Trace element analysis by multiple gamma ray detection method

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Experimental Procedure

We have developed a new analytical method of NAAMG by combining INAA and multiple gamma ray detection method. The multiple gamma ray detection method is widely used in the field of the nuclear physics. The advantages of NAAMG are non necessity of chemical separation, low detection limit, and simultaneous determination of multiple elements. In this method, two or more sets of gamma ray detectors detect simultaneously emitted gamma rays. By analyzing the two dimensional gamma ray peak, the resolution can be raised by leaps and bounds and the simultaneous multi-element analysis becomes possible without chemical separation. A pair of gamma rays which is in coincidence can be used for analysis. Iridium forms three strong peaks on the two dimensional gamma ray spectrum. Since the gamma ray peak at 317-468keV is the most prominent, it is used for analysis.

The meteorite impact is one of the most probable hypotheses as the ultimate or motive case for the mass extinction on F/F boundary which occurred about three hundred and seventy million years ago. Participation of the meteorite in this mass extinction may be verified using NAAMG for determination of Iridium and other Pt group elements in rock samples from South China.

Results and Discussion

Fifteen nuclides were detected in rock sample analysis using NAAMG. Among these detected nuclides the contents of Ir, Co and Se are higher in the condrite than in the earth's crust. Anomaly of about 1000ppt of Ir was seen in LD-31 sample from South China. The detection limit of Ir was estimated about 2 ppt. An apparent of anomaly in LD-31 is also observed for Se and Th. It can occur in rocks of certain stages of magmatic evolution or in the sedimentary record under special sedimentation condition. Although discussion on different depositional mechanisms that can lead to anomalous Ir concentration in sedimentary rocks is beyond the scope of this paper, the trace elements pattern of different rocks such as peridotite, basalt, condrite and syenite(intrusive igneous rock) is helpful for the interpretation of higher level concentration of Ir in the specific horizon.

References

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Measurements of atmospheric O_2/N_2 ratio from two monitoring stations in Japan and shipboard sampling in the western and northern Pacific region

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Atmospheric O_2/N_2 ratio measurements have proven to give us valuable information on the global carbon cycles. After developments of the precise O_2/N_2 measurement techniques, the changes in the atmospheric O_2/N_2 ratios have been monitored. However, observation sites for the O_2/N_2 ratio are still limited in comparison with those for the CO_2; especially long-term observation from the equatorial regions is lacking. We also started observation of the atmospheric O_2/N_2 ratios by using a gas chromatographic method [Tohjima, 2000]. Air samples for the O_2/N_2 measurements have been collected from two monitoring stations at Hateruma Island (24°3'N, 123°49'E) since July 1997 and Cape Ochi-ishi (43°10'N, 145°30'E) since December 1998. In addition, we recently began to collect air samples on board cargo ships between Japan and Australia and between Japan and the United States in December 2001.

The time series of the observed O_2/N_2 ratios showed gradual decreasing trends and seasonal variations. Latitudinal distributions of the O_2/N_2 ratio observed in March and September 2002 are depicted in Figure 1. This seasonal change in the latitudinal gradients reflects the fact that the cycles in the both hemispheres are roughly 6 months out of phase. The details of the latitudinal difference in the seasonal cycles will be presented.

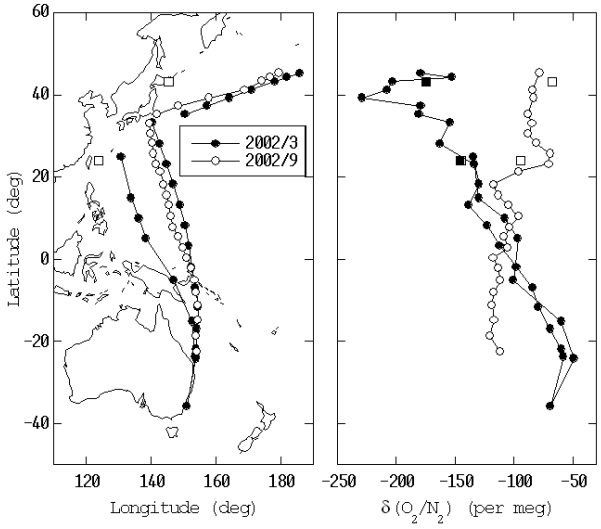

Figure 1: (left) Sampling locatins and (right) latitudinal distibution of O_2/N_2 ratio. Square cymbols indicate data from the monitoring stations.

References

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