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Geochemical compositions of Quaternary sediments in eastern China: implication for paleoenvironmental changes

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Fig. 1 Study area and drill holes

Cores are located in North China Plain (G3: 570m), the Huanghe Delta (DY: 560m) and the Changjiang Delta (PD: 320m)

Chemical weathering proxy indices for indicating paleoenvironmental change

CIA: Chemical Index of Variation (Nesbitt & Young, 1982)
$Al_2O_3/(Al_2O_3+CaO+Na_2O+K_2O)*100$

CIW: Chemical Index of Weathering (CIW: Harnois, 1988)
$Al_2O_3/(Al_2O_3+CaO+Na_2O)*100$
ACNK diagram

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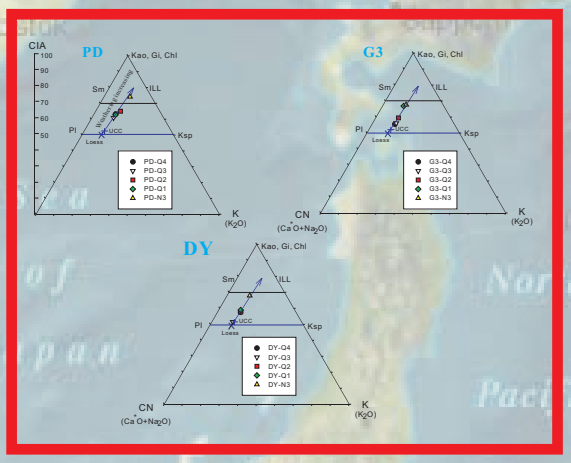
Ref. : S. Y. Yang et al., Paleo3, 2005
S. Y. Yang et al., Sedi. Geol., 2004

Fig. 2 ACNK diagrams of Cores PD, G3 and DY.

Note the similarity of chemical weathering between Cores G3 and DY and stronger chemical weathering signal in Core PD.



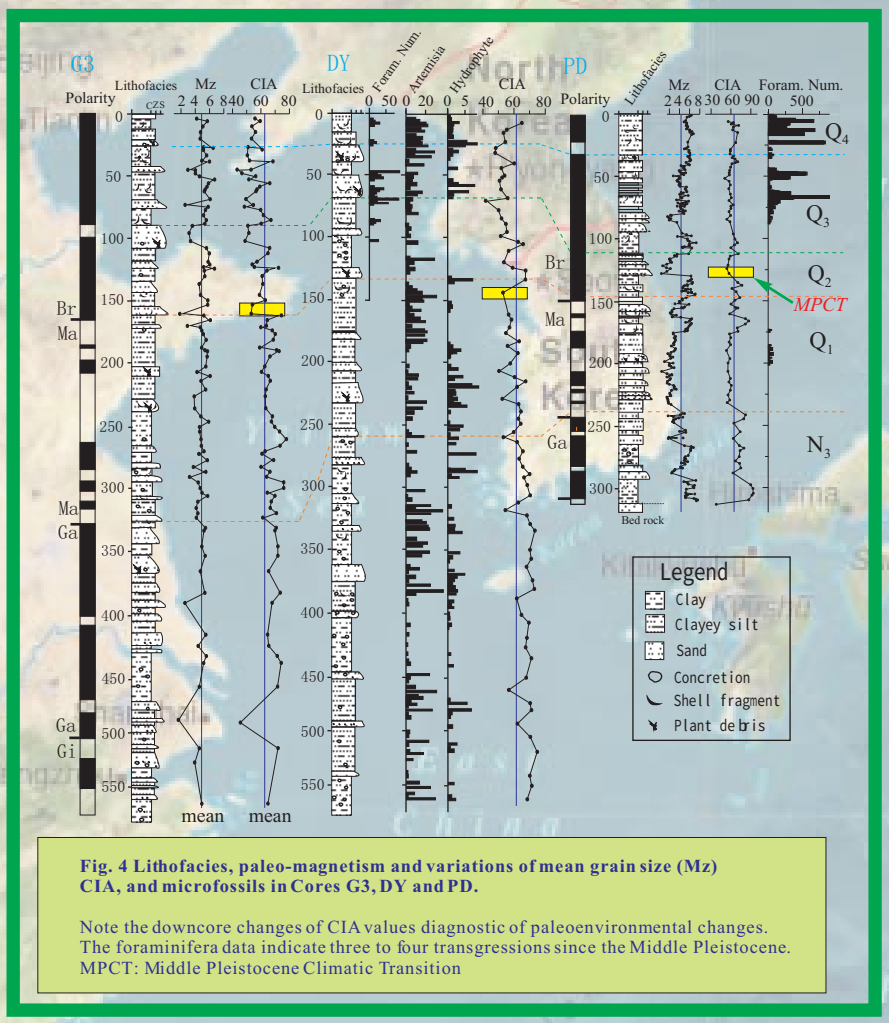


Fig. 4 Lithofacies, paleo-magnetism and variations of mean grain size (Mz) CIA, and microfossils in Cores G3, DY and PD.

Note the downcore changes of CIA values diagnostic of paleoenvironmental changes. The foraminifera data indicate three to four transgressions since the Middle Pleistocene. MPCT: Middle Pleistocene Climatic Transition

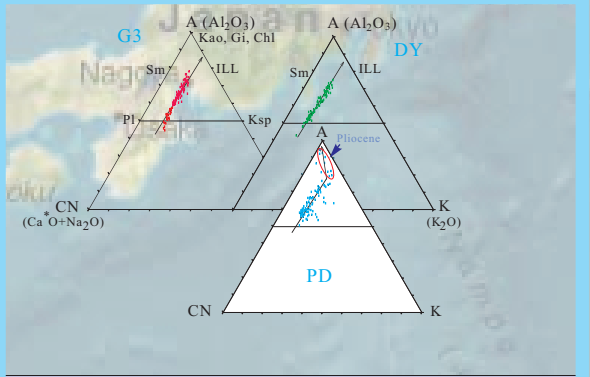
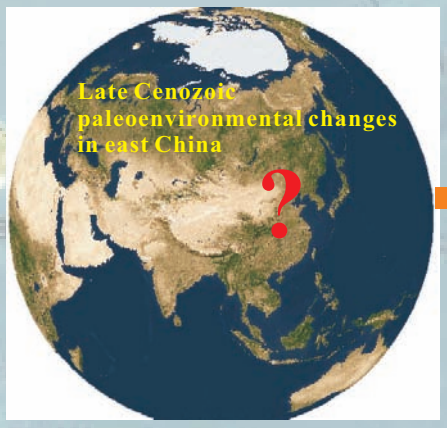


Fig. 3 ACNK diagrams showing chemical weathering trends of Cores PD, G3 and DY.

The chemical weathering trends of Cores G3and DY are very similar and expressed by the dissolution of Ca- and Na-bearing minerals whereas in Core PD the stronger chemical weathering is indicated by the dissolution of K-bearing minerals in the Pliocene sediments.



Conclusions

(1) Chemical weathering was strongest during the late Tertiary, but weakened during the Quaternary with some fluctuations. Carbonates were greatly weathered whereas silicates were less attacked.

(2) Paleo-environments did not change synchronously in eastern China since the late Tertiary. During the later Tertiary the paleo-climate was more humid and hotter in the Changjiang Valley than North China. During the Quaternary North China underwent more variable paleo-climatic changes.

(3) The abrupt decrease in weathering degree in eastern China during the early and middle Pleistocene is in agreement with the middle Pleistocene climate transition at about 0.86-0.45 myr (Hall et al., 2001).

(4) The results indicate difference in impacts of the East Asian paleomonsoon since the late Tertiary. During the late Cenozoic, the summer monsoon was stronger in southeast China than north China whereas the winter monsoon was to the contrary. This is consistent with the shift ways of the East Asian paleomonsoon in Quaternary (An, 2000; An et al., 2001).