The applications of the $^{187}\text{Re}-^{187}\text{Os}$ isotope pair as a petrogenetic and geologic tracer are increasing in recent years due to several advances in the chemical extraction and purification of Re and Os, occurring at ppb levels in environmental samples, and in the precise determination of the Os isotope composition. We have established in our laboratory, based on available methods, chemical procedures and Negative Thermal Ionisation Mass Spectrometric techniques for the measurement of Re-Os concentrations in environmental samples and the Os isotope composition in them. Using these techniques, we are able to determine $^{187}\text{Os}/^{186}\text{Os}$ ratios with a precision of $\sim 1\%$ (±$2\sigma$); twice the standard error of the mean) in several tens of picogram of Os. Preliminary analysis of black shales from the Lower Tal section of the Maldeota phosphorite mine yields a mean $^{187}\text{Re}-^{187}\text{Os}$ model age of $597 \pm 30$ Ma. The $^{187}\text{Os}/^{186}\text{Os}$ and Os concentration in black shales of the Lesser Himalaya range from 8 to 96 and 0.02 to 13 ng g$^{-1}$ respectively. The mean $^{187}\text{Os}/^{186}\text{Os}$ in these samples is $\sim 25$, significantly higher than the crustal value of $\sim 10.5$, suggesting that these black shales could be an important source of radiogenic Os to the rivers draining the Himalaya and to the steady increase in $^{187}\text{Os}/^{186}\text{Os}$ of the oceans through the Cenozoic.

1. Introduction

The chronometric and tracer applications of the $^{187}\text{Re}-^{187}\text{Os}$ isotope pair in Earth and Planetary systems are getting increasingly recognised. The precise measurement of Re and Os concentrations and Os isotope composition in terrestrial and extraterrestrial samples by secondary ion mass spectrometry, SIMS (Allegre and Luck 1980; Luck et al 1980; Luck and Allegre 1983) facilitated the applications of the Re-Os decay scheme in geology, geochemistry and cosmochemistry. These studies got a further boost, during the past few years, with the development of the Negative Thermal Ionisation Mass Spectrometry (NTIMS) technique for the precise determination of Re and Os concentrations and Os isotopic composition in very small samples, several tens to a few hundreds of picograms (Creaser et al 1991; Volkening et al 1991; Hauri and Hart 1993). In this paper, we document the establishment of techniques for the extraction and measurement of Re-Os isotopes from environmental samples in our laboratory based on available methods. These techniques, established for the first time in India, have been used to analyse a variety of environmental samples for their Re-Os isotope systematics. Some of these results from the sedimentaries of the Lesser Himalaya, specifically those on the black shales, are presented in this paper. Our studies on black shales are motivated by two considerations: (i) to explore the possibility of using the $^{187}\text{Re}-^{187}\text{Os}$ pair to determine their chronology (Ravizza and Turekian 1989) and look for age correlation between the inner and outer belt sedimentary sequences and (ii) to assess their potential to contribute radiogenic Os to the oceans and thereby to the marine Os isotope evolution (Pegram et al 1992; Ravizza 1993; Ehrenbrink et al 1995). Weathering of black shales, which are generally rich in Re and Os (Ravizza 1991), from the Himalaya has been suggested as a source for the steady increase in oceanic $^{187}\text{Os}/^{186}\text{Os}$ during the Cenozoic (Pegram et al 1992; Ehrenbrink et al 1995; Turekian and Pegram 1997). A reconnaissance survey of Os isotope composition of black shales from the Lesser Himalaya was initiated as a part of this study to determine the range of Os concentration and $^{187}\text{Os}/^{186}\text{Os}$ in them.

Keywords. Re-Os isotopes; Himalaya; black shales; chronology.

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