

***K-Ar dates for biotite from two paleontologically significant localities:
Duchesne River Formation, Utah and Chadron Formation, South Dakota***

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K-AR DATES FOR BIOTITE FROM TWO PALEONTOLOGICALLY SIGNIFICANT
LOCALITIES: DUCHESNE RIVER FORMATION, UTAH AND CHADRON
FORMATION, SOUTH DAKOTA

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The following two ages were obtained at The University of Texas at Austin during 1971-72. Potassium was analyzed in duplicate by flame spectrophotometry with lithium internal standardization and sodium buffering. Precision for biotites is $\pm 0.5\%$ (1σ). Argon was determined three times for each sample by conventional isotope dilution techniques using a modified CEC model 21-615 residual gas analyzer for the mass spectrometry. Precision for micas is $\pm 1\%$ (1σ). The uncertainties for the ages reflect 95% confidence limits on the analytical determinations. Experiments with standards analyzed in other labs indicate that our bias does not exceed these limits. Constants used are: $\lambda_p = 4.72 \times 10^{-10} \text{ yr}^{-1}$; $\lambda_e = 0.584 \times 10^{-10} \text{ yr}^{-1}$; and $K^{40} = 0.0119$ atom percent K.

GEOLOGIC DISCUSSION

Sample 1 is from a volcanic ash or siltstone 3 feet below the top of the Ahearn Member, which is the lowest member of the Chadron Formation of South Dakota. The vertebrate fauna of this formation is the stratotype for the Chadronian, a Provincial Age for North America (Wood et al., 1941; Clark et al., 1967). No other K-Ar dates have been obtained from it previously. The date of 36.3 m.y. is Early Oligocene as anticipated, falling within the older portion of the Chadronian interval as given by Evernden et al. (1964) and Berggren (1972).

Sample 2 is from an ashy siltstone or volcanic ash at the contact of the Halfway and Lapoint Members of the Duchesne River Formation, which is another stratotype of a North American Provincial Age, though it does not contain a particularly good vertebrate fauna. The Duchesnean has been placed both in the Eocene and the Oligocene (Wilson et al., 1968; Andersen and Picard, 1972), but we do not wish to reopen that question here. The date of 39.3 m.y. falls within recent estimates of Duchesnean Age limits (Berggren, 1972; Evernden et al., 1964).

In both cases, biotites occur with feldspar and quartz in an altered clayey matrix. Any indication of original glassy fragments has been destroyed. The biotites are a uniform dark brown color despite a wide range of grain size. Both give sharp undistorted x-ray diffraction peaks with no trace of chlorite.

It is our opinion that these samples both represent volcanic ash deposits which are unsorted except for the possible removal of the coarsest material. This may be the result of primary sorting during emplacement (distance from source) or it may indicate some degree of horizontal reworking without concentration of the phenocrysts. The uniformity and freshness of the biotites and the fact that distinct biotite-rich layers were sampled suggest that little or no older material has been included. Thus we believe that the biotite ages closely approximate the time of volcanic eruption and ash deposition. However we caution that these are single ages and need corroboration before they can be considered firmly established. Efforts toward this end are now being made.

SAMPLE DESCRIPTIONS

1. UT-G 3635 K-Ar (biotite) 36.3 \pm 0.7 m.y.

Unnamed tuff (?), 3 ft below top of Ahearn member, Chadron Fm. (SW $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 4, T4S., R10E, Red Shirt Quadrangle, Custer Co., SD). Analytical data: K = 6.82%, 6.95%; (a) $\overset{*}{\text{Ar}}^{40} = 0.991 \times 10^{-5}$ scc/gm; $\overset{*}{\text{Ar}}^{40}/\Sigma\text{Ar}^{40} = 73\%$; (b) $\overset{*}{\text{Ar}}^{40} = 1.004 \times 10^{-5}$ scc/gm; $\overset{*}{\text{Ar}}^{40}/\Sigma\text{Ar}^{40} = 85\%$; (c) $\overset{*}{\text{Ar}}^{40} = 1.010 \times 10^{-5}$ scc/gm; $\overset{*}{\text{Ar}}^{40}/\Sigma\text{Ar}^{40} = 84\%$. Collected by: J. Clark (1963).

2. UT-G 4833

K-Ar

(biotite) 39.3 ± 0.8 m.y.

Unnamed tuff or ashy siltstone, contact of Halfway and Lapoint members, Duchesne River Fm. (SE $\frac{1}{2}$ Sec. 35, T4S, R19E, Salt Lake Meridian, Uintah Co., UT). Analytical data: K = 7.47%, 7.54%; (a) $\text{Ar}^{40} = 1.168 \times 10^{-5}$ scc/gm; $\text{Ar}^{40}/\Sigma\text{Ar}^{40} = 89\%$; (b) $\text{Ar}^{40} = 1.196 \times 10^{-5}$ scc/gm; $\text{Ar}^{40}/\Sigma\text{Ar}^{40} = 93\%$; (c) $\text{Ar}^{40} = 1.189 \times 10^{-5}$ scc/gm; $\text{Ar}^{40}/\Sigma\text{Ar}^{40} = 91\%$. Collected by: J. Clark (1968).

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