C and O isotope Evolution of Carboniferous strata in Jiangsu and Anhui Provinces, China

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In this study $\delta^{13}C$ and $\delta^{18}O$ evolution curves have been obtained for the Carboniferous System (including Lower Carboniferous Jinling Formation (hereafter Fm), Gaolishan Fm, Hezhou Fm and Laohudong Fm, Upper Carboniferous Huanglong Fm and Chuanshan Fm in Jiangsu and Anhui provinces of South China. The Carboniferous $\delta^{13}C$ record can be divided into four stages. The positive $\delta^{13}C$ values occur in the lower Jinling Fm, lower Hezhou Fm, lower Huanglong Fm and Chuanshan Fm, which may have been caused by the increase in terrestrial plants and other organism, and organic carbon burial. The earlier three isotopic evolution stages are similar to those of the coeval Carboniferous strata in North America (Mii et al., 1999).

The C1 stage began with high positive $\delta^{13}C$ in the Jinling period with $\delta^{13}C$ values between +4.46‰ and +1.76‰, and then decreased evidently to negative values in the Gaolishan period. The high positive $\delta^{13}C$ values in the Jinling Fm is broadly comparable to the positive $\delta^{13}C$ excursion of the Tournaisian strata in North America and Western Europe. This is one of the known highest $\delta^{13}C$ values in the Phanerozoic which may imply global enhanced storage of organic carbon and low atmospheric CO_2 levels.

Stage C2 began with a 3‰ increase in $\delta^{13}C$ from the late Gaolishan period to the early Hezhou period (C1-C2 translation), and then during the late Hezhou and Laohudong periods the $\delta^{13}C$ decreased to negative values between -1.40‰ and –2.81‰ which were the lowest values in the Carboniferous. At the end of Stage C2, there was a positive $\delta^{13}C$ excursion (4.27‰) between the late Laohudong and early Huanglong periods (C2-C3 translation), then the $\delta^{13}C$ value sharply decrease to negative values in the late Huanglong period. During C3-C4 translation the $\delta^{13}C$ value evidently increased to positive values, then stayed in positive (+1.09‰ to +3.33‰) during stage C4.

The $\delta^{18}O$ record can also be classified into four stages, which is generally consistent with the $\delta^{13}C$ stages. Increase in carbonate $\delta^{18}O$ value may reflect cooling or glaciation, and negative excursion of $\delta^{18}O$ value is consistent with the warming or deglaciation period, which is correlated with sea level change. Meteoric fresh water's eluviation is responsible for some abrupt decrease in $\delta^{13}C$ and $\delta^{18}O$ values of carbonate formed in shallow tide environment.

Reference

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Meteoritic ^{44}Ti evidence for decrease in cosmic ray flux during the past two hundred years

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The activity of ^{44}Ti produced by galactic cosmic rays (GCR) in chondritic meteorites that fell during the past 150 years show a decreasing trend with time. Fifteen chondrites including Mooresfort (H5), the earliest fall (1810) available to us have been measured using a highly selective and specific gamma ray spectrometer consisting of large volume germanium detector and NaI(Tl) scintillator which count the 1157 KeV ^{44}Ti line in coincidence with its positron annihilation gamma rays. Since the ^{44}Ti activity is small (~5 dpm/kg Fe+Ni), the counting errors increase with terrestrial age of the meteorite. To improve the precision, data from two adjacent falls were combined. Corrections for shielding depths were made from the measured track density and ^{26}Al activity (Bonino et al., 2003). The profile shows that the activity level is generally higher than that expected from the sun spot number (R) dependent GCR flux and decreases with time. The profile is sensitive to the half life and we have used the latest value of 59.2 ±0.6 years.

This observation implies that the GCR intensity has decreased and consequently the heliospheric magnetic field in the interplanetary space has increased between 1810 to 1996. At the end of the Maunder minimum, the results suggest that the cosmic ray flux approached about 80% of the interstellar value. The increase is consistent with the flux expected from the long term evolution of the Sun's large scale open magnetic field (Solanki et al., 2000) which reproduces the doubling of the interplanetary field calculated on the basis of the <aa> geomagnetic index (Lockwood et al., 1999).

References

Bonino et al (2003) *Advances in Sp. Res.* (in press).
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