The Re-Os isotope geochemistry of the Raobazhai Ultramafic Complex of North Dabieshan, Central China

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The Raobazhai ultramafic complex, located geographically in Huo shan County, Anhui Province and tectonically in the collision-orogenic zone between the North China and Yangzi cratons, is the largest of the high- and ultrahigh pressure ultramafic and mafic rock belts of north Dabieshan. It is composed of upper and lower bodies separated by 300m, based on drill cores. 15 samples were collected from 5 drill cores located along the main section of the rock body, which strikes from northwest to southeast and extends down to 650m in depth.

The Raobazhai ultramafic rocks are composed predominantly of harzburgite and subordinately of dunite and lherzolite which are all serpentinized to various extents. The Al_2O_3, CaO, SiO_2, TiO_2 and Na_2O whole-rock contents of the peridotites are all inversely correlated with MgO, which varies from 37.50 to 47.00 wt%. The major element trends from fertile lherzolite to highly depleted harzburgite and dunite are consistent with those expected for the residues of mantle partial melting. Primitive mantle normalized whole-rock REE patterns are U-shaped, showing MREE depletion relative to LREE and even to HREE to various extents. HREE (e.g. Yb or Lu etc.) contents are correlated with major elements (e.g. Al_2O_3, CaO and MgO etc.). LREE enrichment indicates that the Raobazhai peridotites experienced cryptic and/or modal mantle metasomatism after mantle melting, concordant with the existence of various amounts of hydrated phases (pargasite and phlogopite) in the rocks.

The $^{187}Os/^{188}Os$ ratios of 15 drill hole samples of Raobazhai peridotites range from 0.117 to 0.130, while the Os concentrations range from 0.548 to 3.533 ppb. Re concentrations range from 0.004 to 0.570 ppb. No correlation exists between $^{187}Os/^{188}Os$ and $^{187}Re/^{188}Os$ which implies that the Re-Os isotopic system was disturbed by mantle metasomatism and/or serpentinization. $^{187}Os/^{188}Os$ ratios are strongly correlated with Al_2O_3 and Yb contents. This allows a formation age of 1.6 or 1.9 Ga of the progenitor of Raobazhai ultramafic rocks to be deduced by comparison with the Os isotopic evolution curve of the convecting mantle. Os isotopic compositions provide a means of seeing through metasomatism or/and serpentinization in Raobazhai ultramafic rocks. Raobazhai peridotites are a part of the subcontinental lithospheric mantle which was tectonically emplaced into relatively young crust during exhumation of metamorphic subducted surpercrustal rocks.

Monitoring of atmospheric CO at Mt. Waliguan, China

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Site and experiment

Carbon Monoxide (CO) plays an important role in the chemistry of the troposphere. CO is short lived, its global distribution varied with space and time. An automatic RGA system was established and quasi-continuous measurement started since 1997 at Waliguan (36°17'N, 100°54'E, 3816m a.s.l.), to provide long-term and accurate mixing ratios of atmospheric CO in the remote plateau of western China. Monthly mean time series, average seasonal cycle, annual means and growth rates during 1991-2002 were discussed by the cooperative flask air sampling records (1 pair/week, analyzed by NOAA/CMDL, USA).

Results and discussions

CO standards 50-300ppbv in clean dry air are used to determine the quadratic calibration curves, and to calculate ambient CO mixing ratios based on peak height responses. Detection limit 1ppb, precision 0.1% and accuracy within 0.05% under the setting conditions.

High correlation of the two independent data sets (in-situ vs flask) suggests good quality of both measurements. temporal variability of CO, black carbon aerosol, CH_4 and CO_2 episodes over period of in-situ measurements showed similar even on time scales of less than a day, reflected synoptic events and local sources.

During 1991-2002, ambient CO monthly means mostly in 80-180ppbv. Annual means had a slightly increase, growth rates within 20ppbv. Detrended average seasonal cycle showed a peak-to-peak amplitude 45ppbv, with maximum in early spring and minimum in late autumn, reflected seasonal differences and effects of air mass transport probobly caused by CO temporal imbalance of its sources and sinks.

Conclusions

Observational records at Waliguan can provide atmospheric CO characteristics in the Asian inland, and be used in other studies to improve understanding of atmospheric chemistry processes and climatic change.

References

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