Improving $^{40}Ar/^{39}Ar$ dating of Quaternary basalt with the Noblesse 5-collector mass spectrometer

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We have developed automated gas extraction and mass spectrometry protocols using a Noblesse 5-collector instrument with ion counting ETP dynode multipliers at the 2 low mass and 2 high mass positions to measure the argon isotope composition of Pleistocene basalt. The Noblesse has a resolving power of 2900 on the low mass 36 collector. This separates ^{36}Ar from isobars of $H^{35}Cl$ and $3•^{12}C$. Blanks for ^{36}Ar are 30 cps and equivalent to about $2x10^{-19}$ moles. These blanks derive 50% from 2 GP 50 getters in the extraction line, 20% from the remainder of the extraction line, and 30% from the spectrometer.

We have developed a two step procedure for multicollector analysis, which requires a peak jump of one amu, but provides accurate determination of the essential isotope ratios. Analyses follow a blank-standard-blank-sample routine. The standard gas consists of a mixture of atmospheric Ar and ^{39}Ar that has a $^{40}Ar/^{39}Ar$ ratio of 2:1. Its isotopic composition was determined via single collector analyses on the Noblesse.

Incremental heating of a 250 mg groundmass sample of weakly alkaline, phenocryst-free, basalt from Maui using a resistance furnace and an MAP 215-50 spectrometer operated with a single Balzers SEV 217 multiplier in analog mode yields a 9 step spectrum and a plateau age of 917±12 ka (±2s analytical). This automated analysis takes 24 hours to measure blanks, the sample, and air for mass discrimination.

Using a CO_2 laser and -120 ^{o}C He cryotrap on an extraction line connected to the Noblesse spectrometer, incremental heating of 5 and 10 mg aliquots of the same basalt in 10 to 12 steps is completed in 15 hours including measuring blanks, standard gas, and sample. The age spectra are remarkably similar to that obtained using the MAP 215-50 with plateau ages of 916±13 and 909±11 ka, and a wtd. mean plateau age of 912±8 ka. Advantages of the Noblesse laser method relative to the MAP furnace approach are: (1) ^{36}Ar is resolved from isobars, (2) the ^{36}Ar blanks are exceptionally low and stable, (3) sample size is reduced by a factor of 50, and (4) analysis time is reduced by 30%. We will present additional results from paleomagnetically significant Quaternary lava flows that directly record excursions and polarity reversals.