

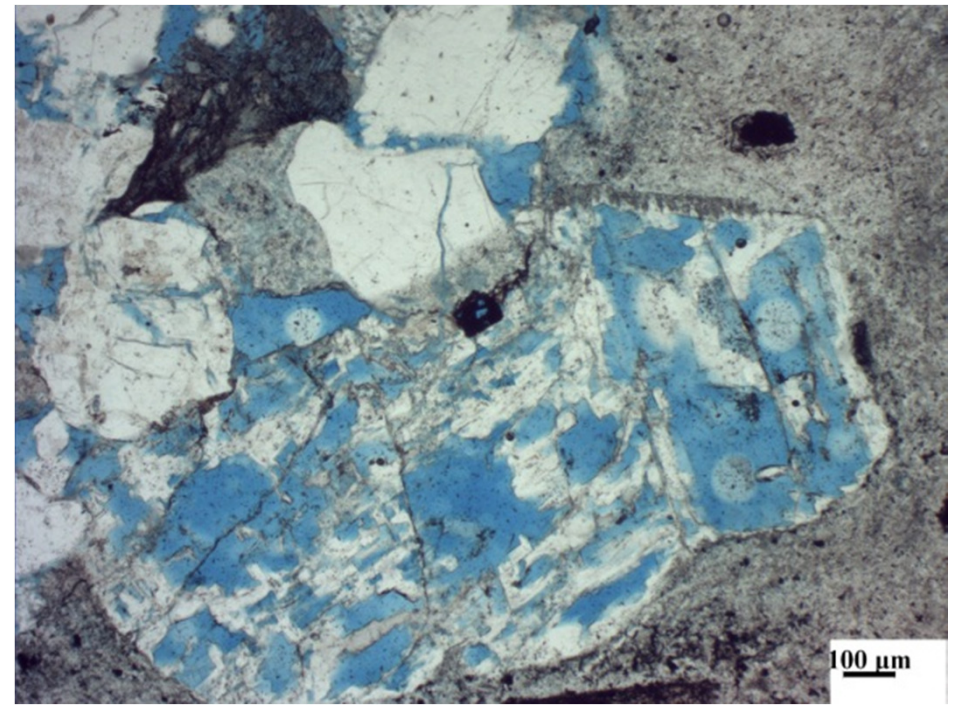
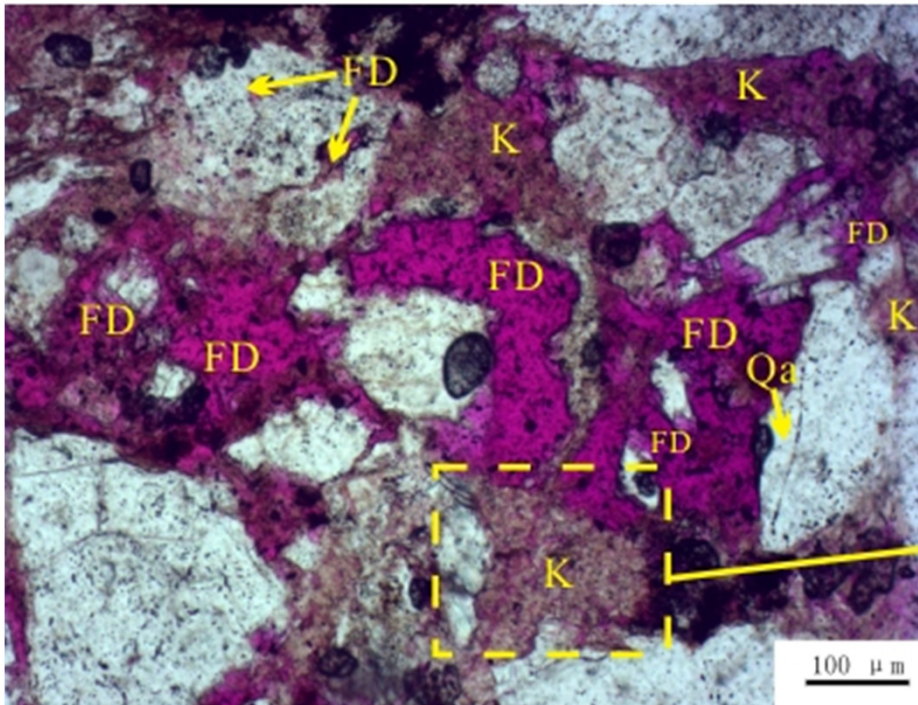


Feldspar dissolution, authigenic clays and quartz cements in open or closed sandstone geochemical systems

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China University of Petroleum (East China),

Florida, June 23rd 2015

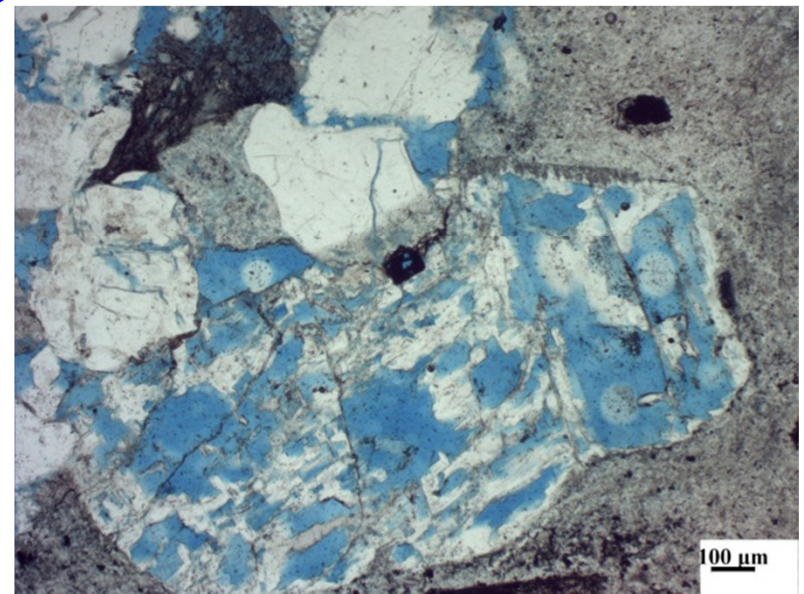
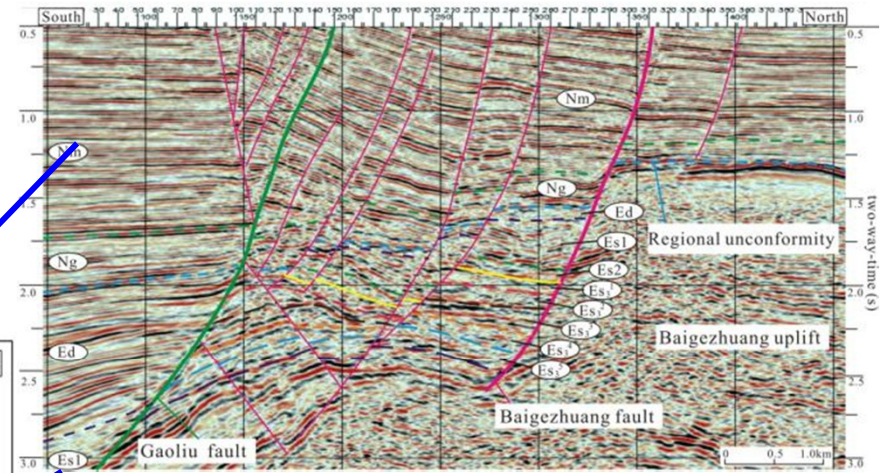
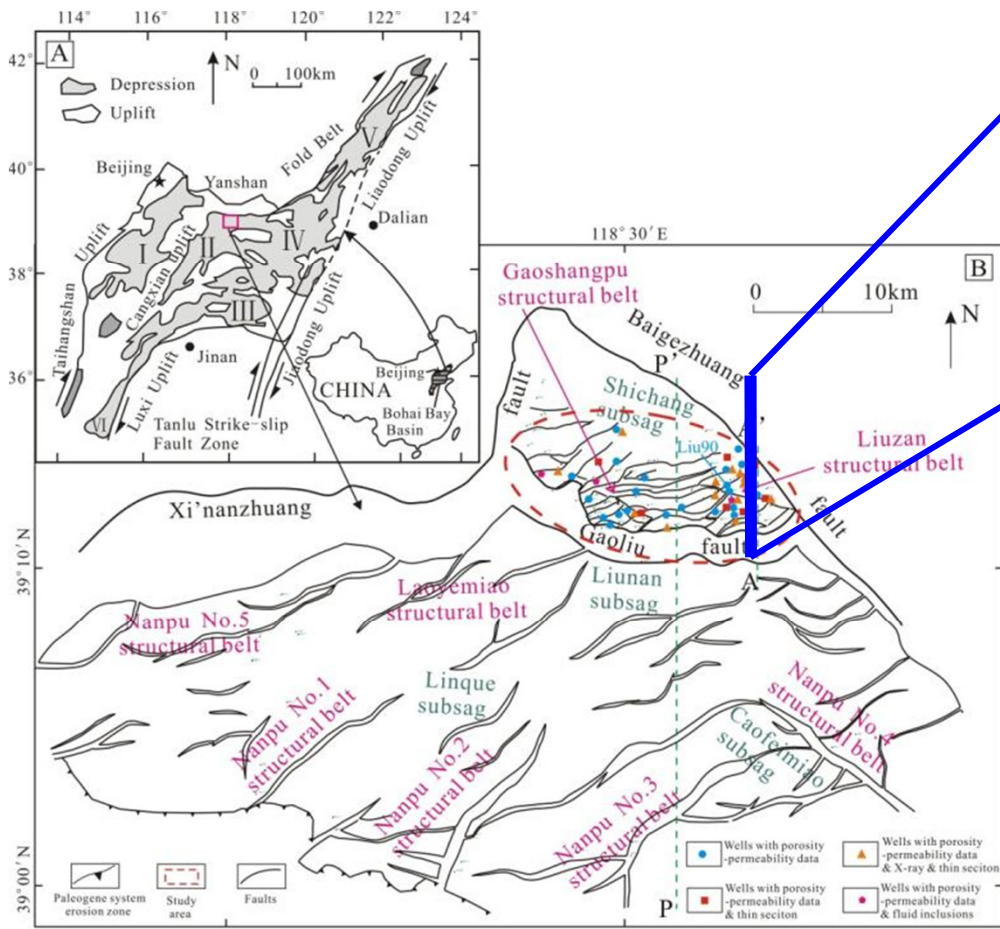
Questions



Buried sandstones

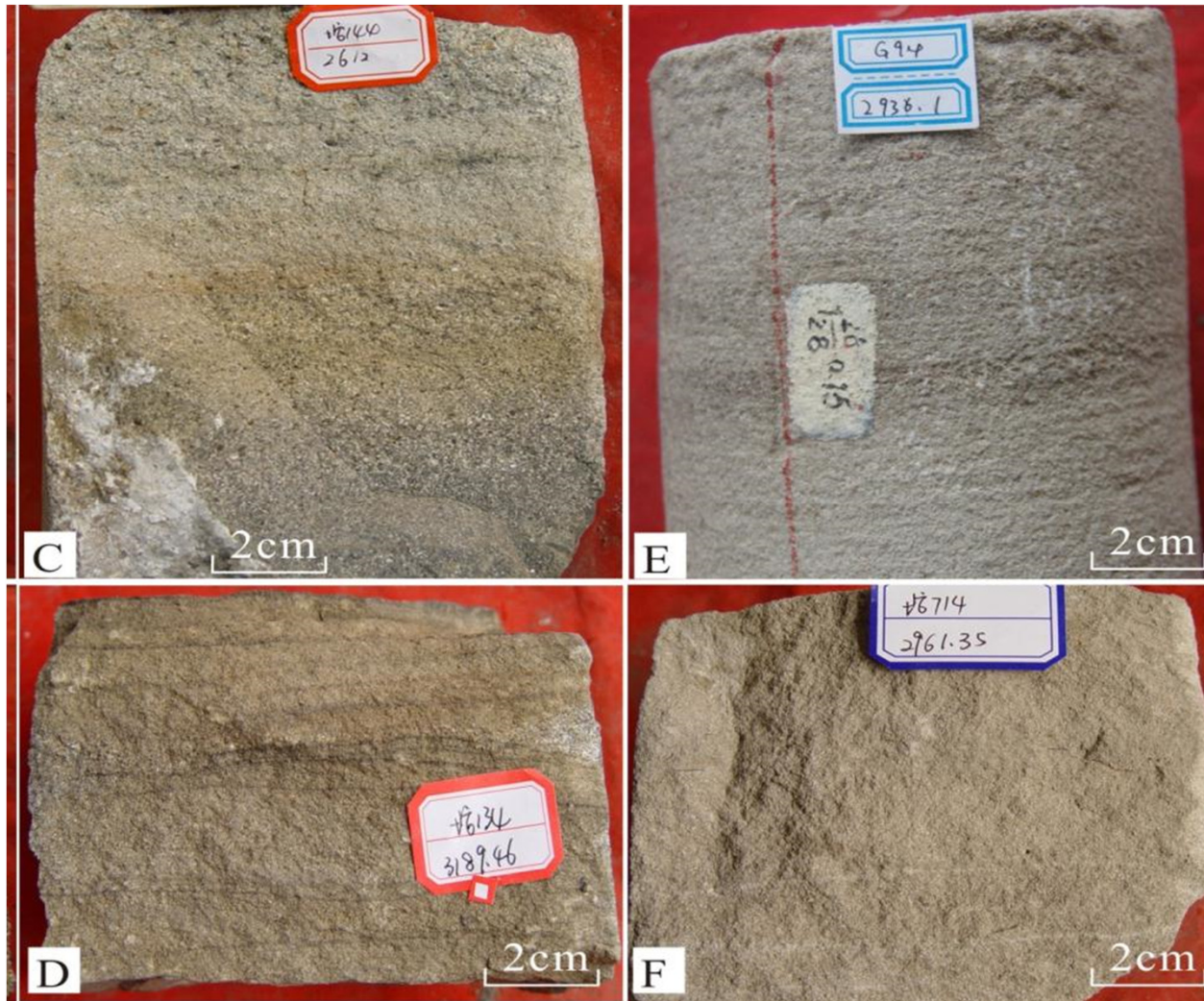
- Mineral assemblage A:** Feldspar pores + Authigenic clays + quartz cements ?
- Mineral assemblage B:** Feldspar pores ?

Nanpu Sag



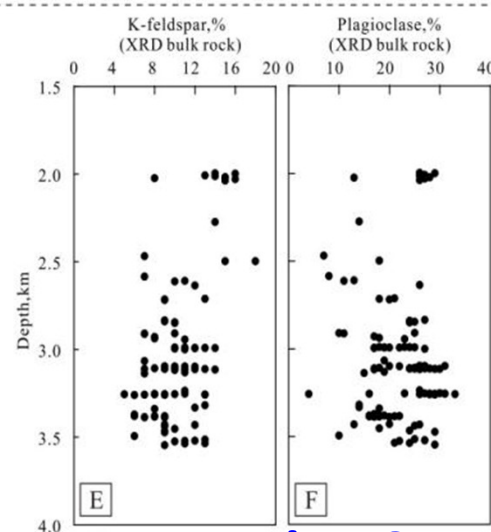
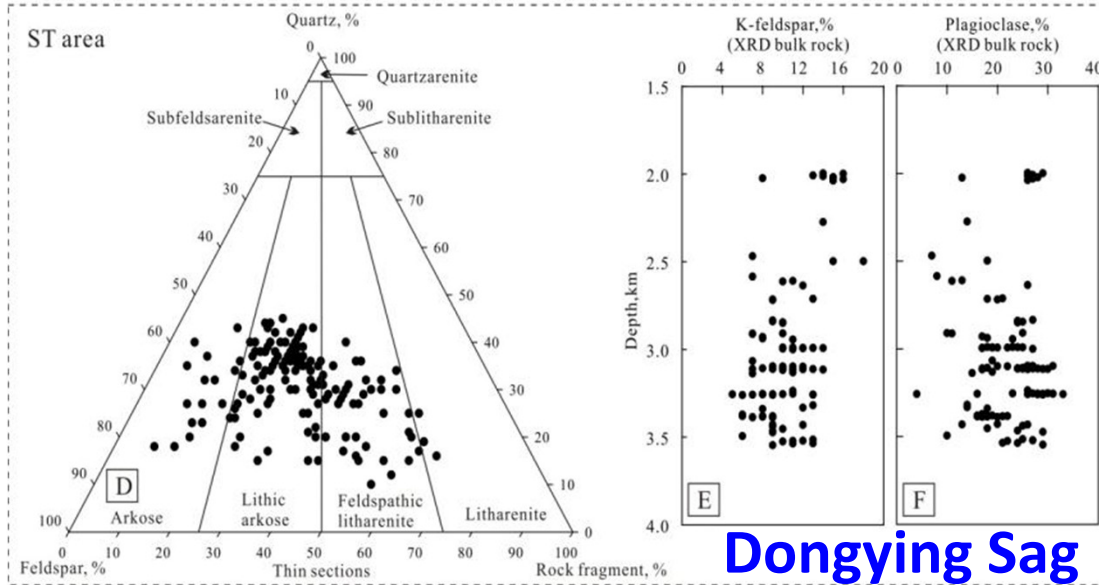
Developed faults — normal fluid pressure — low water salinity

Lithofacies

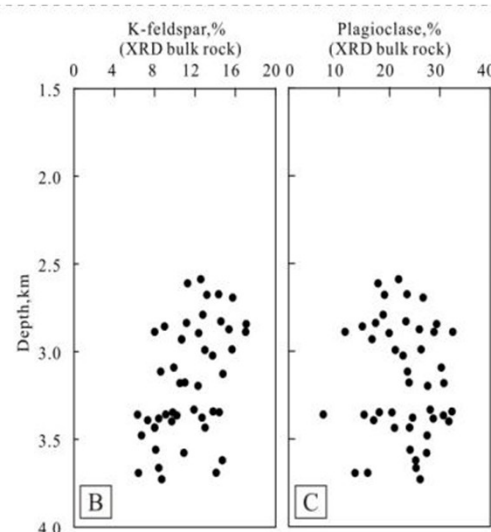
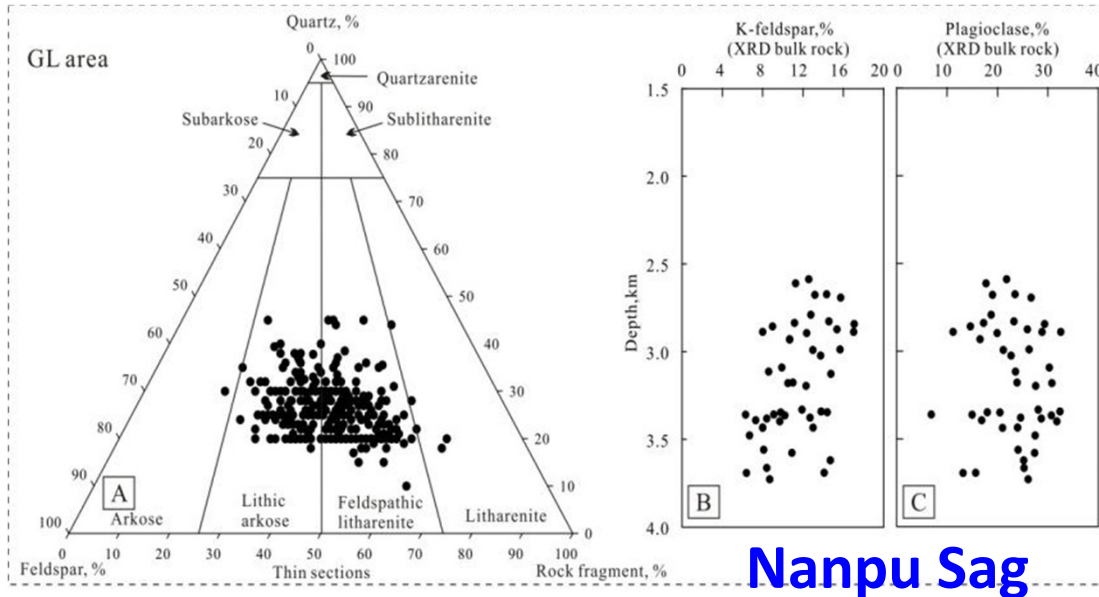


Medium- to coarse-grained sandstones

Detrital compositions

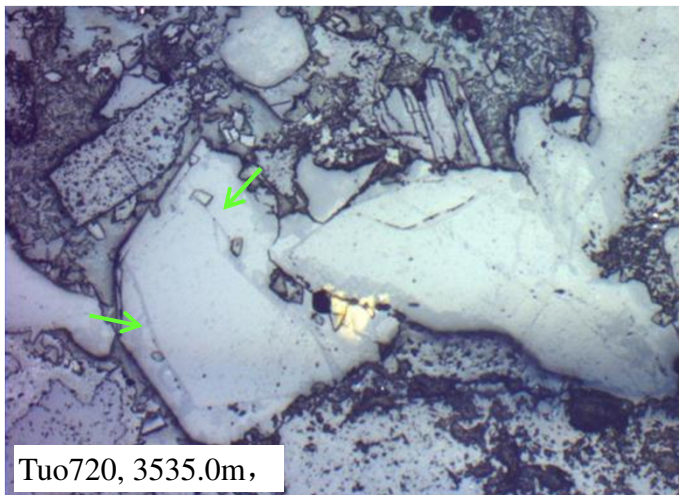
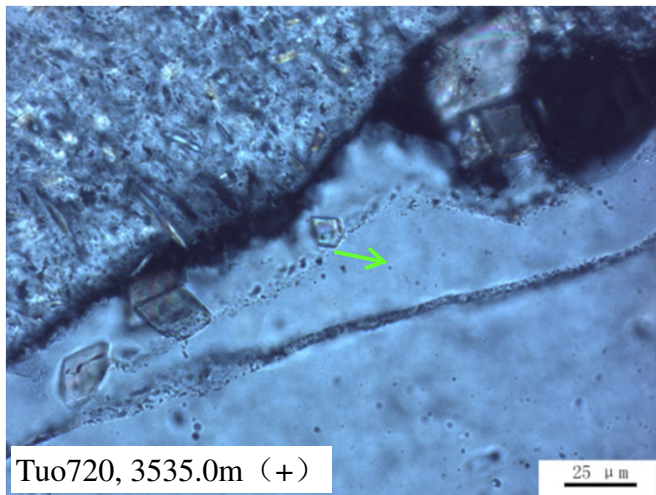
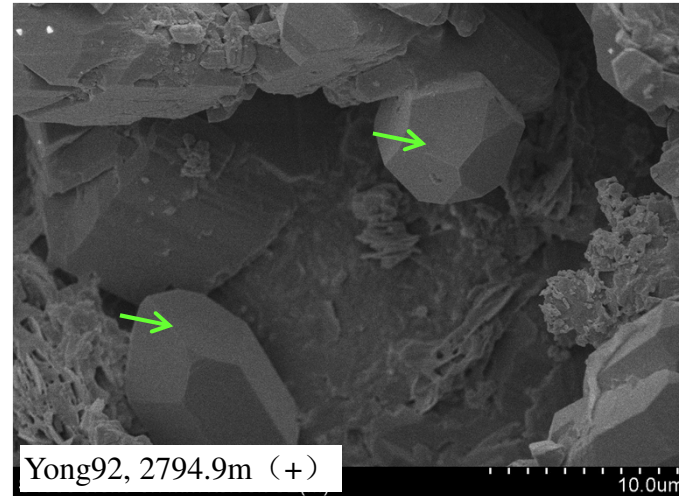
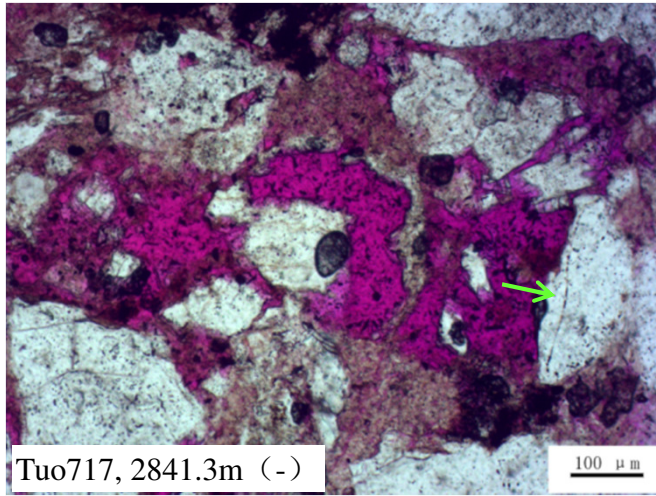


**lithic arkoses &
feldspathic litharenites**



Diagenesis: Quartz cements

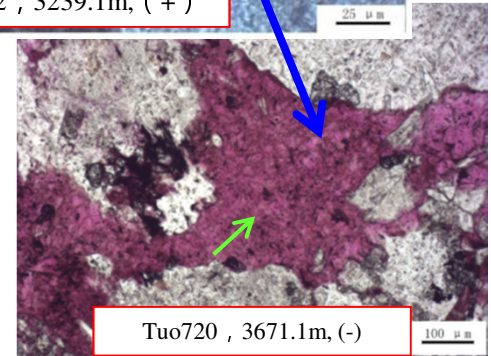
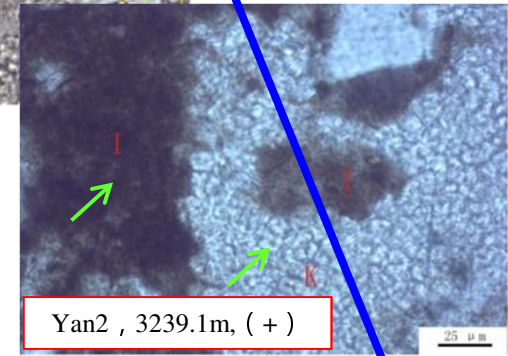
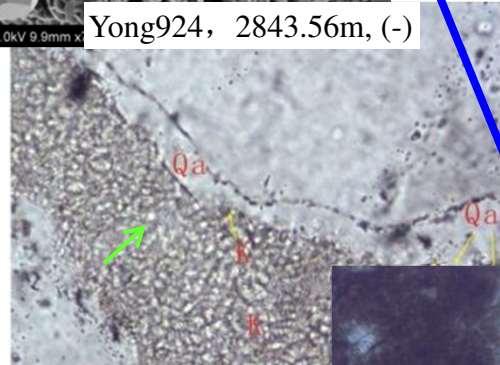
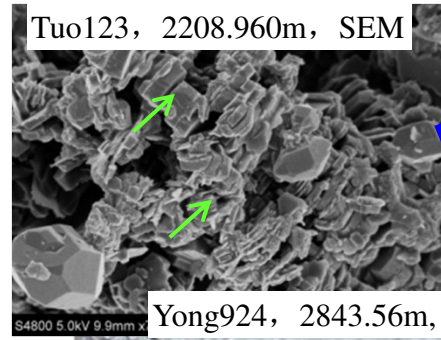
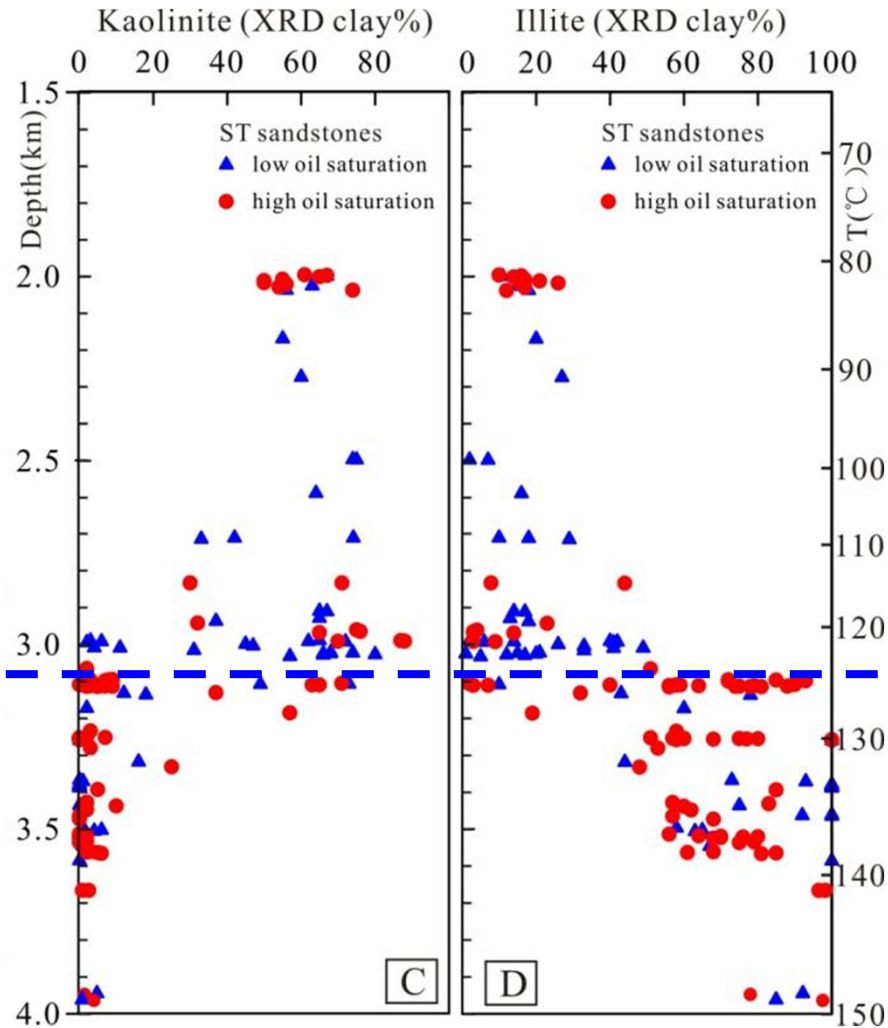
Dongying Sag



Quartz overgrowths + quartz crystals

Diagenesis: Authigenic clays

Dongying Sag



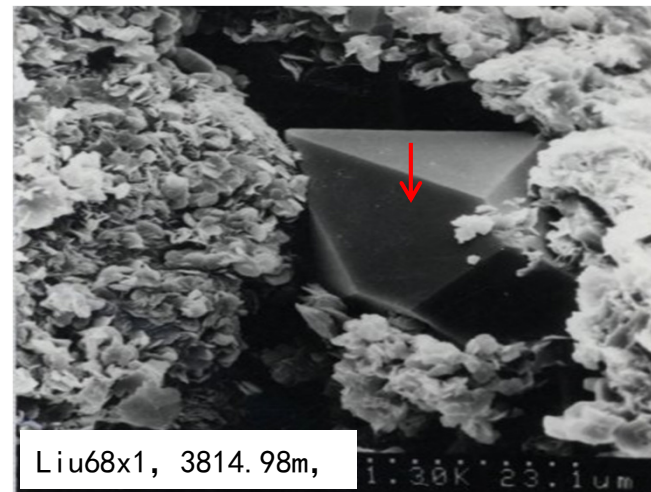
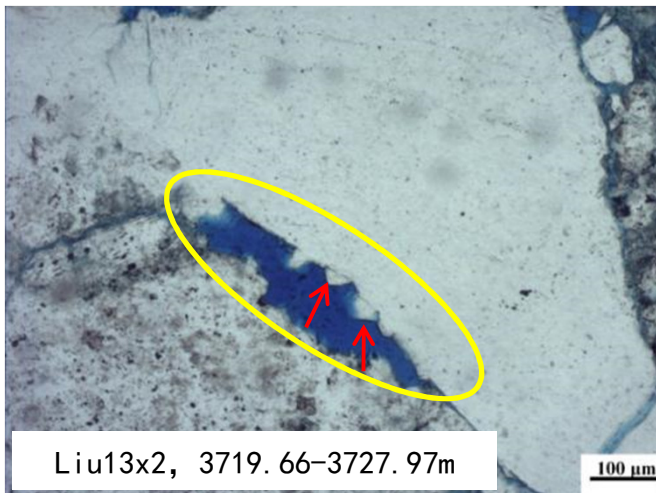
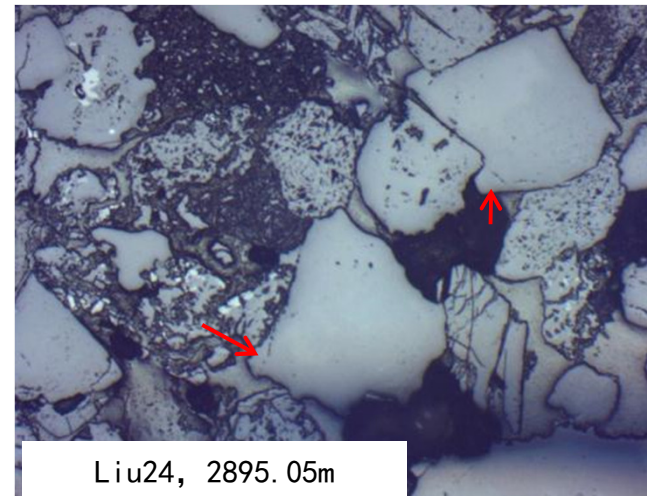
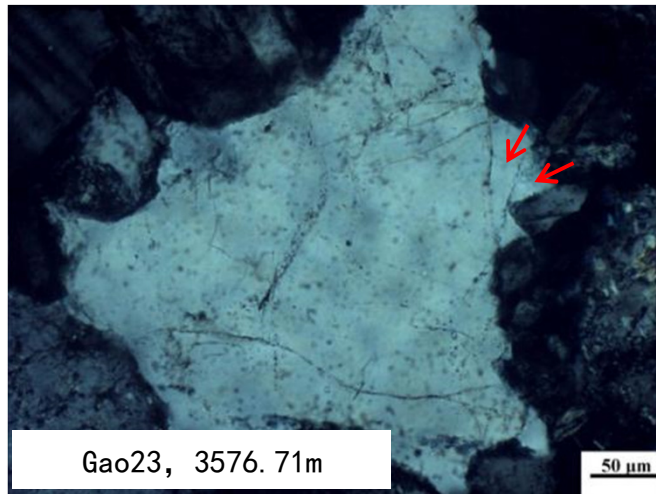
>125°C

2000-3100m(80-125°C): Quartz + kaolinite

3100-4000m(125-150°C): Quartz + illite

Diagenesis: Quartz cements

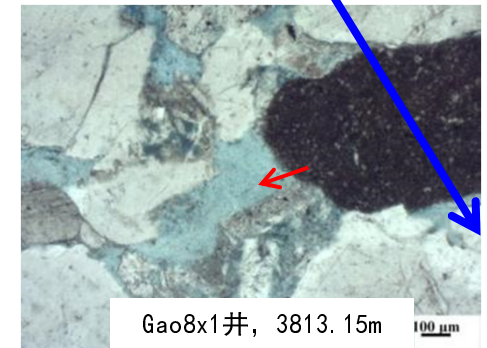
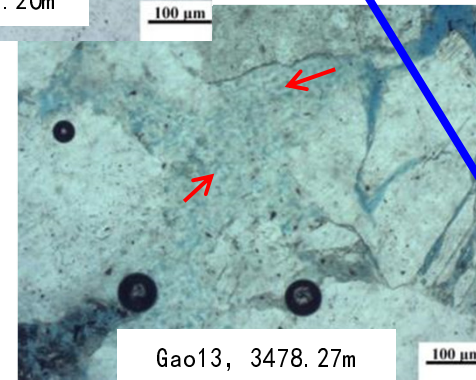
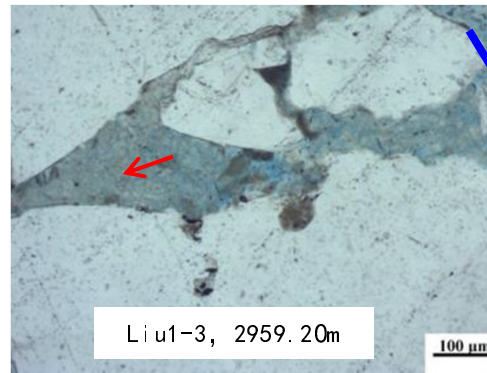
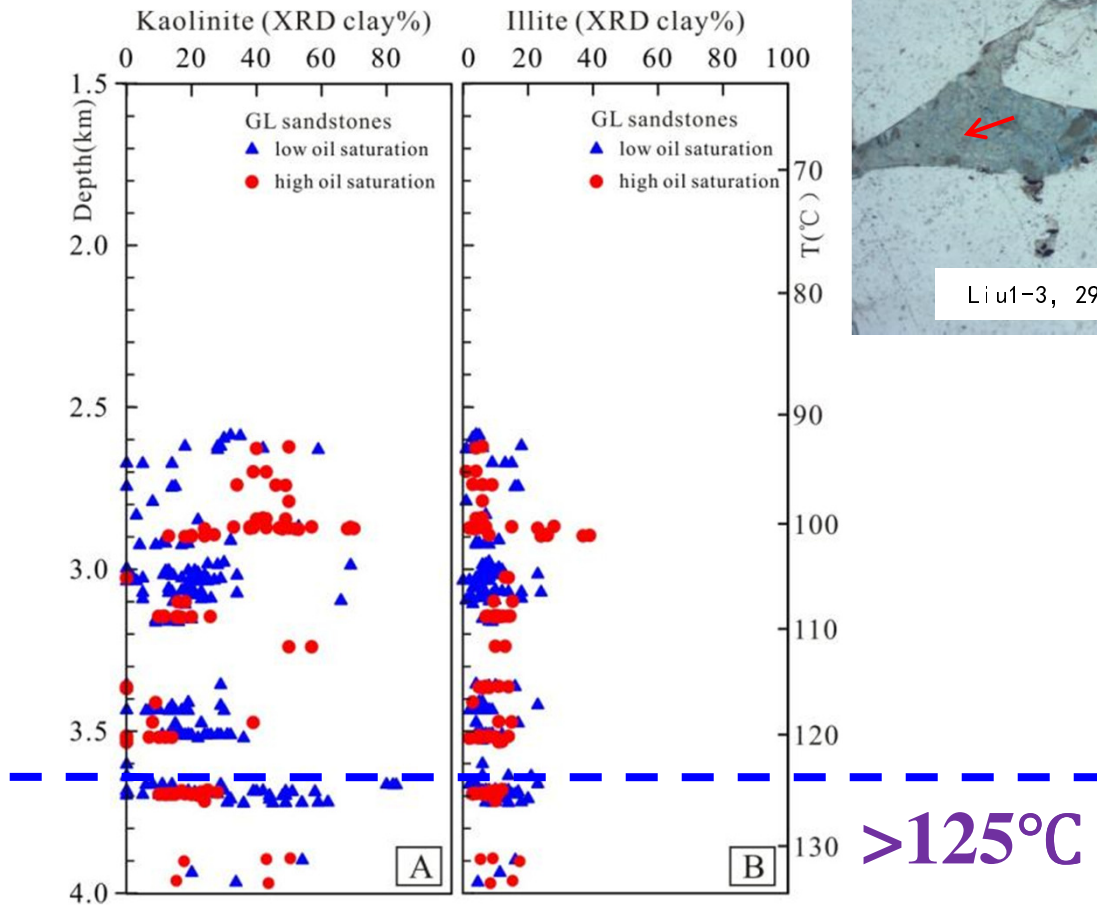
Nanpu Sag



Quartz overgrowths + quartz crystals

Diagenesis: Authigenic clays

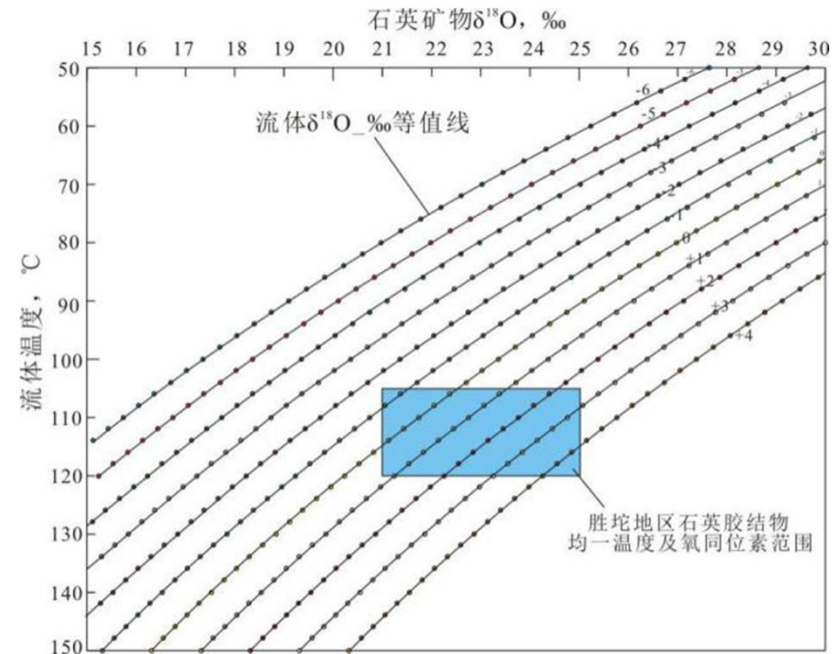
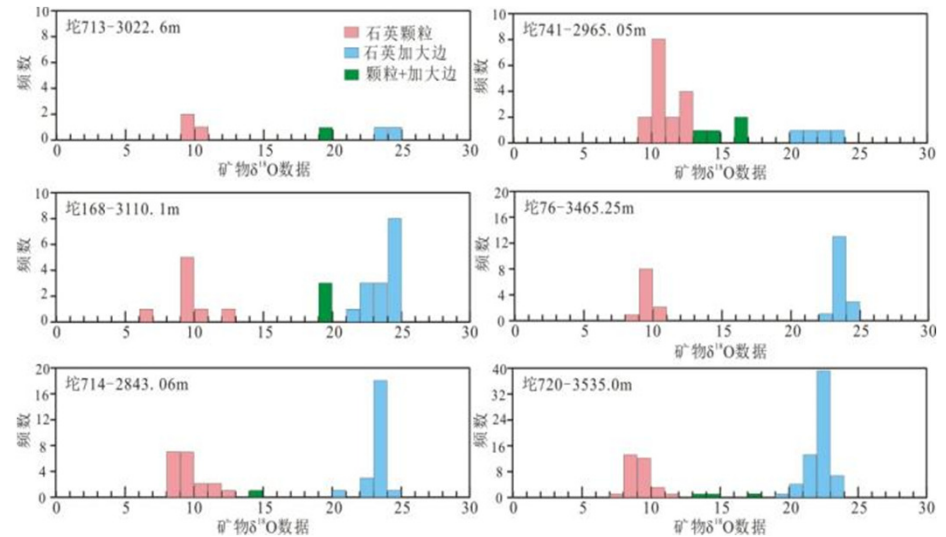
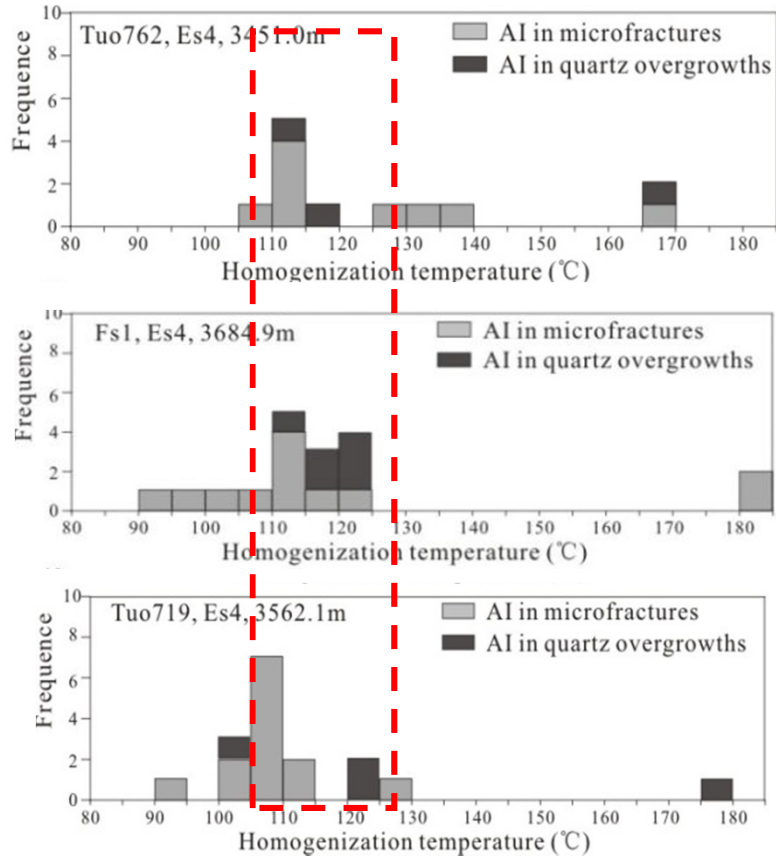
Nanpu Sag



2500-4000m(90-135°C): Quartz + kaolinite

Fluid inclusions & $\delta^{18}\text{O}$

Dongying Sag



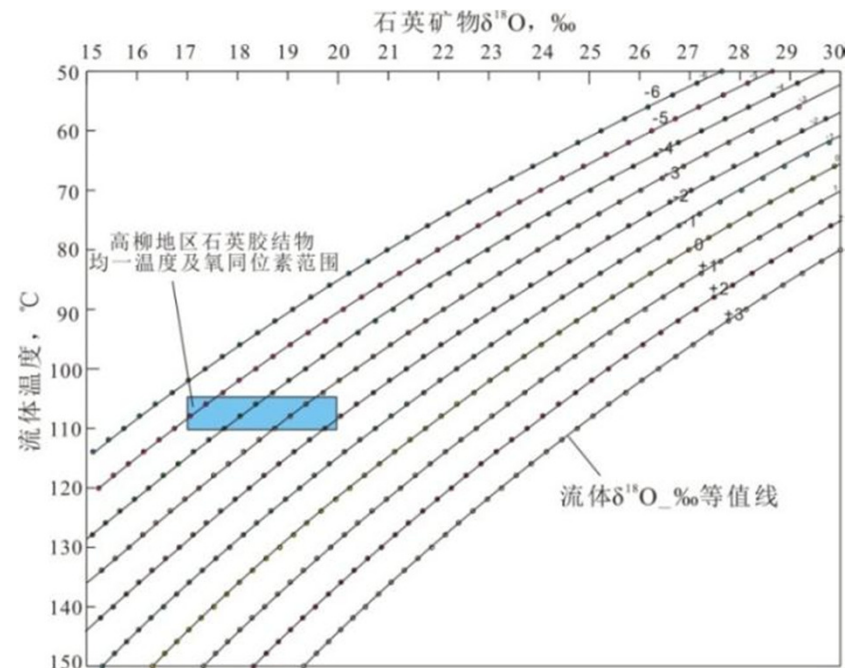
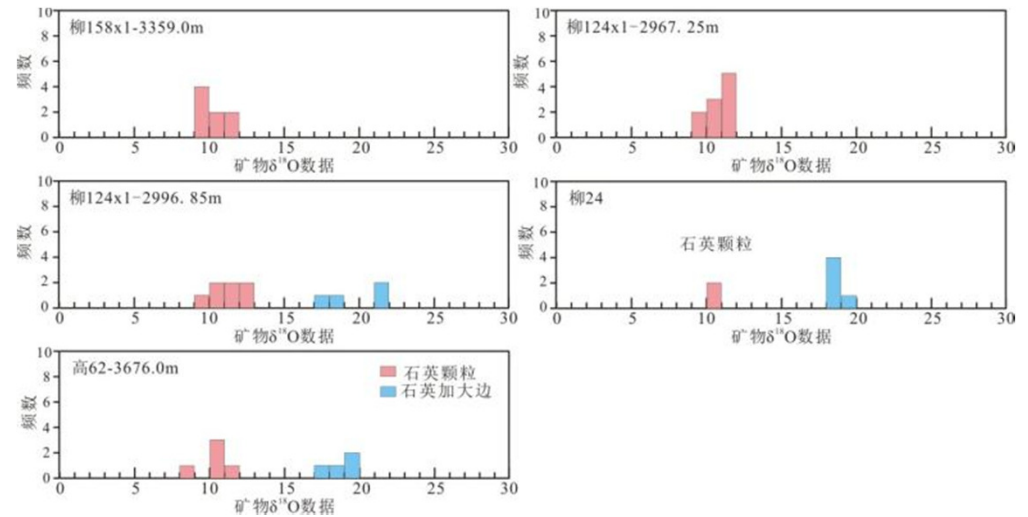
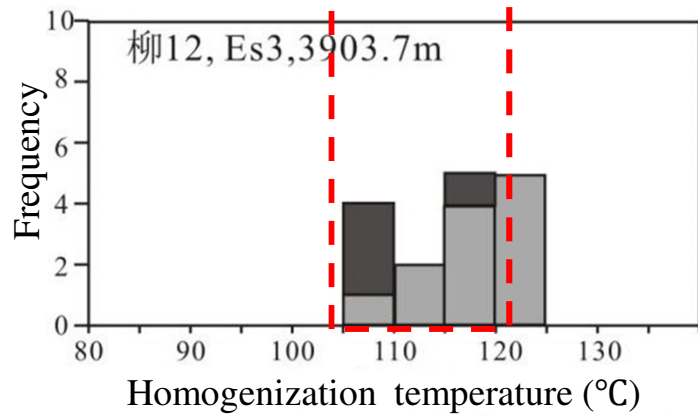
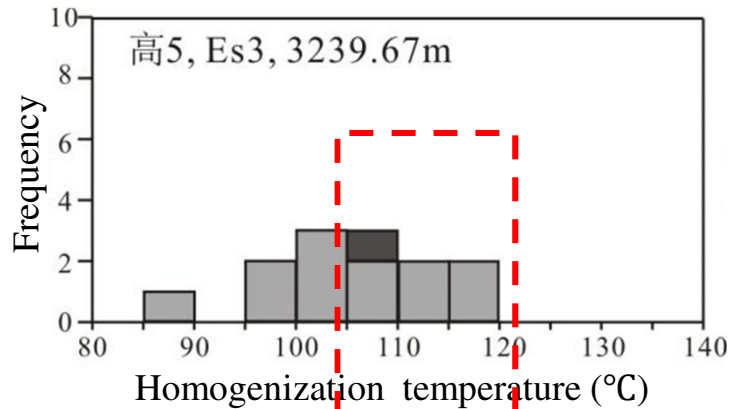
Th: 105 ~ 125°C

$\delta^{18}\text{O}$ -cement: 20 ~ 25‰

$\delta^{18}\text{O}$ -water: +1 ~ +4‰

Fluid inclusions & $\delta^{18}\text{O}$

Nanpu Sag

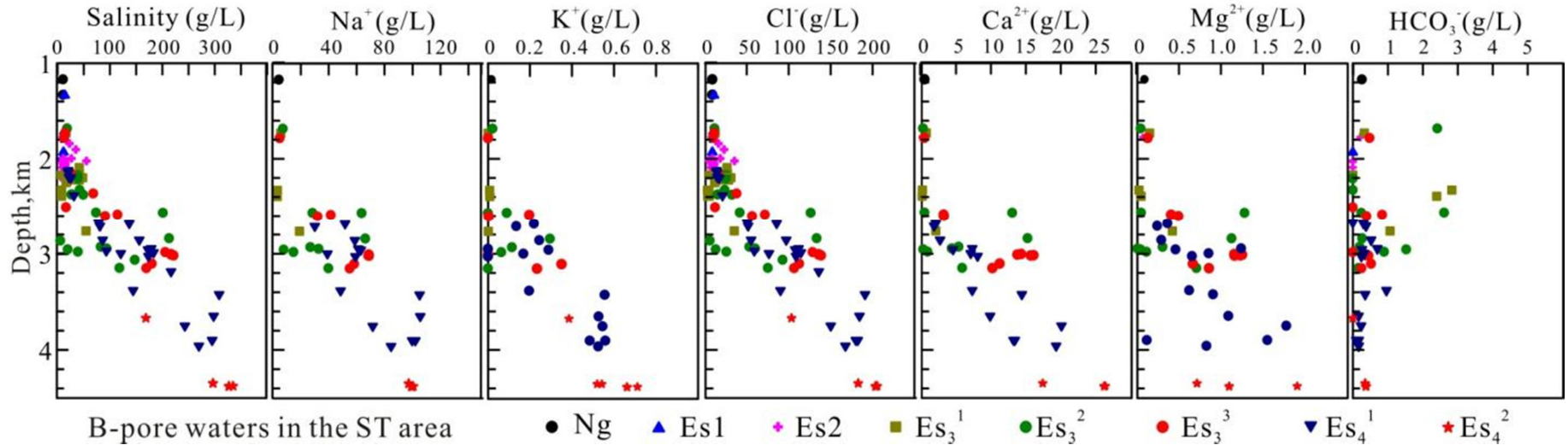


Th: 105 ~ 120°C

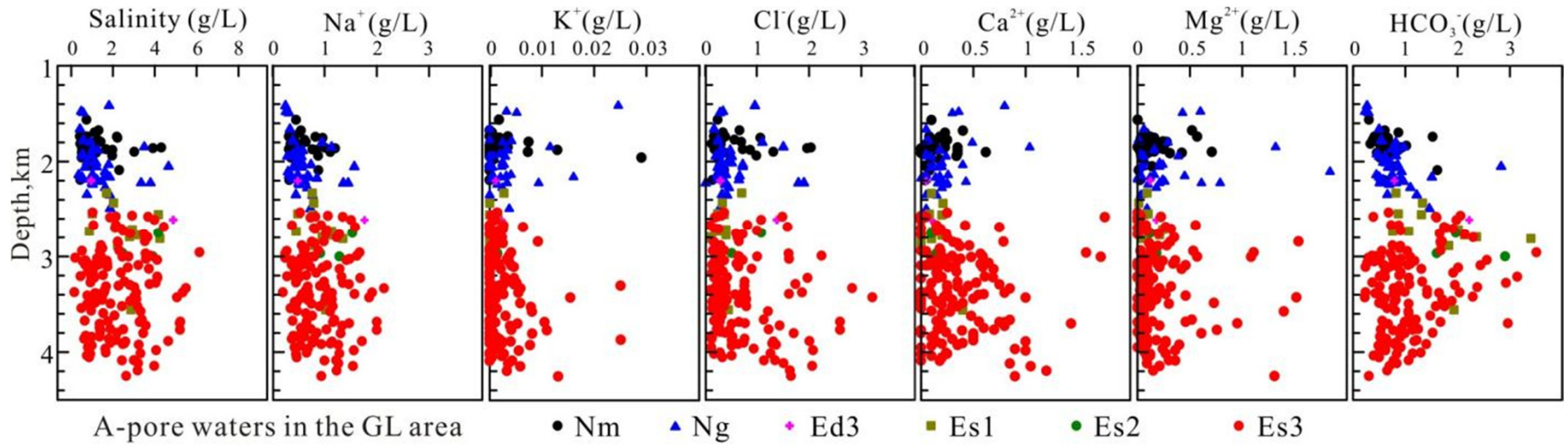
$\delta^{18}\text{O}$ -cement: 17 ~ 20‰

$\delta^{18}\text{O}$ -water: -5 ~ -2‰

Pore water chemistry



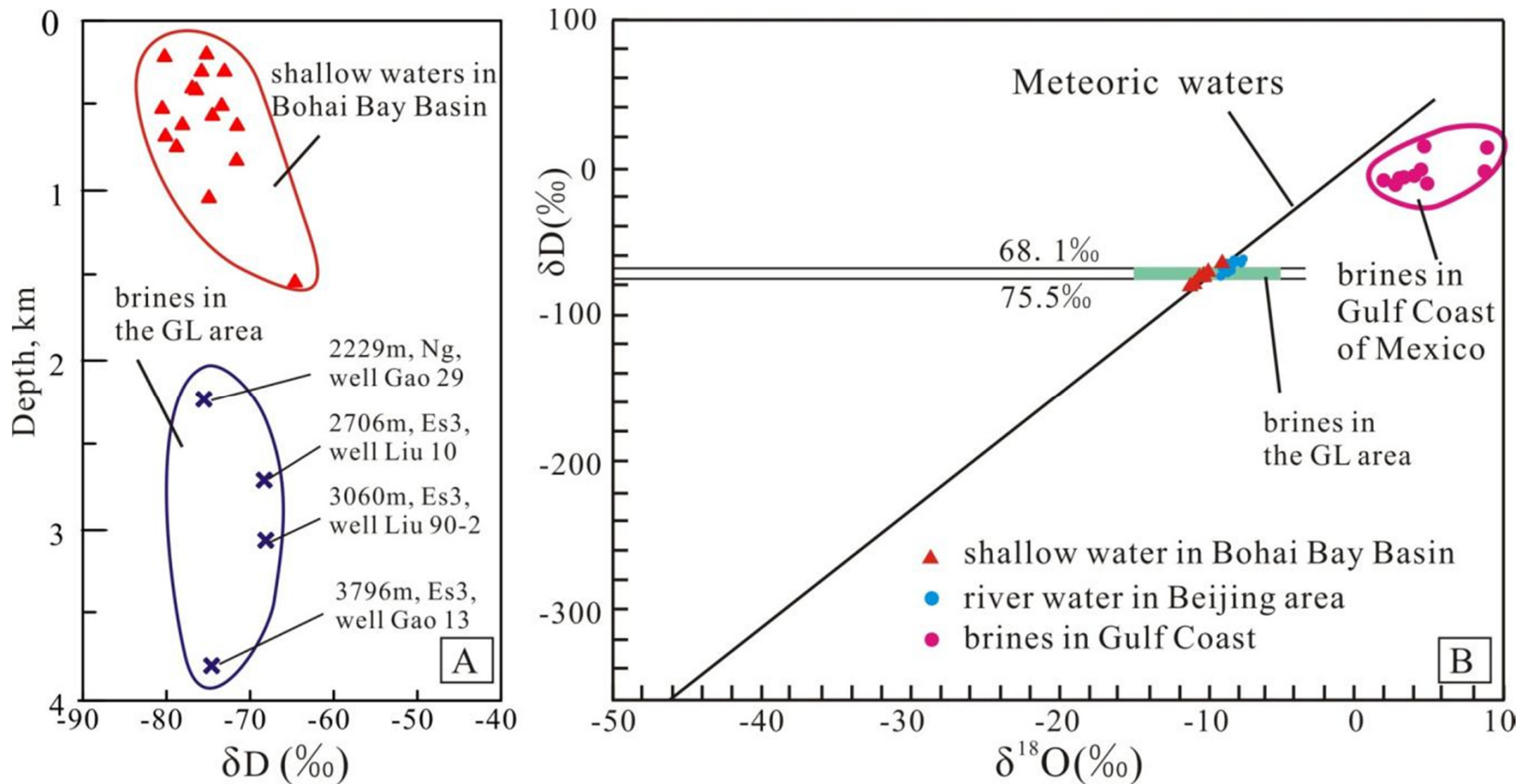
Dongying Sag: high salinity + high salinity gradient



Nanpu Sag: low salinity + low salinity gradient

Pore water chemistry

Nanpu Sag



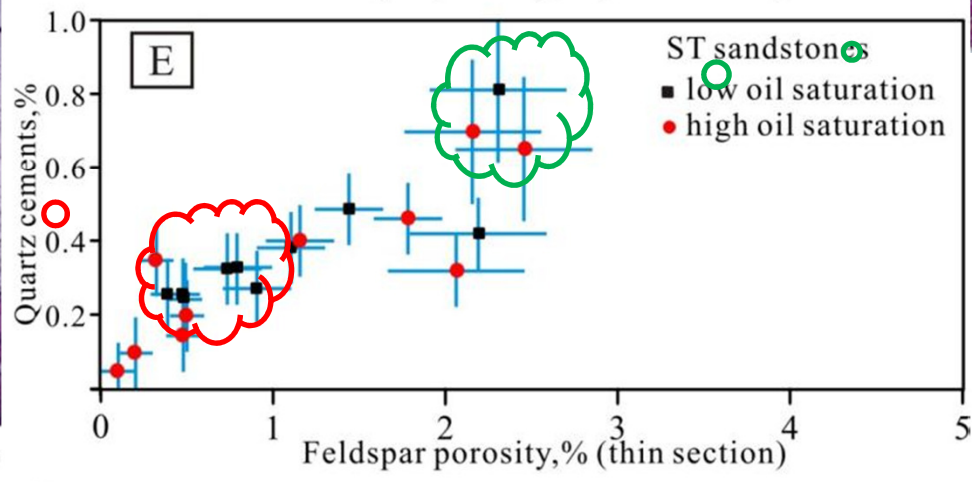
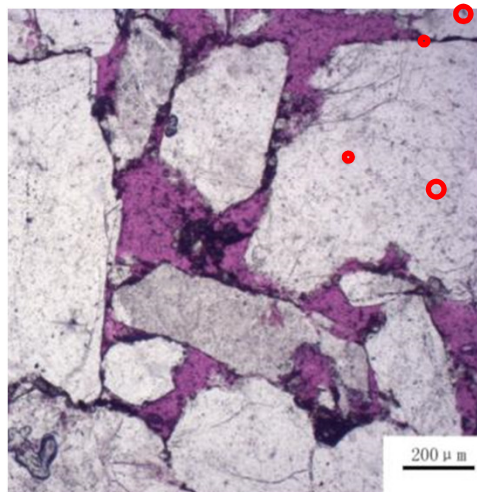
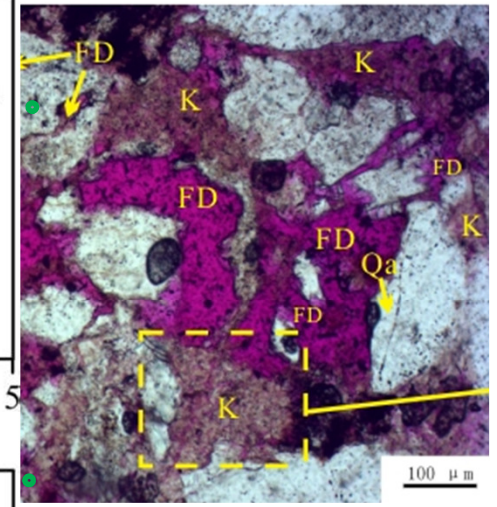
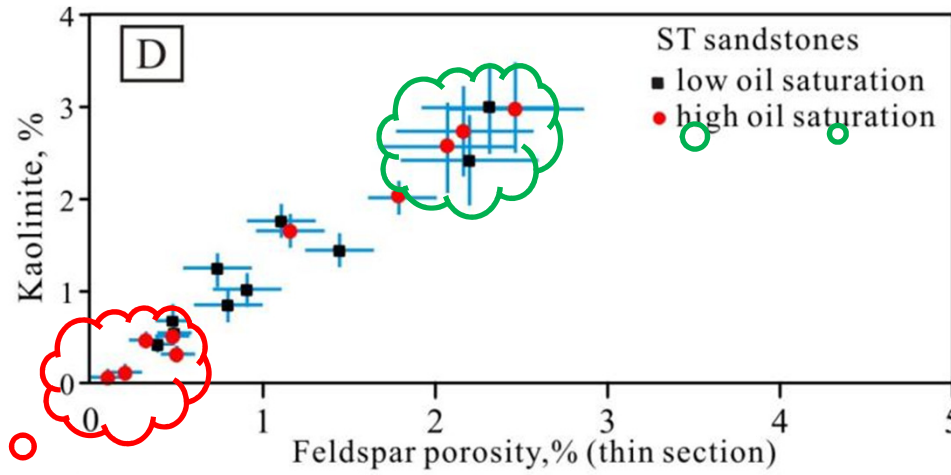
Negative δD

(1) little difference to shallow water or river water

(2) great difference to formation water without meteoric water flux

Mass transfer

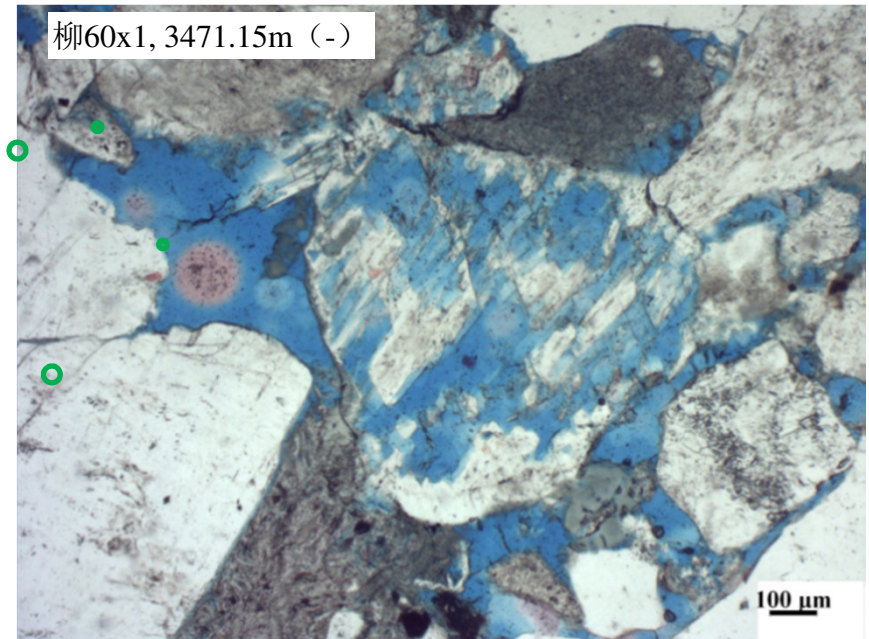
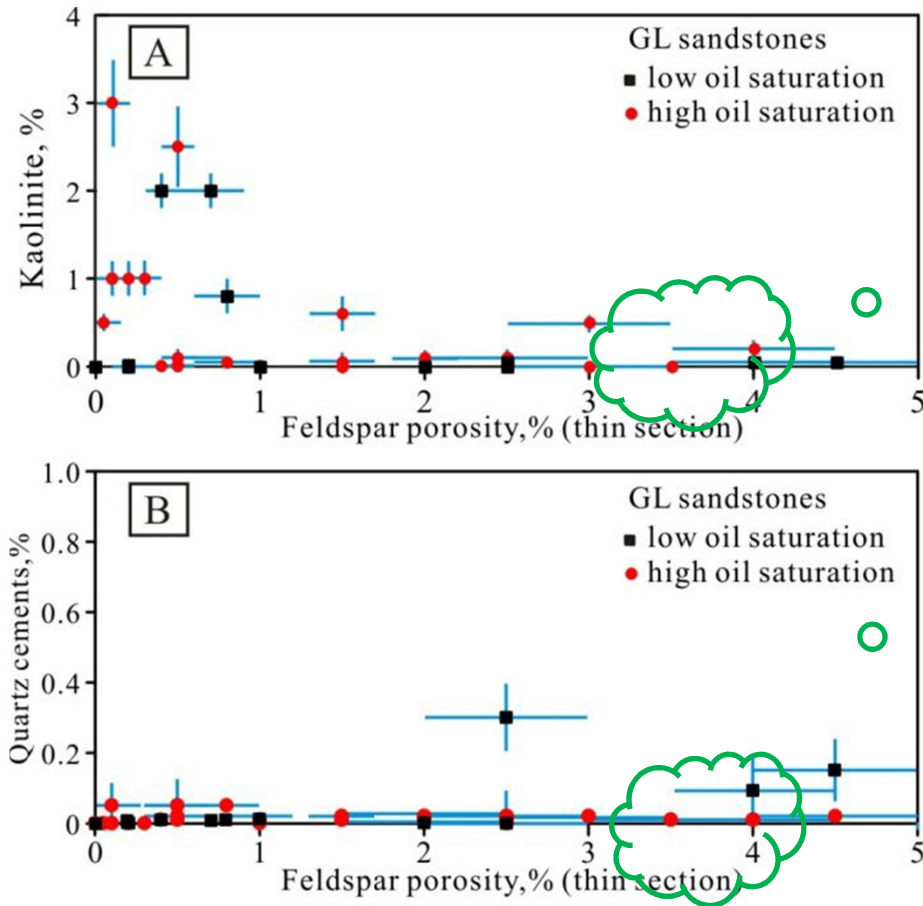
Dongying Sag



System on scale of **grains**: open to Al^{3+} and $SiO_2(aq)$
System on scale of **thin section**: closed to Al^{3+} and $SiO_2(aq)$

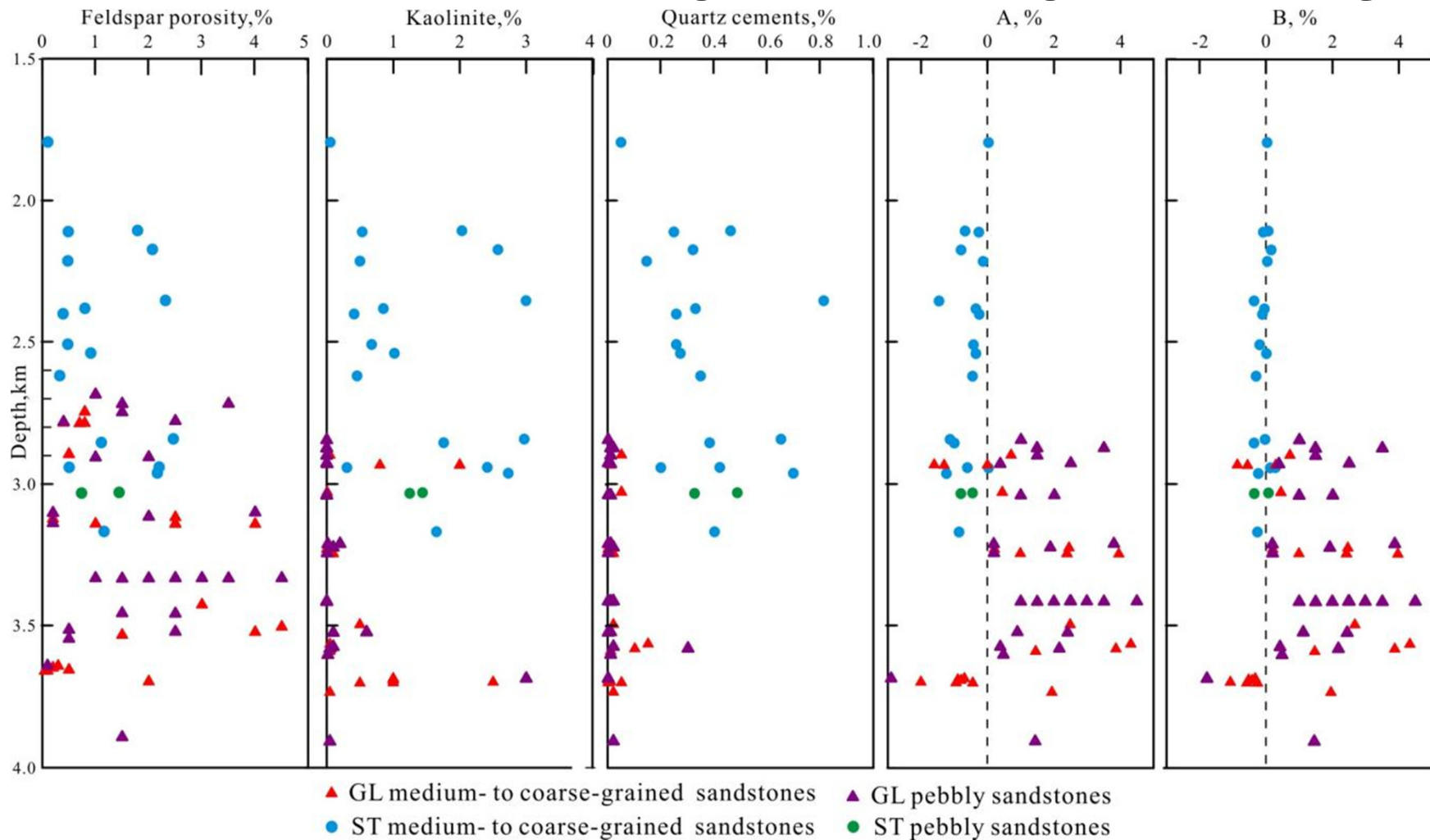
Mass transfer

Nanpu Sag



System on scale of **thin section – sandstone beds** :
open to Al^{3+} and $\text{SiO}_2(\text{aq})$

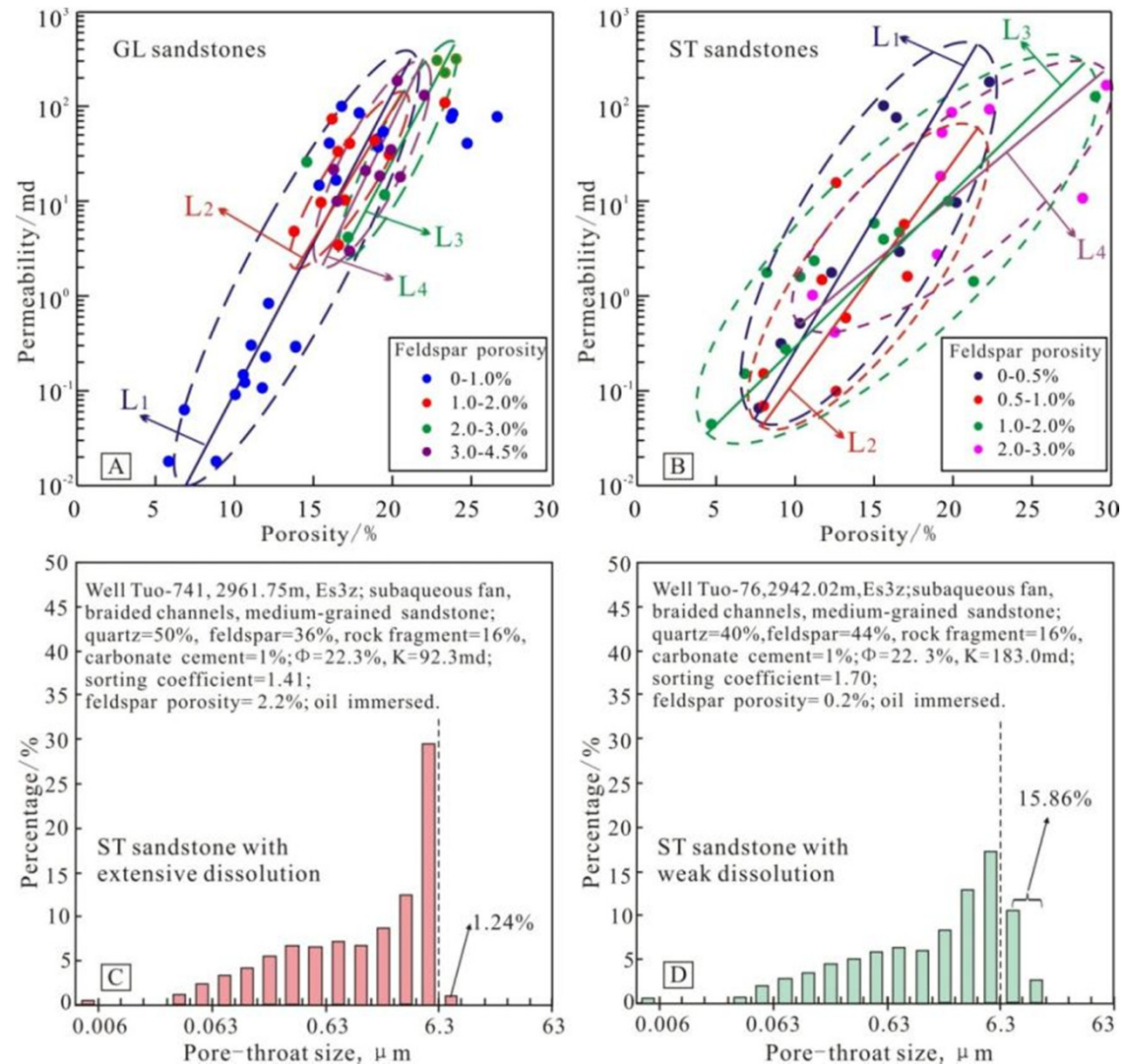
Dissolution's impact on porosity



Closed system: little impact on porosity

Open system: enhance significant porosity

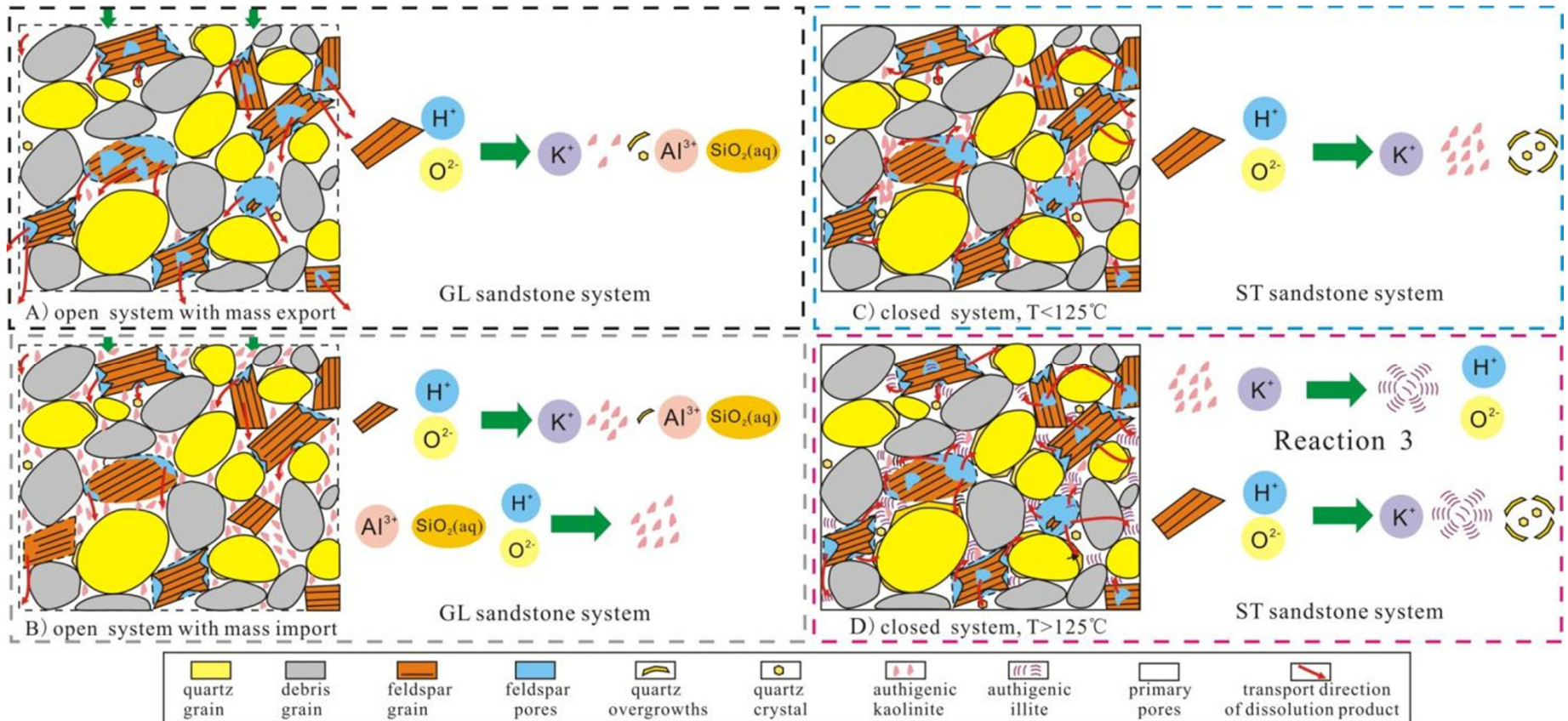
Dissolution's impact on permeability



Closed system: degrade permeability

Open system: enhance permeability

Redistribution models of byproducts



Closed system: feldspar dissolution \rightarrow secondary pores + in situ quartz + clays

Open system: feldspar dissolution \rightarrow secondary pores

Conclusions

1. Feldspar dissolution in Dongying Sag occurred in closed geochemical system with limited fractures, little meteoric water flux and high water salinity.
2. Feldspar dissolution in Nanpu sag occurred in open geochemical system with developed fractures, massive meteoric water flux and high water salinity.
3. Feldspar dissolution in closed geochemical system led to extensive in situ precipitation of authigenic quartz and clays, enhanced little porosity and degraded permeability;
4. feldspar dissolution in open geochemical system led to weak in situ precipitation of authigenic quartz and clays, enhanced much porosity and permeability.

Thanks a lot!

