A 40Ar/39Ar Geochronology Case Study of Vapor-Phase Sanidine, Biotite, Amphibole, Pyroxene, and Plagioclase from a Syenodiorite Intrusion within Big Bend National Park, Texas

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Big Bend National Park (BBNP) and adjacent areas contain a variety of intrusive rock types. One of the major setbacks of trying to date these intrusions by 40Ar/39Ar geochronology is the lack of unaltered K-bearing mineral phases. In most cases K-feldspar is the only phase present. Crystallization ages for many of the dated intrusions in BBNP yield younger discordant 40Ar/39Ar K-feldspar ages compared to their corresponding U-Pb zircon ages for the same intrusion; up to 10 m.y. younger for the older gabbros and 1 m.y. for the younger gabbros and syenites. These discrepancies in ages are most likely due to later stage thermal overprints from younger intrusions or hydrothermal fluids. However, several of the youngest intrusions contain areas within the intrusive bodies that are more felsic in composition, either as a result of crystal fractionation and/or melt segregation. Peña Mountain, located in western BBNP, is a geographically small intrusion at the surface, contains localized vapor-phase minerals within vesicles and in large cavities within the lighter colored units (syenodiorites). One of these larger cavities contains numerous vapor-phase minerals: sanidine, biotite, amphibole, pyroxene (cpx), plagioclase, quartz, apatite, illmenite, magnetite, chlorite, zeolite (natrolite?), zircon, and possibly others. Sanidine from this location yielded a 40Ar/39Ar age of 28.77 ± 0.08 Ma [1], which is similar to biotite ages from a geochemically similar intrusion (non-vapor phase) at Rattlesnake Mountain to the north. This study aims to date several of the other mineral phases such as biotite, amphibole, pyroxene, and plagioclase from this same vapor-phase unit from Peña Mountain to determine if their ages are coeval to the sanidine age of 28.77 Ma. Electron microprobe analyses for these phases show K2O contents (weight percent) of the 9.8% for biotite, 0-1.0 % for amphibole, 0.02–0.10 % for pyroxene, and 0.5–1.0 % for plagioclase. With these ages we hope to establish the timing of the last crystallization event for this intrusion and to show that all of the phases crystallized at the same time.

[1] Turner *et al* (2011), USGS Sci. Inv. Map 3142