Sm/Nd ratio of the Earth

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The composition of Bulk Silicate Earth (BSE) provides an important "roadmap" understanding the thermal evolution, mass flow and the structure of Earth's mantle. Athough it has been known since 1960s that the BSE composition is overall not chondritic [1], it is assumed that the refractory elements in the Earth are present in chondritic proportions relative to each other [2], which is the basis of many models about the compositions of BSE and depleted mantle (DM) [e.g., 3].

The ^{147}Sm-^{143}Nd isotopic system has been used as a "backbone" to estimate the compositions of BSE and DM. This is because both Sm and Nd are refractory elements, and all chondrites have essentially the same Sm/Nd ratio (within ±2%) [e.g., 2, 4]. BSE is assumed to have chondritic Sm/Nd and ^{143}Nd/^{144}Nd ratios. However, this assumption is challenged by recent ^{142}Nd studies [4, 5]. Specifically, Boyet and Carlson [4] reported ~20 ppm ^{142}Nd/^{144}Nd difference between Earth and ordinary chondrites. Although this difference could be of nucleosynthetic origin [6, 7], it has also been attributed to either early silicate differentiation of a chondritic Earth, occurred within 30 Myrs after the Earth's formation [4], or to a superchondritic BSE, which has a Sm/Nd ratio 6% higher than the chondritic value [5].

Here we re-examine published data, and found that:

1. There is ~50 ppm ^{142}Nd/^{144}Nd variation in chondrites, and it is correlated with nucleosynthetic anomalies in ^{135}Ba, ^{144}Sm and ^{148}Nd. Consequently, the 20 ppm ^{142}Nd/^{144}Nd difference between Earth and ordinary chondrites must reflect nucleosynthetic origin;
2. Possible nebular processes are unable to significantly fractionate Sm/Nd ratio; consequently, it is unlikely that the Earth accreted from a nebular reservoir with a superchondritic Sm/Nd ratio;
3. Our analyses of the ^{147}Sm-^{143}Nd isotopic systematics of continental crust and DM suggest that BSE, or the accessible portion of BSE under the "hidden reservoir" hypothesis, has a near-chondritic Sm/Nd ratio.

[1] Wasserburg *et al* (1964) *Science*. [2] Jacobsen and Wasserburg (1984) *Earth Planet Sci Lett*. [3] McDonough and Sun (1995) *Chem Geol*. [4] Boyet and Carlson (2005) *Science*. [5] Caro *et al* (2008) *Nature*. [6] Ranen and Jacobsen (2006) *Science*. [7] Andreasen and Sharma (2006) *Science*.

Studies on the characteristics and mechanism of a heavy haze episode in Jiangsu Province, China

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Autumn is one of the periods that poor air quality frequently occurs in Jiangsu [1]. In this study, the characteristics and mechanism of a regional haze episode were investigated in late October 2012 over Jiangsu. The analysis was conducted with the observational concentrations of air pollutants (PM_{10}, $PM_{2.5}$, and CO) in 13 cities, visibility data in 5 cities, meteorological elements (relative humidity, wind speed, air temperature, precipitation in surface, upper air soundings, and synoptic situation), fire locations from FIRMS, and trajectories from the numerical models of HYSPLIT. The northern cities suffered more heavily with the highest hourly PM_{10}, $PM_{2.5}$, CO, ratio of $PM_{2.5}$ to PM_{10} exceeding 0.50mg/m^3, 0.45mg/m^3, 3.5mg/m^3, and 0.9, respectively. The lowest hourly visibility was below 5km in the 5 cities. Backward trajectories accompanied with fire spots exhibited that pollutants from large areas of biomass burning during the harvest season mixed with local anthropogenic emissions contributed to this event. The degradation of air quality in northern cities was mainly caused by emissions from biomass burning, while the southern cities were affected by the mixed emissions. Synoptic condition was another factor, especially calm and weak wind, and relatively high temperature before rainfall.

[1] Deng *et al* (2011) *Atmos. Res.* **101**, 681-691.

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