AMS FACILITY AT IUAC, NEW DELHI – STATUS REPORT

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Abstract

Accelerator Mass Spectrometry (AMS) facility based on 15UD Pelletron Accelerator at Inter-University Accelerator Centre (IUAC) is in operation to carry out ^{10}Be measurements since last couple of years. Status of the facility and future plans are discussed in the paper.

INTRODUCTION

AMS is an ultrasensitive technique for measuring trace elements and therefore is used for the determination of concentration of long lived radioisotopes present in the nature. These trace elements have various dating and tracing applications in the studies related to the Earth sciences. IUAC AMS facility has been utilized by various user groups to carry out the studies in geological sciences. Till now the main thrust area has been to carry out the paleaoclimatic studies from Mn nodules, river sediments and ocean sediments to model the past climatic conditions [1-3].

AMS SYSTEM AND ^{10}Be MEASUREMENTS

Many up-gradations were incorporated in the existing Pelletron system to make it suitable for AMS related studies. The new components added to the system are Multi- Cathode Source of Negative Ion by Cesium Sputtering (MC-SNICS), Recirculating turbos at the terminal for gas stripper [4], offset Faraday cup after the analyzer magnet and +30^0 AMS beam line [5]. For ^{10}Be AMS measurement simultaneous measurement technique is used [5]. At the stripper combination of gas and foil stripper is used, which is useful for getting higher transmission through the accelerator in case of molecular beam. System calibration is done with standard reference material (SRM) 4325 procured from National Institute for Standards and Technology (NIST), USA. The sensitivity for ^{10}Be/^{9}Be ratio measurement achieved for the system is about 7E-15. The samples measured at IUAC have been verified with internationally established labs and found in very good agreements.

^{10}Be is produced by two ways; one is the atmospheric production; by the interaction of secondary cosmic rays with the ^{14}N and ^{16}O present in the atmosphere and then transport to the natural archives with dry and wet fallout. Another type of production is "in-situ" which happens at the ground level by the spallation reaction of secondary cosmic rays with Si present in the surface of the rock. The decay of ^{10}Be is very slow with a half life of 1.378Ma and therefore it can be used to study the climatic conditions in the long past (~10's of million years).

Recent ^{10}Be measurements have been done with an ocean sediment core collected from the south western Indian Ocean. The objective of the study is to establish chronology of the core and to understand the paleoclimate in the proposed region. The top 57cm of the core was chosen for the study and the chronology of 57 cm corresponds to the ~30.34 ± 1.82 ka. [6]

^{26}Al AMS MEASUREMENTS

^{26}Al ($T_{1/2}$=0.72Ma) measurements have also been tried and ^{26}Al has been measured successfully in the standard samples. The sequential measurement technique [7] is used for ^{26}Al measurements. Initially, measurements have been carried out using standard samples procured from University of California, USA. [8] Standards of various concentrations of ^{26}Al/^{27}Al ratio show good agreement between quoted and measured value as shown in fig.1. ^{26}Al extraction from the natural samples is in progress and measurements will be tried soon.

AMS CHEMISTRY LABORATORY DEVELOPMENT

Chemical processing of sample is an integral part of AMS measurement. It is required to process the sample prior to AMS measurement to reduce the unwanted elements and to convert the sample in a form suitable to be used in the ion source. Till now the chemistry laboratory at Dept of Earth Sciences Pondicherry University has been utilized for this purpose. To provide all the AMS related facilities at IUAC itself, a clean chemistry laboratory has been recently developed. The laboratory is a metal free and equipped with all modern instruments. The lab has been designed to be kept at a positive pressure than the atmosphere with the clean air of about 6000 class. Laminar Flow stations of 100 class air environment are being utilized for performing the column chemistry for samples processing.

The chemical procedure to extract ^{10}Be from Mn nodules and sediments has been developed [1]. Sediment samples are first digested and leached with 6N HCl at room temperature. After adding ^{9}Be carrier solution, samples are processed through the cation and anion exchange columns to separate Be from the other elements present in the matrix. Be is precipitated to $Be(OH)_2$ and finally converted into BeO by step heating up to 900^{o}C. BeO is loaded in the cathode holder after mixing with Ag or Nb powder. River sediment samples have been

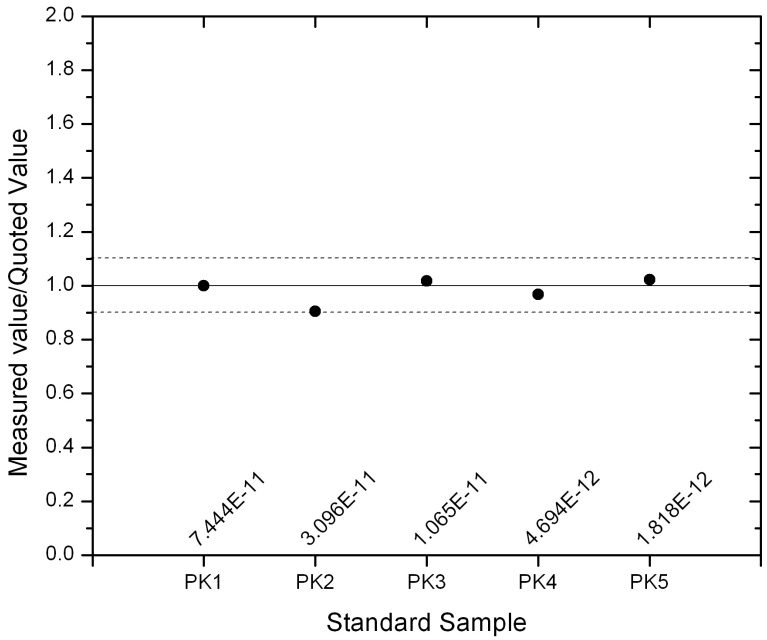

Figure 1: Ratio of measured to quoted value for ^{26}Al measurement has been plotted for various concentrated standard samples. The ratio is close to one within ±10% for all the samples.

powder. River sediment samples have been prepared using this lab and initial calibrations are in progress.

RESULT AND DISCUSSION

Facility for the ^{10}Be measurements is in operation and many user groups are utilizing the facility. Clean Chemistry laboratory has also been developed. ^{26}Al measurements with standard samples have been carried out and measurement from natural samples will be carried out.

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