

## Supplemental File

### <sup>40</sup>Ar/<sup>39</sup>Ar Geochronology

To document the timing of volcanism and faulting, and to calculate fault slip rates across the VBR, 14 samples collected from the Miocene, Pliocene, and Quaternary volcanic sequence were dated using <sup>40</sup>Ar/<sup>39</sup>Ar incremental heating techniques or with a continuous CO<sub>2</sub> laser system following the methods described in Nagorsen-Rinke et al. (2013) and Dalrymple and Duffield (1988) (Figs. S1, S2, and S3). <sup>40</sup>Ar/<sup>39</sup>Ar geochronology samples were prepared and analyzed following the procedures outlined in Supplemental File 1 in Nagorsen-Rinke et al. (2013). Clean separates (either groundmass plagioclase or sanidine), collected from one rhyolite tuff (Mrt), one hornblende dacite (Mdh), five basalt flows (Pbp<sub>2</sub>, Pbb, Pbc, Pbm<sub>1</sub>, and Pbm<sub>2</sub>), two andesite flows (Pah and Pa), one dike from one of the volcanic centers (Pvc), and the Tuff of Taylor Canyon (Qtc), yield either plateau ages, a decreasing age spectra, a result of <sup>39</sup>Ar recoil (Turner and Cadogan, 1974; Onstott et al., 1995), or weighted mean ages (Figs. S1, S2, and S3). For samples affected by <sup>39</sup>Ar recoil, the recoil model age is calculated by incorporating age dispersion into the weighted mean age error (e.g. Nagorsen-Rinke et al., 2013).

The Miocene units, Mrt and Mdh, yield a sanidine weighted mean age and a groundmass model recoil age of  $22.878 \pm 0.051$  Ma and  $14.695 \pm 0.816$  Ma, respectively (Fig. S1). Groundmass plagioclase from the five basalt flow units (Pbb, Pbm<sub>1</sub>, Pbm<sub>2</sub>, Pbc, and Pbp<sub>2</sub>) and two andesite flow units (Pah and Pa) yield plateau ages or model recoil ages that range between  $3.606 \pm 0.060$  Ma to  $3.361 \pm 0.020$  Ma (Fig. S2); and groundmass plagioclase from a basaltic dike cross-cutting one of the Pvc cones yields a model recoil age of  $2.996 \pm 0.063$  Ma (Fig. S2). Our geochronologic data suggest that the Pliocene mafic volcanism across the Black Mountain-River Spring area occurred over a relatively short time span of ~550 ka, similar to the Adobe Hills region (Nagorsen-Rinke et al., 2013). Sanidine from the Tuff of Taylor Canyon (unit Qtc) yields a weighted mean age of  $1.976 \pm 0.013$  Ma (Fig. S3).

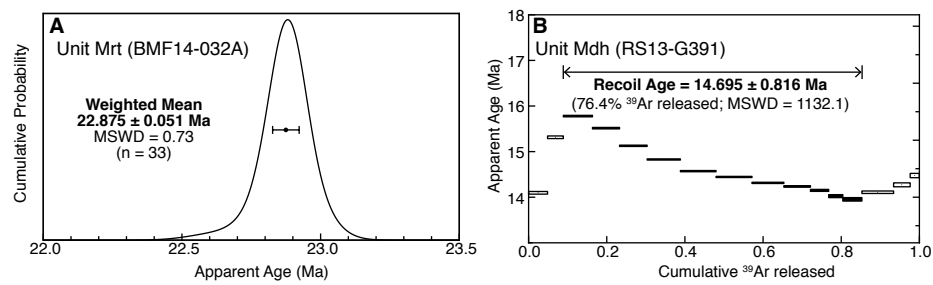
## References Cited

- Dalrymple, G.B., and Duffield, W.A., 1988, High precision <sup>40</sup>Ar/<sup>39</sup>Ar dating of Oligocene rhyolites from the Mogollon-Datil volcanic field using a continuous laser system: *Geophysical Research Letters*, v. 15, p. 366–463.
- Nagorsen-Rinke, S., Lee, J., and Calvert, A., 2013, Pliocene sinistral slip across the Adobe Hills, eastern California–western Nevada: Kinematics of fault slip transfer across the Mina

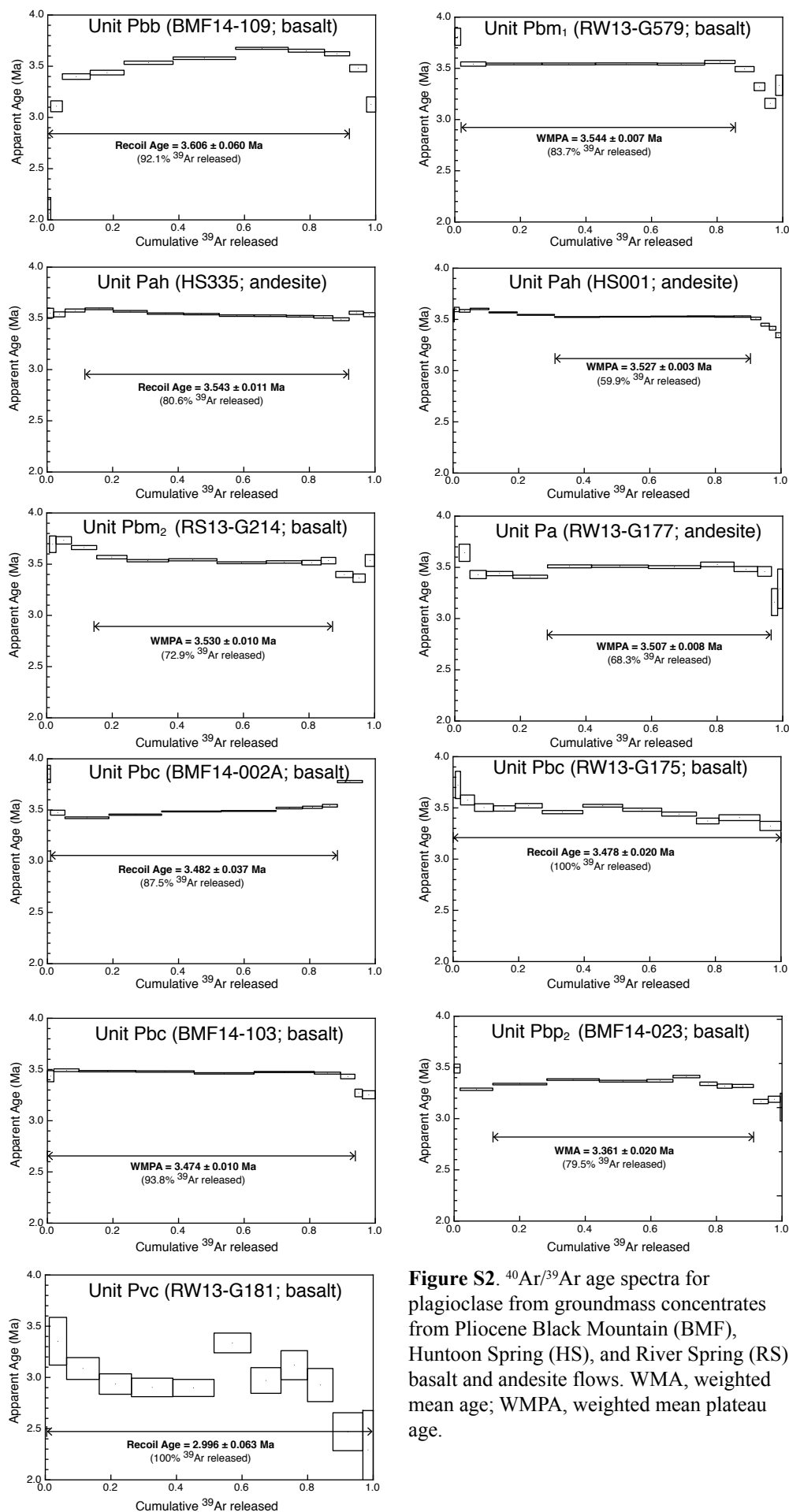
deflection: *Geosphere*, v. 9, no. 1, p. 37–53.

Onstott, T.C., Miller, M.L., Ewing, R.C., and Walsh, D., 1995, Recoil refinements: Implications for the  $^{40}\text{Ar}/^{39}\text{Ar}$  dating technique: *Geochim. Cosmochim. Acta* 59, 1821–1834.

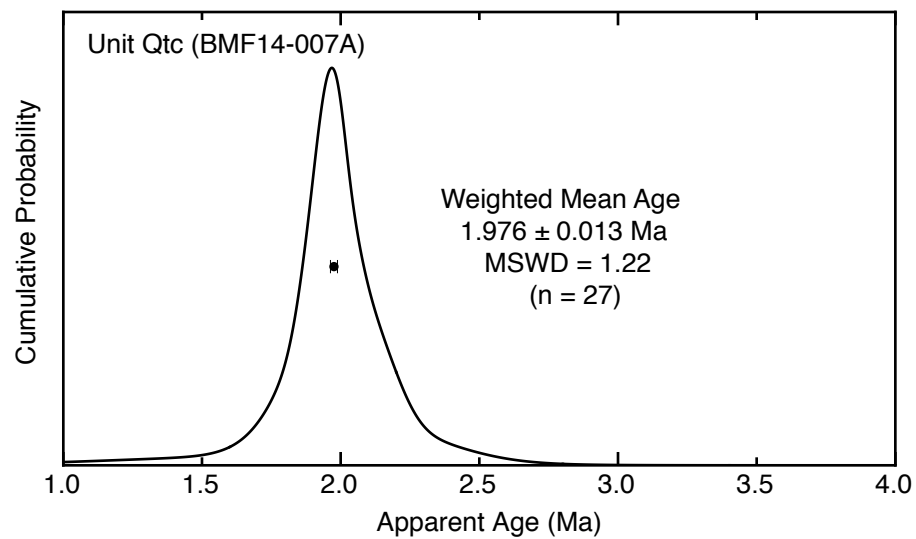
Turner, G., and Cadogan, P.H., 1974, Possible effects of  $^{39}\text{Ar}$  recoil in  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  dating: *Geochimica et Cosmochimica Acta*, v. 2, supplement, p. 1601–1615.



**Figure S1.**  $^{40}\text{Ar}/^{39}\text{Ar}$  age data from Miocene units from Black Mountain (BMF) and River Spring (RS) areas. (A) Age probability distribution plot for sanidine from unit Mrt and (B) age spectrum for plagioclase from a groundmass concentrate from unit Mdh. Summary of ages is shown in Table 1; analytical data are listed in the Supplemental File.



**Figure S2.**  $^{40}\text{Ar}/^{39}\text{Ar}$  age spectra for plagioclase from groundmass concentrates from Pliocene Black Mountain (BMF), Huntton Spring (HS), and River Spring (RS) basalt and andesite flows. WMA, weighted mean age; WMPA, weighted mean plateau age.



**Figure S3.**  $^{40}\text{Ar}/^{39}\text{Ar}$  age probability distribution plot for sanidine from the Tuff of Taylor Canyon (unit Qtc) in the Black Mountain area.