

⁴⁰Ar-³⁹Ar GEOCHRONOLOGY AT UNIVERSIDADE DE BRASÍLIA: INSTRUMENTATION, ANALYTICAL PROCEDURES AND CALIBRATION

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RESUMO: Laser heating ⁴⁰Ar-³⁹Ar geochronology is a modern way to improve high analytical precision and accuracy. Accuracy of this method is limited by the ages of standards (neutron fluence monitors) used, as well as the precision and accuracy of intercalibrations between standards. The greatest challenge limiting ⁴⁰Ar/³⁹Ar multicollection measurements is the frequent detectors calibrations using atmospheric argon or international standard. The mass spectrometer Noblesse is composed of four cups, three Ion Counter and one Faraday Cup. The natural mass dispersion of the Noblesse geometry causes argon ion beams separated by two atomic mass units (a.m.u.), allowing simultaneous measurement of three isotopes, such as ⁴⁰Ar, ³⁸Ar, and ³⁶Ar or ³⁹Ar, ³⁷Ar and ³⁵Ar. For argon isotopic analysis atmospheric Ar is the only readily available reference material. Its isotopic composition of ⁴⁰Ar (99.6%), ³⁸Ar (0.06%), and ³⁶Ar (0.34%) effectively limits routine measurements to two isotopes: ⁴⁰Ar and ³⁶Ar. Calibration of the Noblesse with atmospheric Ar is not easy because peak-jumping of ⁴⁰Ar and ³⁶Ar on to each detector does not adequately simulate the conditions for ⁴⁰Ar/³⁹Ar, because ³⁹Ar is measured in a subsequent step. Correction factors must be measured using the same detectors, ion-optic tuning, source, and detector settings used to measure ⁴⁰Ar/³⁹Ar ages for unknown samples. Reliance upon an atmospheric Ar standard to calibrate the Noblesse is problematic because there is no straightforward way to relate atmospheric ⁴⁰Ar and ³⁶Ar to measurements of ⁴⁰Ar and ³⁹Ar if they are measured on separate detectors. The Ar-Ar equipment of Geochronology Laboratory at Universidade de Brasília is divided into two major units: an extraction line and the mass spectrometer. The extraction line is equipped with a automated noble gas extraction and purification system composed of an optical table, gas extraction by a 100-W laser (MIR 10 - New Wave) and ultra-high vacuum (UHV) gas purification system and PG-50 and NP-10 getters. Calibration of equipment is performed daily before analysis. Atmospheric argon and gain values in different cups are determined before analysis and gain calibration, cross calibration and age calculations corrections are performed after. For calculation, a customized worksheet was planned considering the variety of run files created and used in routine analysis and plateau ages graphics are plotted using isoplot. Ages ⁴⁰Ar/³⁹Ar so far calculated using this methodology are 1,2 to 2% uncertainties. After a long calibration period and exhaustive tests performed, we have learned the necessary frequency of equipment calibration and how to proceed corrections post analysis.

PALAVRAS-CHAVE: ⁴⁰Ar/³⁹Ar Geochronology, mass spectrometer, calibration.