Three decades of Hf isotope research

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Following early experiments with the Lu-Hf system in the 1950's to 1970's, we established routine chemistry and TIMS measurement in 1980. TIMS Hf measurement is a "brute force" technique, involving use of a Re ionizing filament at the limit of its range. Practitioners can testify to the strain that high filament temperatures and high Re ion beams place on the ion source and collectors of the mass spectrometer. Nevertheless in this period many of the important areas of Lu-Hf isotopic studies were identified and developed. These included meteorites, crust-mantle differentiation, and the use of dated zircons to determine initial Hf isotopic signatures.

The advent of MC-ICPMS allowed analysis of up to 100 times less Hf, so that samples like chondrites and komatiites became truly accessible. High precision was obtained on small rare meteorites, and oceanic tholeiites could be analyzed in large numbers. ICP techniques also allowed a reduction of chemistry and much more rapid mass spectrometry. Somewhat intricate and/or empirical corrections needed to obtain accurate Lu and Hf data in ICP measurement are manageable. The large database now existing shows that Hf isotopic data do mirror patterns from Nd in many cases, but that Hf has considerable importance where behavior differs from Nd. Examples are oceanic sedimentation and mantle partitioning, particularly in higher-pressure mineral phases.

It seems inevitable that one of the main future applications of Hf will be in determination of initial $^{176}Hf/^{177}Hf$ in zircons U-Pb dated by laser MC-ICPMS. The initial Hf data are powerful in discriminating crustal sources, and the opportunity to acquire hundreds of Hf values is tempting. However, non-specialists often do not realize that 10 to 40% of the 176 mass signal has to be subtracted to remove Yb and Lu and arrive at the abundance of ^{176}Hf. This is an enormous correction when epsilon-unit (i.e. 0.01%) variations of $^{176}Hf/^{177}Hf$ are the target. Intricate and empirical correction procedures are needed to account for differences in mass fractionation behavior of Yb, Lu and Hf, as well as the Er sometimes employed, and the accuracy of the 10-40% interference correction is critically dependent on these. Parallel analysis of zircon Hf by solution ICP has been employed in some critical studies, but this may not be practical for groups who measure large numbers of zircons, particularly detrital zircons. Probably, many who will measure and present laser Hf data for zircon will not be even partly specialized in isotope geochemistry. We must place a high priority on establishing robust, globally-agreed standards and procedures for laser Hf analysis of zircons.

Monitoring of atmospheric particulate matter around Raipur Central India

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The concentration, variations and sources of air borne carbonaceous particulate matters: volatile organic carbons (VOC_{10}, $VOC_{10-2.5}$ and $VOC_{2.5}$) nonvolatile organic carbns (OC_{10}, $OC_{10-2.5}$ and $OC_{2.5}$) and black carbons (BC_{10}, $BC_{10-2.5}$, and $BC_{2.5}$) in most polluted area of chhattisgarh Raipur have been studied for one year, June 2005-May 2006. The $PM_{2.5}$ and PM_{10} samples were collected on pre-heated quartz fiber filters with the Partisol model 2300 Sequential Speciation Sampler (Rupprecht & Patashnick Co., Inc., USA) simultaneously. The combustion method equipped with the non-dispersive infrared detector (NDIR) is used for measurement of the volatile organic carbon (VOC), nonvolatile organic carbon (OC) and elemental carbon (EC) in the terms of CO_2.. The annual mass concentration of PM_{10}, $PM_{10-2.5}$, and $PM_{2.5}$ was ranged from 62 – 975,17-602 and 20 – 373 $\mu g\ m^{-3}$ with arithmetic mean, median and STD values of 242, 139 and103; 222, 129 and 100; and ± 164.6,100.2 and 73.4 $\mu g\ m^{-3}$, respectively. The annual mass concentration of their carbons i.e. VOC_{10}, $VOC_{10-2.5}$, $VOC_{2.5}$ and OC_{10} ,$OC_{10-2.5}$ and $OC_{2.5}$; and EC_{10}, $BC_{10-2.5}$ and $BC_{2.5}$ was ranged 2.1 – 47.9, 1.6 – 32.2, 4.1 – 80.2; 10.3-160 and 0.1 – 35.0, and1.6 – 23.1 and 2.6 – 65 and 4.6-123 $\mu g\ m^{-3}$ with arithmetic mean, median and STD values of 10.4, 12.3, 26.1, 48.8, 6.9, 7.9, 19.1, and 33.9, 6.7, 11.8, 25.6, 40.9, 5.0, 7.8, 17.2,and 30.7; and 9.8. 7.4, 16.5, 32.1, 7.4, 5.5, 14.0, and 25.6 respectively.

Keywords*:* particulate matters, carbonaceous particulate, Partisol model 2300 sequential speciation Sampler