Open tube combustion method of organic samples for stable carbon isotope analysis

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A simple and effective conversion method of organic carbon into carbon dioxide for analysis of stable carbon isotopes ($\delta^{13}C$) in samples of solid and liquid substances and sedimentary rocks is presented. The conversion of organic carbon of the samples is carried out in a quartz reactor connected to a vacuum line for CO_2 freezing and purification. A solid organic sample mixed with CuO is placed at the reactor bottom and the reactor is subsequently filled up with a granular CuO. One end of the CuO column is preheated up to 850°C while the other end of the column in contact with the sample is kept at ambient temperature. Then, heating of the sample (850°C) and remainder of the column is performed. The preheated part of the column provides the efficient conversion of carbon into CO_2. The reactor for conversion of volatile organic carbon compounds is filled in with a granular CuO. The column of CuO is heated to 850°C. Volatile liquid organic samples are introduced into the reactor through a septum using a micro syringe. Complete conversion is 10 minutes for solid samples and 3 minutes for volatile liquids. Precision of $\delta^{13}C$ analysis for solid and volatile liquid organic substances is ±0.1‰ and ±0.04‰ respectively.

The method presents an alternative to the well established sealed tube methods for combustion of organic material (Buchanan and Corcoran, 1959, Sofer, 1980)

The procedure of preparing the samples for combustion is simplified owing to the use of open tubes instead of sealed ampoules. The repeated use of reactors reduces considerably the consumption of expensive materials. Simultaneous use of several reactors enhances the economical aspects of the method. The method of carbon conversion demonstrates a high accuracy of $\delta^{13}C$ analysis for solids and liquids. Validity of results is confirmed by the comparison with data obtained by the universally recognized sealed tube combustion method and analysis of international standards reference materials.

References

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Sulfide mobility during melt percolation: Implications for PGE and Os isotopes from the Oman ophiolite

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This study is focused on the origin of Os isotope heterogeneity in the Oman ophiolite in the context of melt percolation and sulfide mobility. Basically, two different sulfide populations occur: (1) *Residual peridotites* contain pentlandite (Pn) and chalcopyrite (Cp). Cp occurs either as thin lamellae or at the margin of Pn. In subgroup 1a, the grain sizes of the rare sulfides range from 10-60 µm. They are associated with opx as spherical inclusions, or they are located at triple junctions of olivines. Sulfides of subgroup 1b occur typically as interstitial, subhedral or anhedral grains with curvilinear boundaries. The grains sizes frequently range from 100 to 400 µm and they are closely associated with spinel and/or cpx, suggesting precipitation from an immiscible sulfide melt. (2) *Non-residual peridotites and pyroxenitic dikes*: The relative abundance of sulfides strongly increases from the residual group to the non-residual group. The primary sulfide assemblage is composed of massive pyrrhotite + Cp + Pn. Large sulfide grains (up to 700 µm) are attached to coarse grained, subhedral cpx and/or spinel. The 1a type residual peridotites have very depleted trace element abundances (e.g. Yb_N (cpx) ~ 1.1; Ti_N (cpx) ~ 0.3), $(Pd/Ir)_N$ ratios of < 1 and low $^{187}Os/^{188}Os$ ratios ($^{187}Os/^{188}Os_{(t = 90Ma)}$ = 0.1149 and 0.1169). The unradiogenic Os compositions yield Re depletion ages of ~ 2 Ga. Type 1b residual peridotites have chondritic to suprachondritic Os isotopic ratios ($^{187}Os/^{188}Os_{(t = 90Ma)}$ = 0.1234 to 0.1318) and $(Pd/Ir)_N$ ~ 1 to 2. Samples from the non-residual group have suprachondritic Os isotopic ratios ($^{187}Os/^{188}Os_{(t = 90Ma)}$ = 0.1367 to 0.1675). The PGE and REE abundances of pyroxenitic dikes (Os = 0.13 ng/g; Pd = 6ng/g; $(Pd/Ir)_N$ = 40.4) resemble those of mantle-derived melts. The PGE and REE distribution patterns of the non-residual peridotites are similar to or transitional between those of the residual peridotites and the pyroxenites. In a $^{187}Os/^{188}Os_{t=0}$ vs 1/Os diagram the radiogenic samples define a mixing line having a depleted mantle and radiogenic pyroxenitic dykes as end members. It is suggested that the initial PGE and Os isotopic composition of the Oman mantle has been locally chemically overprinted by percolating melts, dissolving and re-precipitating sulfide liquids. In regions of high melting degrees and/or high melt/rock ratios, the initial PGE budget and Os isotope composition of a mantle rock may be completely replaced by sulfides derived from an Os radiogenic source.