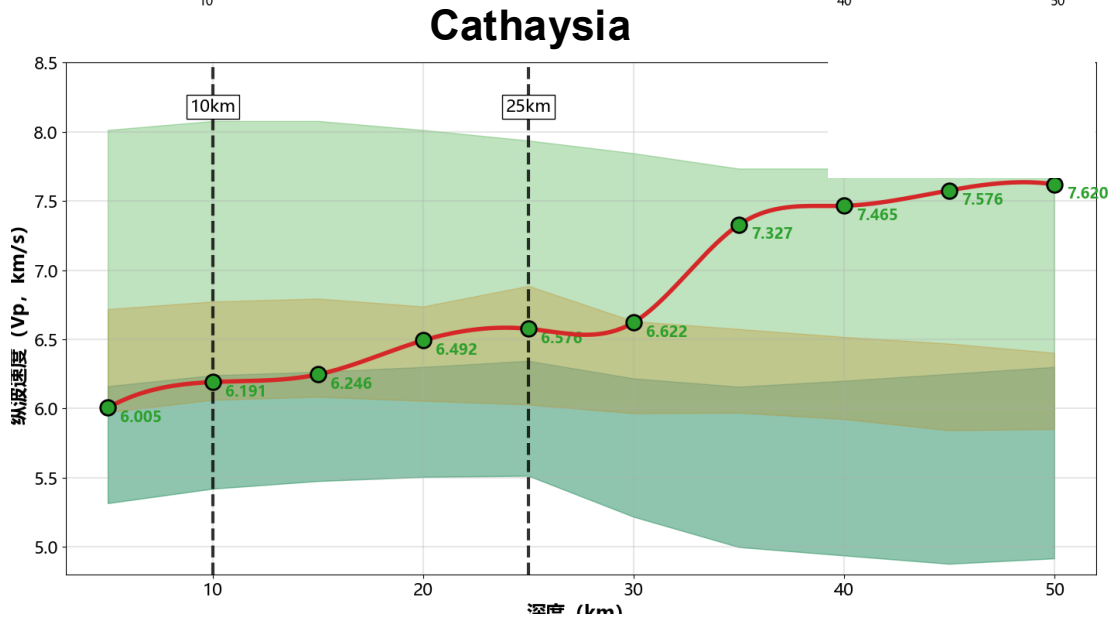
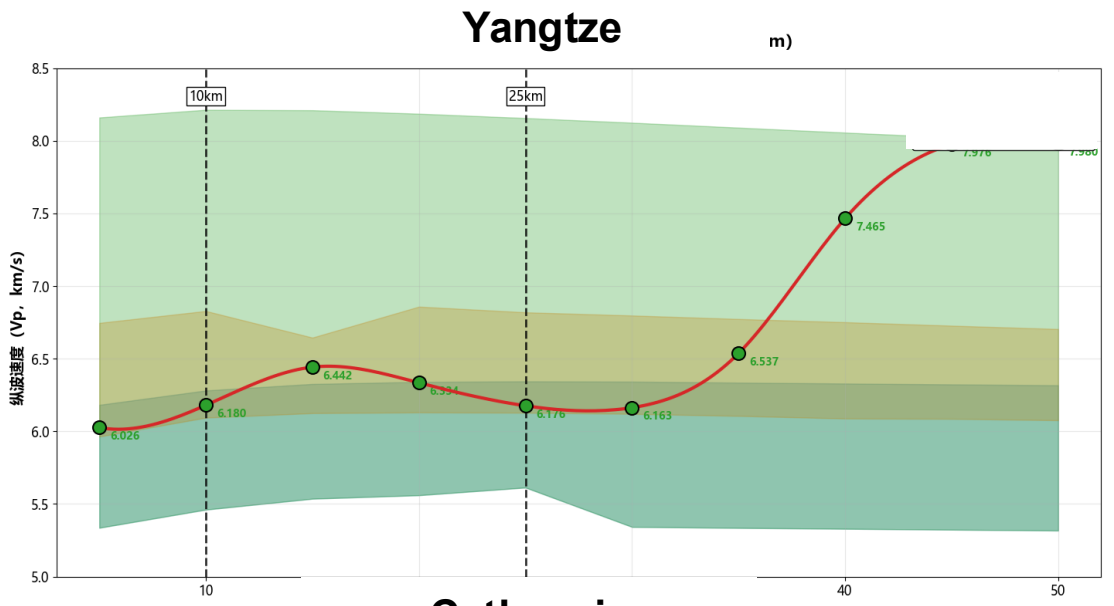
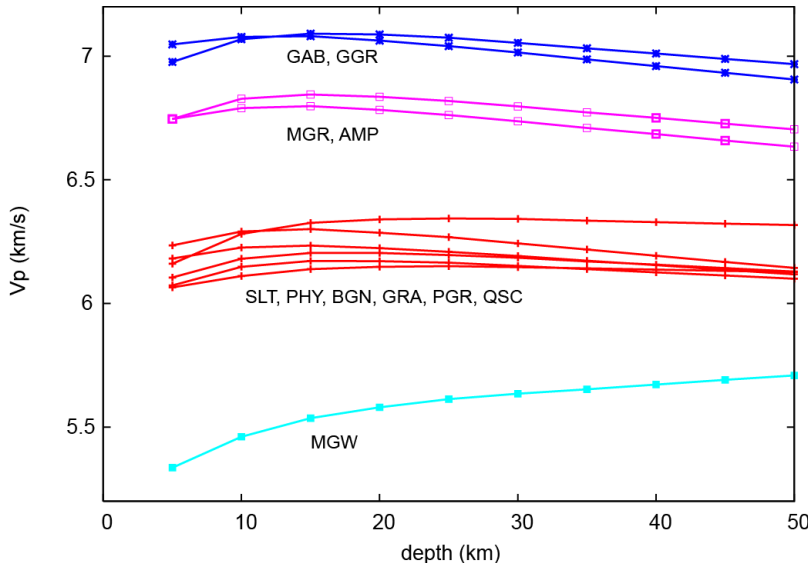
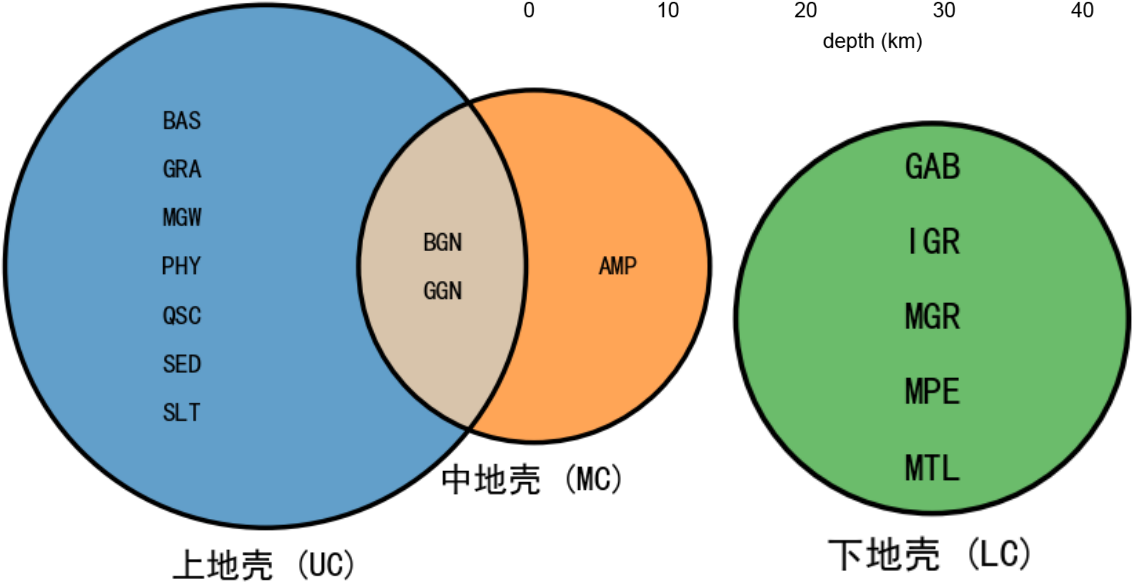
$$S_{\text{TOT}} = S_{\text{LOC}} + S_{\text{ROL}} + S_{\text{Mantel}}$$

Strategy flow chart

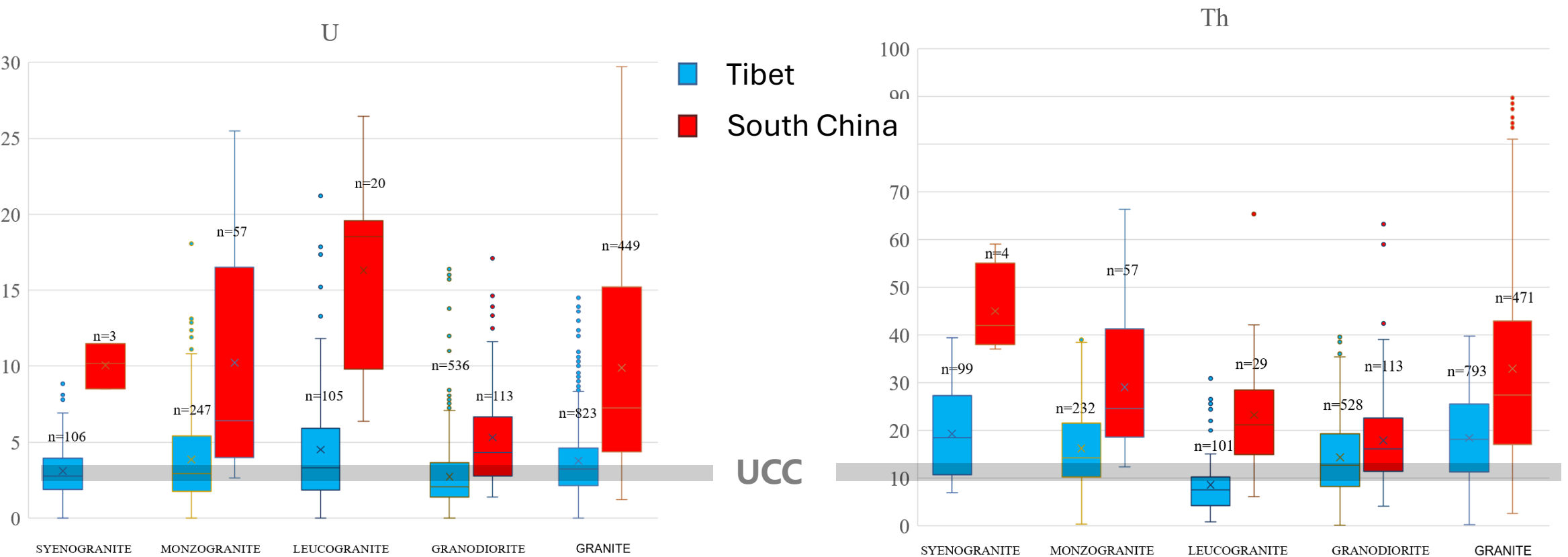


LOC geochemical model: Vp ---> lithology proportion

$$\begin{cases} V_p = \sum V_{p_i} \times P_i \\ \sum P_i = 1 \end{cases}$$

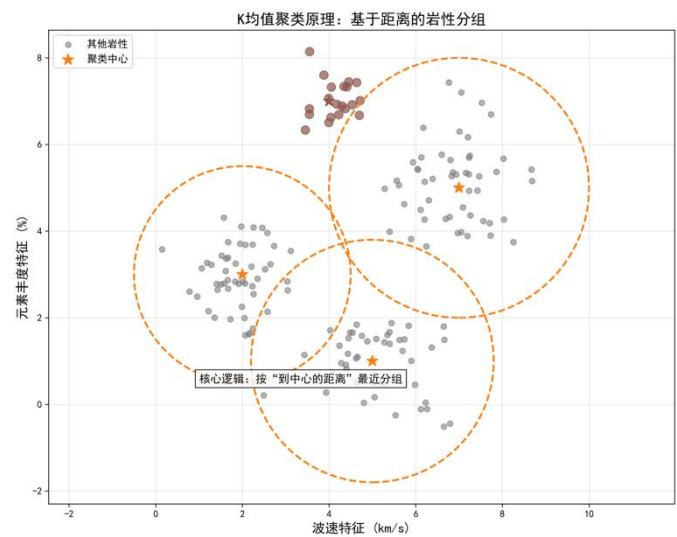


LOC geochemical model: element abundances of different lithology

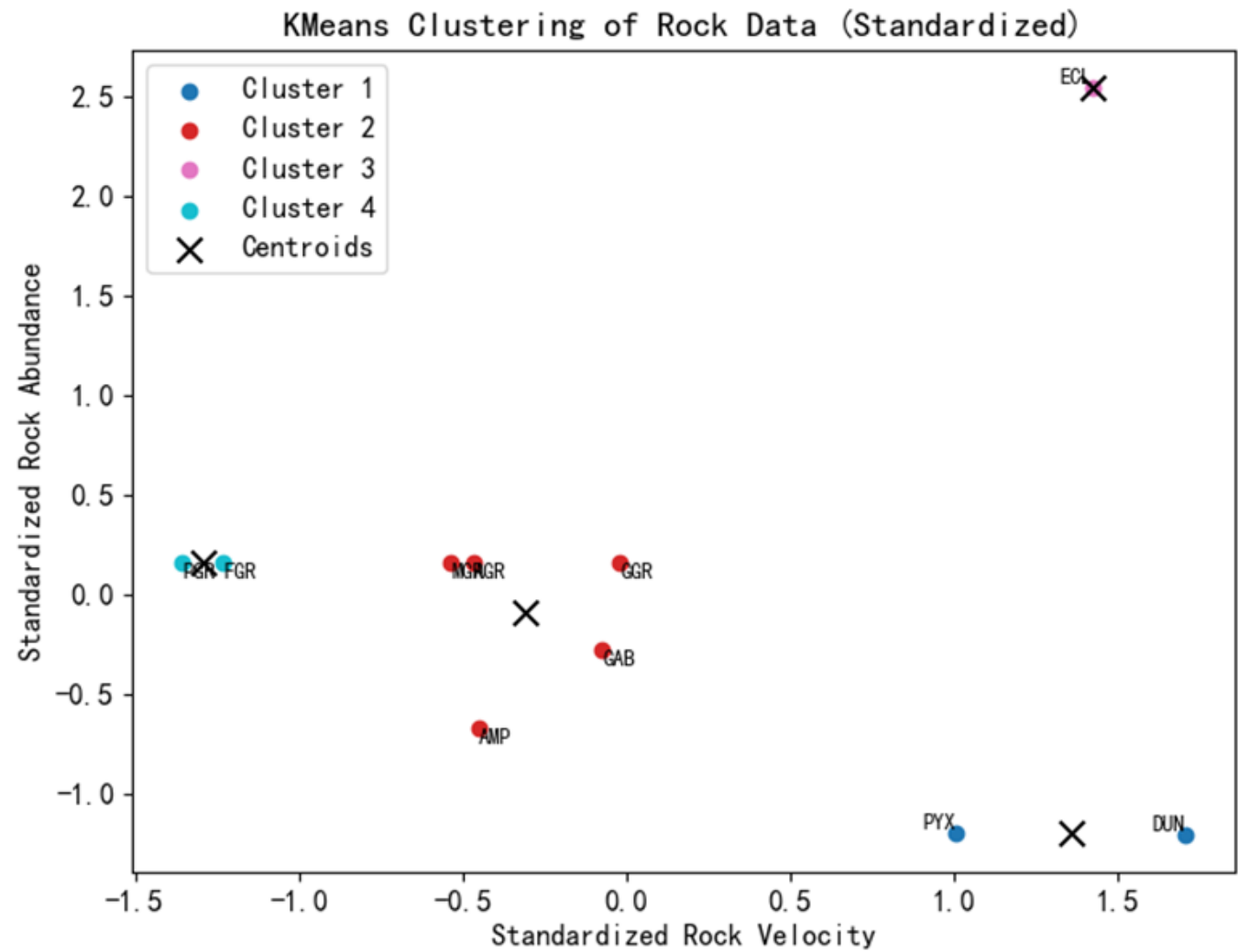
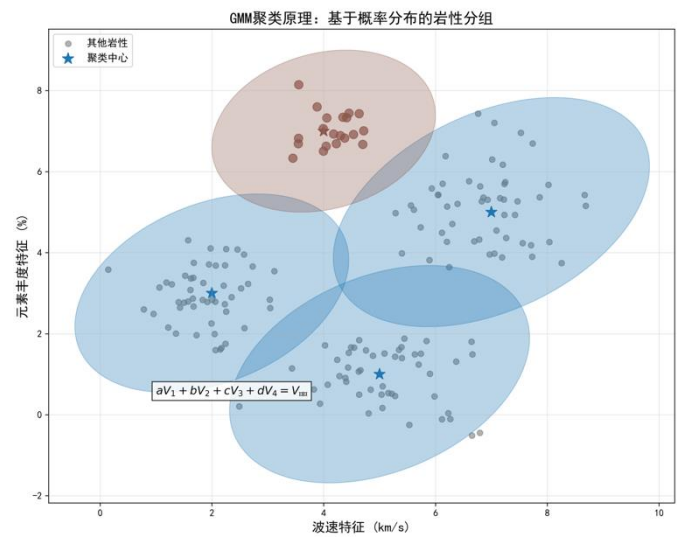


LOC geochemical model: reduce variables

K-means

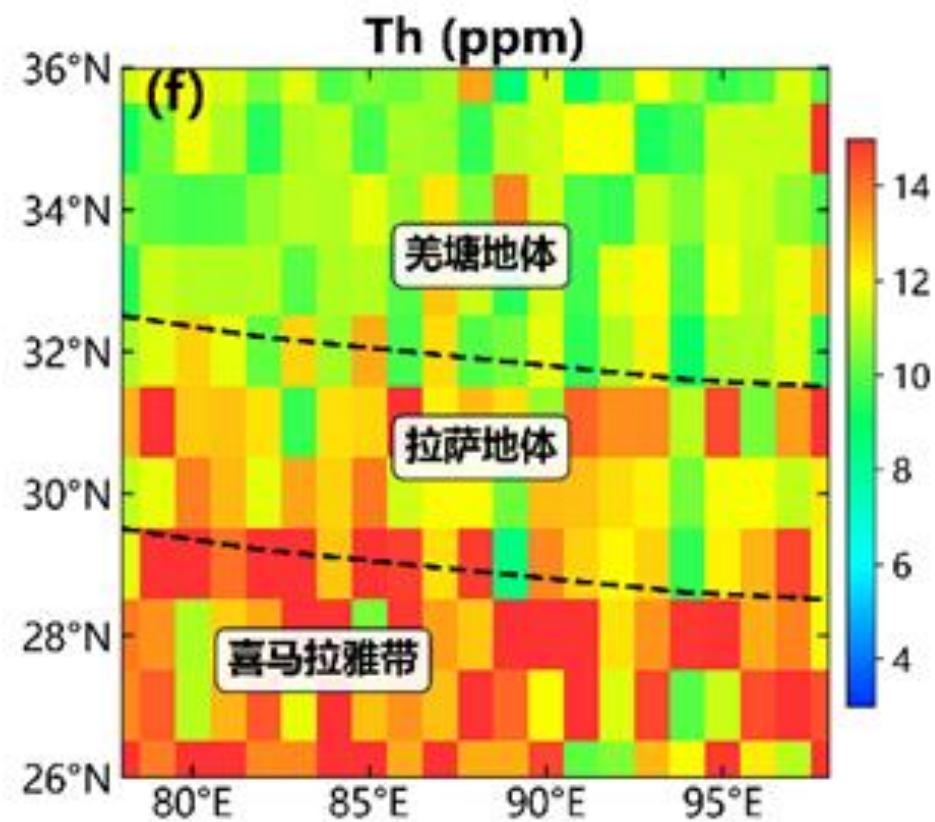
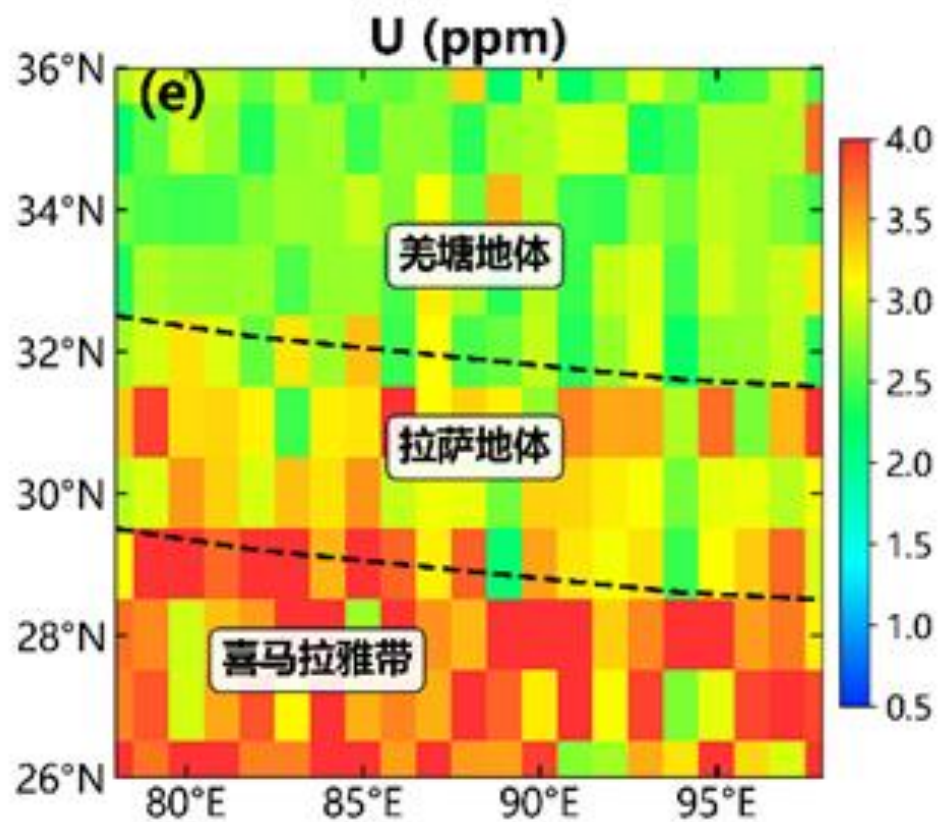


GMM

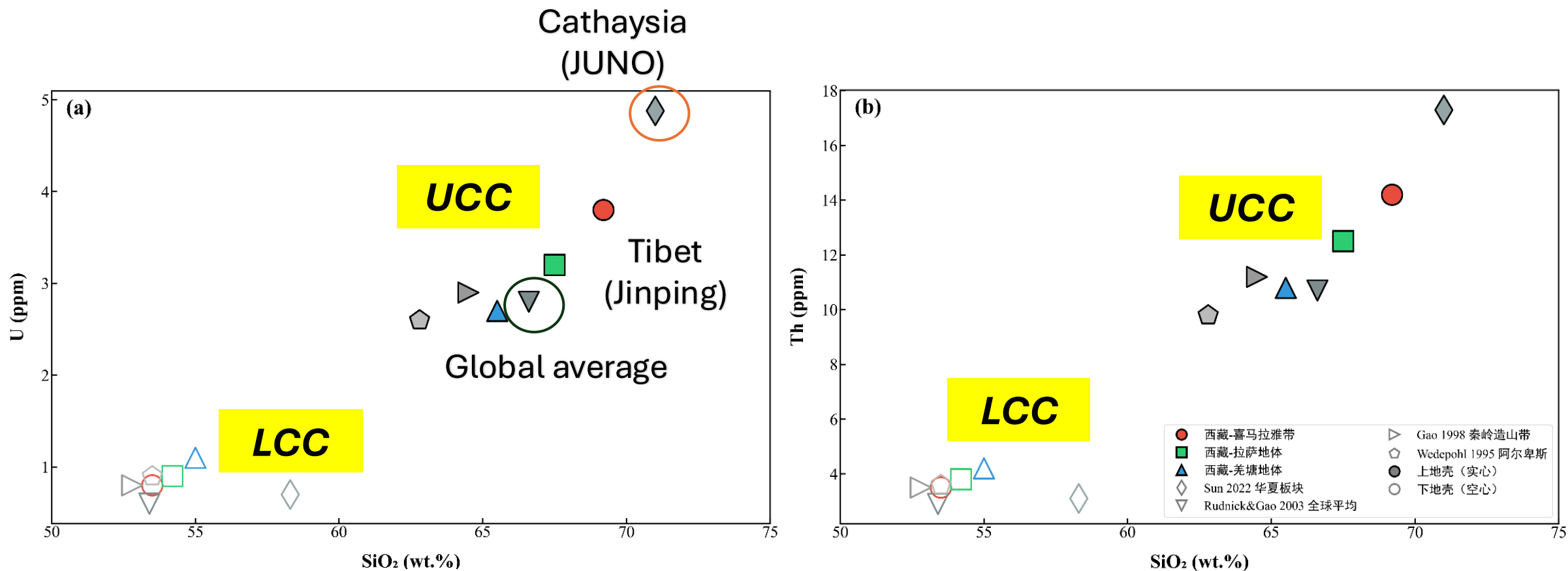


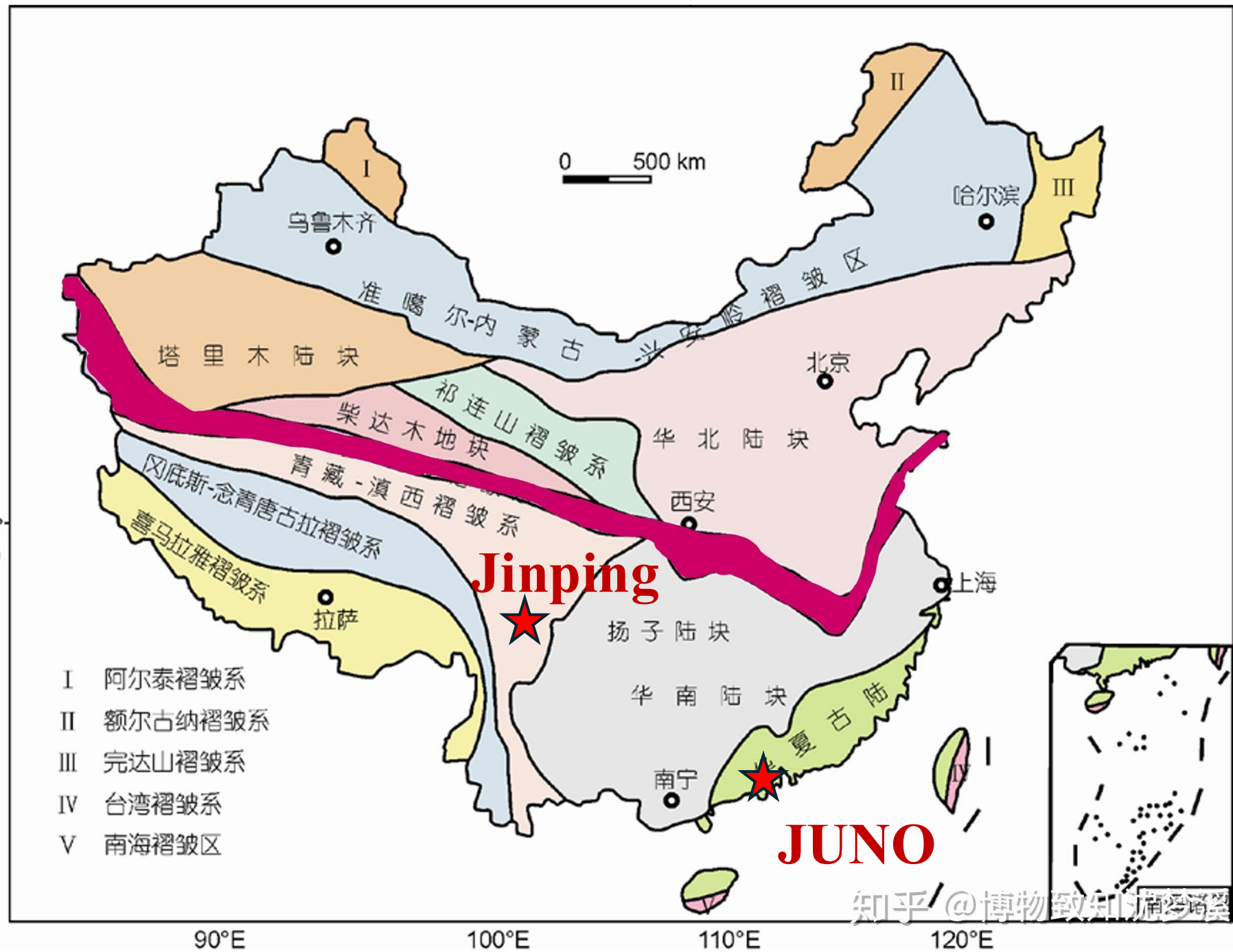
LOC geochemical model: average abundance of each cell

$$C_{\text{cell}} = \sum (C_i \times P_i)$$

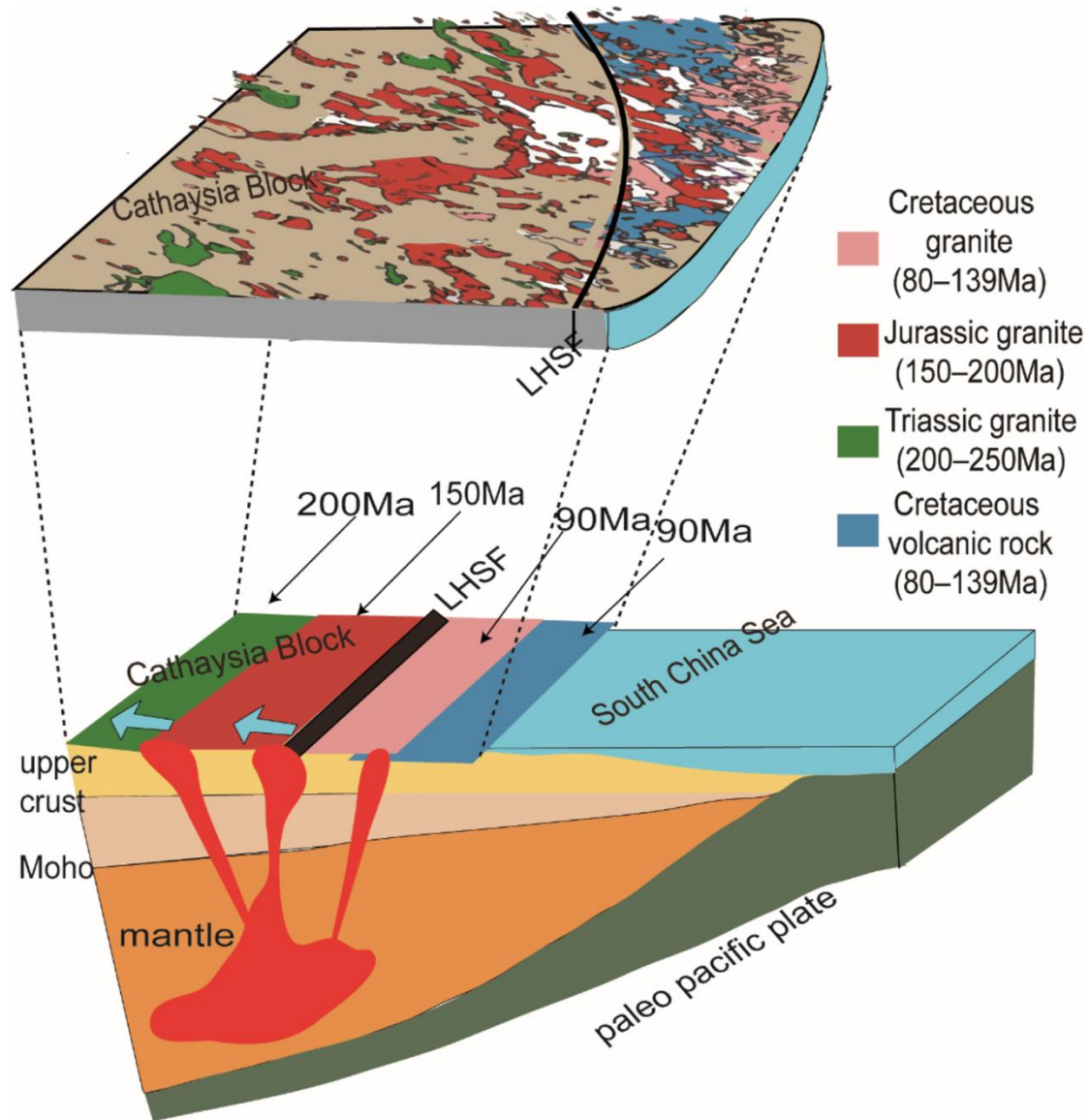


Comparison between Cathaysia (JUNO) and Tibet (Jinping)

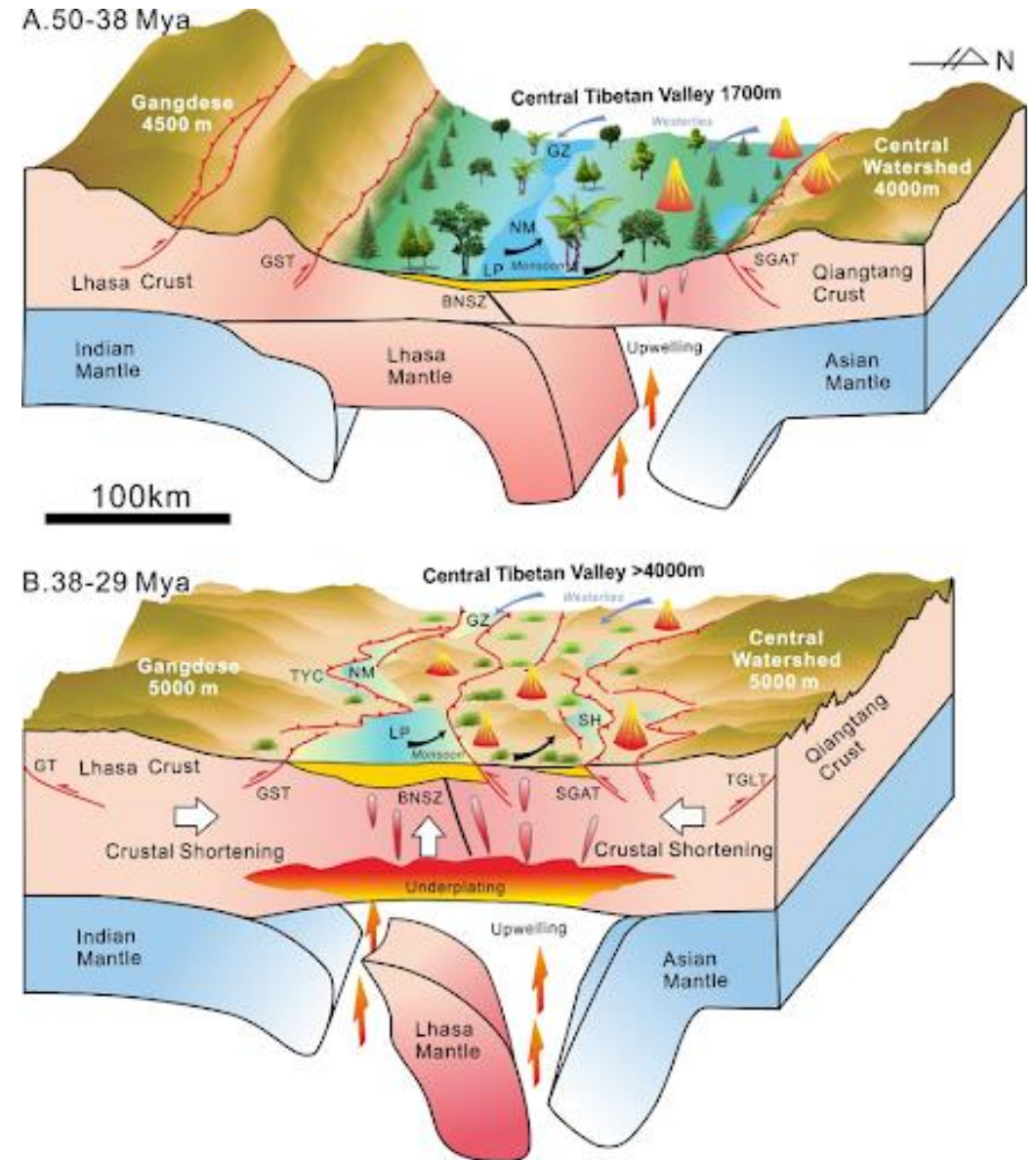




• Southeast China



• Tibet



Geoneutrino measurements will examine our geo-models

Intercept:
Constraints
on BSE
models

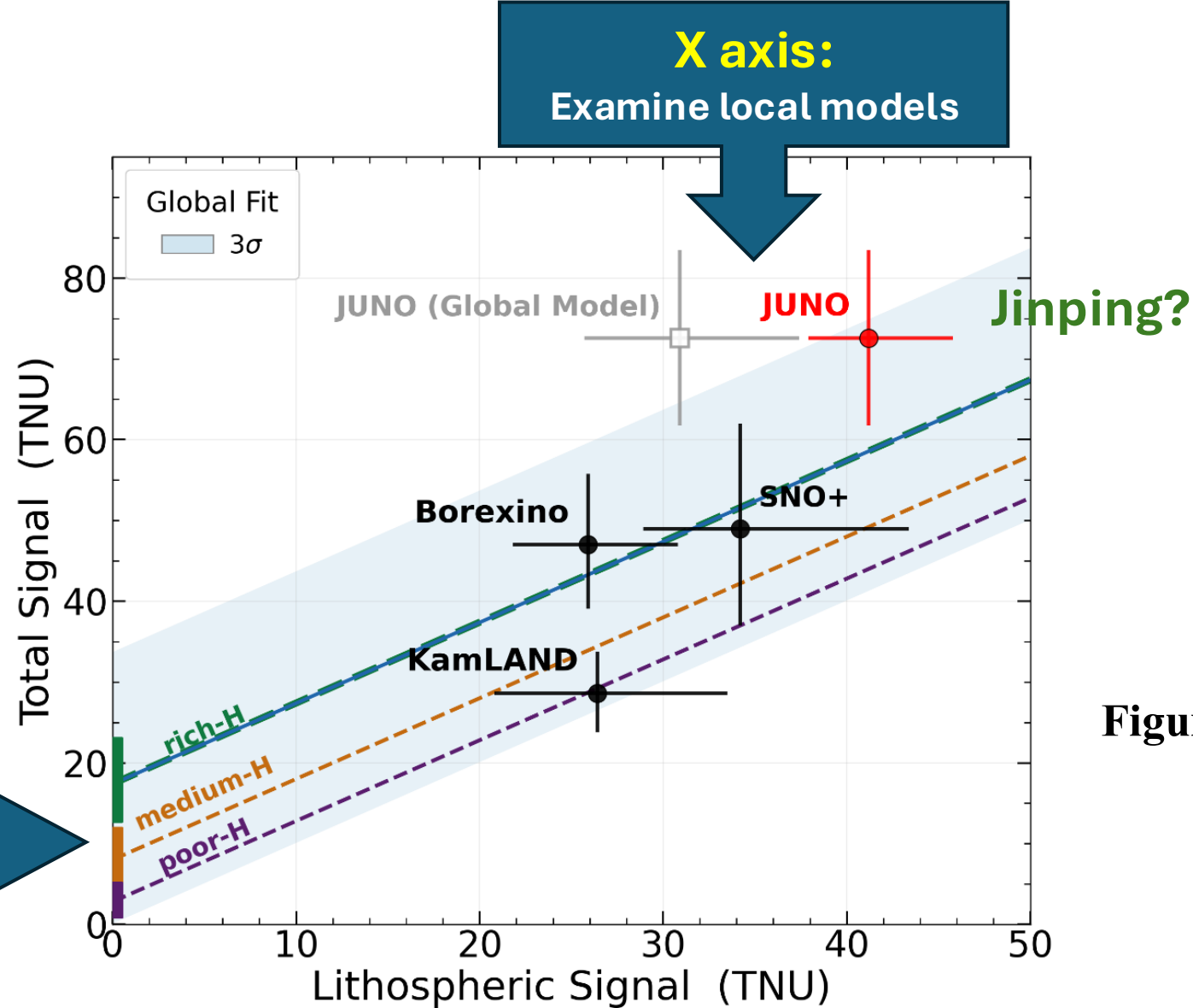


Figure by Liu Qishan

Thank you!