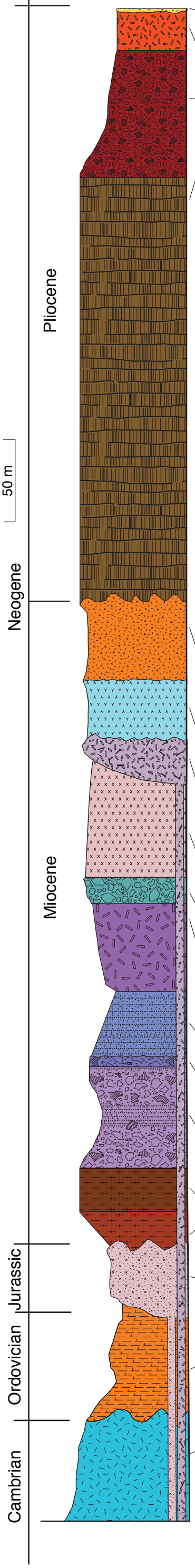
Plate 3: Stratigraphic Column for the Huntoon Mountain area



Qos Aeolian volcanic sand and obsidian fragments likely sourced from the Mono and Inyo craters to the west (Reheis et al., 2002; Nagorsen-Rinkeet al., 2013; Delano et al., in press). Qos consists of mostly fine-grained volcaniclastic sediments with angular obsidian fragments, ranging from millimeter to centimeter scale, exposed on its surface. These obsidian fragments occur throughout the field area in unit Qos, with a higher density in the southern portion of the HMA field area. Exposed in the south-central location a consolidated sample of Qos was collected with small wood twigs in it. This sample is a candidate for carbon dating.

Pbc Red and black basalt scoria and cinder ranging in size from sand to cobble with infrequent phenocrysts of pyroxene and olivine. Sourced from nearby volcanic centers and cinder cones.

Pvc Volcanic centers and cinder cones. Defined by cone-shaped exposures composed of angular red breccia blocks, cobble to pebble sized basalt cinder, rare volcanic bombs, and associated basaltic dikes. $^{40}Ar/^{39}Ar$ groundmass plagioclase from a dike cross-cutting unit Pvc in the River Spring area yields an 40Ar/39Ar model recoil age of 2.996 ± 0.063 Ma (Delano et al., in press).

Pb (Interfingered basalt lava flows)

Pbb Aphanitic basalt lava flow that has a flaggy columnar outcrop pattern, is dark grey on fresh surfaces, and tan-brown on weathered surfaces. Unit Pbb is weakly-phyric with minor olivine phenocrysts.

Pbx Two-pyroxene basalt lava flow that is ridge forming, dark grey on fresh surfaces, red-purple on weathered surfaces, with a blocky columnar outcrop pattern. Unit Pbx is phenocryst bearing (clinopyroxene + orthopyroxene + minor olivine). In thin section, unit Pbx has ~1 mm clinopyroxene, ~1 mm orthopyroxene, and infrequent <0.5 mm olivine. Unit Pbx groundmass has elongate swallowtail plagioclase, pyroxene, and Fe-Ti oxides. $^{40}Ar/^{39}Ar$ groundmass plagioclase dating of this unit is in progress.

Pbol Olivine basalt lava flow that is ridge forming with a bulbous outcrop pattern, rare cooling columns, silvery grey on fresh surfaces, and dark grey brown on weathered surfaces. Unit Pbol is phenocryst bearing (olivine + clinopyroxene + minor plagioclase) with a silvery grey coarse-grained matrix. In thin section, Pbol has ~3% 0.2-0.6 mm euhedral olivine with common iddingsite alteration rims, ~2% 0.1-0.5 mm subhedral clinopyroxene, infrequent elongate ~0.3 μm plagioclase, and glomerocrysts of olivine + clinopyroxene + plagioclase. Pbol groundmass is medium to coarse grained consisting of lathy swallowtail plagioclase, clinopyroxene, minor olivine, and Fe-Ti oxides. $^{40}Ar/^{39}Ar$ groundmass plagioclase dating of this unit is in progress.

Pbm_1 Weakly phyric basalt lava flow that is ridge forming and has common flow foliation defined by compositional flow banding. Unit Pbm_1 is silvery gray to dark gray on fresh surfaces and weathers tan to dark brown. This phenocryst bearing (olivine + clinopyroxene) unit is fresh silvery grey to dark grey fine-grained groundmass. In thin section, Pbm_1 has ~1% 0.1-0.5 mm euhedral olivine with common skeletal examples and ~1% 0.1-0.5 mm euhedral clinopyroxene (Fig. 6f). Pbm_1 groundmass is fine grained consisting of lathy swallowtail plagioclase, clinopyroxene, orthopyroxene, and Fe-Ti oxides (Fig. 6f). Groundmass plagioclase $^{40}Ar/^{39}Ar$ geochronology yields an age of 3.544 ± 0.007 Ma (Delano et al., in press).

Pbn Plagioclase-bearing basalt lava flow that is ridge forming with infrequent cooling columns, silvery grey on fresh surfaces, reddish buff brown on weathered surfaces, and has frequent large (up to ~5 mm) vesicles throughout the unit. Pbn is phenocryst bearing (plagioclase + olivine + clinopyroxene + orthopyroxene) with a fresh silvery grey medium grained groundmass (Fig. 6e). In thin section, phenocrysts of subhedral plagioclase (0.5-2 mm), euhedral olivine (0.4-1 mm), subhedral clinopyroxene, and subhedral orthopyroxene occur as solitary crystals and as part of large (up to 4 mm) glomerocrysts (Fig. 6e). Two distinct populations of plagioclase phenocrysts are observed here. The first, less abundant, population consists of 1-2 mm elongate (1:1 – 1:5 aspect ratios) with polysynthetic twining, oscillatory zoning, boxy cellular rims, spongy cellular cores making up ~80% of the phenocryst with frequent pyroxene and Fe-Ti oxide inclusions (Fig. 6e). The second, and more abundant population, consists of 0.5-2 mm elongate phenocrysts (1:3 – 1:7 aspect ratios) with polysynthetic twinning, oscillatory zoning, boxy cellular rims, and no inclusions (Fig. 6e). Resorbed cores, larger crystal size, and smaller aspect ratios (relative to the second population) suggest that this plagioclase population represents an older disequilibrium event prior to the formation of the Plagioclase from the second population (Fig. 6e). Groundmass consists of lathy swallowtail plagioclase, pyroxene, and Fe-Ti oxides with infrequent glassy inclusions. $^{40}Ar/^{39}Ar$ geochronology of groundmass plagioclase from this unit is in progress.

Pba Andesitic basalt lava flow that is ridge forming, silvery grey on fresh surfaces, dark brown to purple on weathered surfaces, and has 'snowflake' texture that appears at the center of flows with 'a'a texture occurring at flow tops. Pba is phenocryst bearing (clinopyroxene + olivine + infrequent plagioclase) and has a medium to coarse grained matrix consisting of pyroxene and plagioclase easily visible in hand sample. In thin section, olivine is occasionally skeletal with rims altered to iddingsite (0.2-1.5 mm), and infrequent plagioclase (~1 mm, 1:5 aspect ratios) with spongy cellular texture cores and boxy cellular rims. Groundmass consists of elongate swallowtail plagioclase, pyroxene, olivine, and Fe-Ti oxides.

Pbg Glomerocrystic basalt lava flow that is ridge forming with a bulbous outcrop pattern and infrequent cooling columns, silvery-grey on fresh surfaces, and buff brown to tan on weathered surfaces. Unit Pbg is phenocryst bearing (olivine + orthopyroxene + clinopyroxene + plagioclase) with a medium gray and medium grained groundmass (Fig. 6d). In thin section, Pbg has phenocrysts of euhedral or skeletal olivine with occasional pyroxene rims (~1 mm), euhedral twinned clinopyroxene (~0.5 mm), subhedral orthopyroxene (~0.5 mm), and infrequent elongate plagioclase (0.3-1 mm with 1:3-1:9 aspect ratios). Pbg is also defined by frequent glomerocrysts (olivine + orthopyroxene + clinopyroxene + plagioclase) visible in hand sample and thin section that are up to 3 mm across (Fig. 6d). Groundmass consists of lathy plagioclase with felty texture, pyroxene, less frequent olivine and Fe-Ti oxides. Occasional biotite bearing glass inclusions are observed. Unit Pbg and Pbp are separate, petrographically distinct units that are stratigraphically correlated based on their relation to underlying Miocene units.

Pbp Basalt lava flow weathers to a buff brown to grey color, and is phenocryst bearing (orthopyroxene + olivine) with an unaltered fine to medium grained groundmass. Pbp is informally labeled Picto-basalt, named for an outcrop with Paleoamerican pictographs. In thin section, unit Pbp has elongate orthopyroxene (up to 3 mm) with alteration rims and less frequent occasionally skeletal olivine with iddingsite alteration rims. Groundmass consists primarily of lathy swallowtail plagioclase, orthopyroxene, and Fe-Ti oxides. $^{40}Ar/^{39}Ar$ groundmass plagioclase geochronology is currently in progress, but based on petrographic and stratigraphic observations, unit Pbp likely correlates to Tincher and Stockli's (2009) oldest basalt unit Tb with a 40Ar/39Ar groundmass plagioclase age 4.08 ± 0.10 Ma.

Mlt Latite tuff. Ridge forming with a bulbous outcrop pattern, medium pinky gray on fresh surfaces, and dark brown-purple or brick red on weathered surfaces. Mlt has large (1-35 cm) flattened fiamme, occasional subrounded lithics of various volcanic composition, and infrequent petrified wood (Fig. 9). In hand sample, Mlt has easily visible plagioclase and sanidine (1-2 mm with a few up to 8 mm) and diagnostic euhedral (pseudohexagonal) biotite (~1 mm). In thin section, Mlt is phenocryst bearing (plagioclase + sanidine + biotite + clinopyroxene + Fe-Ti oxides + minor hornblende) with common glomerocrysts of clinopyroxene and plagioclase in a matrix of dark drown glass (Fig. 6c). Plagioclase phenocrysts commonly show polysynthetic twinning, oscillatory zoning, and fractures. Larger feldspar crystals (3-8 mm) having spongy cellular cores with inclusions of clinopyroxene. Plagioclase $^{40}Ar/^{39}Ar$ geochronology yielded an age of 11.399 ± 0.041 Ma (Nagorsen-Rinke et al., 2013).

Mtjs Tuff of Jack Spring. Poorly to moderately welded, ridge forming latite tuff (Figs. 7 and 8). In hand sample, Mtjs contains easily visible phenocrysts of plagioclase and sanidine (up to 5 mm) and biotite (up to 2 mm) in a light gray ashy matrix with frequent centimeter scale pumice and occasional fiamme as well as millimeter to centimeter scale volcanic lithic fragments (rhyolite to andesite) (Fig. 6b). In thin section, Mtjs is phenocryst bearing (sanidine + plagioclase + biotite + hornblende + clinopyroxene + quartz) with prevalent 1-2 mm unaltered sanidine crystals (Fig. 6b). Sanidine $^{40}Ar/^{39}Ar$ geochronology yields an age of 12.114 ± 0.006 Ma (Petronis et al., 2019).

Mai Hornblende + two-pyroxene shallow andesite intrusions and lava domes. Unit Mai is non-vesicular and light grey on fresh surfaces, brown-grey on weathered surfaces, and occurs as large dome-like outcrops suggesting it is a shallow intrusion. Unit Mai is phenocryst bearing (plagioclase + clinopyroxene + orthopyroxene + minor hornblende) with a crystalline groundmass of plagioclase + pyroxene + Fe-Ti oxides. In thin section, unit Mai has elongate <5mm plagioclase with most crystals showing an inner rim of spongy cellular texture, <2mm twinned clinopyroxene, <2mm orthopyroxene with clinopyroxene rims, and infrequent <1mm hornblende with alteration rims.

Maf Crystal rich (~40%) andesite lava flow. Subrounded boulder outcrop patter, gray color on fresh surface, brown to orange color with pitted texture on weathered surface, phenocryst-bearing (plagioclase + pyroxene + hornblende + minor biotite) in a microcrystalline groundmass.

Mdh Weakly consolidated, ~15 m thick, poorly sorted, nearly clast supported andesite-dacite debris flow with occasional thinly bedded ~10 cm thick mud layers. Clasts in unit Mdh range in composition from andesitic to dacitic and are subrounded, 2-30 cm in size with infrequent meter scale boulders within a fine grained light grey ashy matrix. Delano et al. (in press) report a groundmass plagioclase $^{40}Ar/^{39}Ar$ recoil age of 14.695 ± 0.816 Ma for unit Mdh.

Mal Two-pyroxene andesite lava flow. Ledge forming, dark grey on fresh surfaces, dark purple-brown on weathered surfaces, and has randomly oriented cooling joints. Unit Mal is porphyritic with plagioclase, clinopyroxene, orthopyroxene, and occasional glomerocrysts of plagioclase, clinopyroxene, and orthopyroxene (Fig. 6a). In thin section, unit Mal has euhedral <3mm plagioclase with partially resorbed cores and boxy cellular rims, <2mm subhedral twinned clinopyroxene, <2mm subhedral orthopyroxene, and occasional glomerocrysts of plagioclase, clinopyroxene, and orthopyroxene (Fig. 6a). The groundmass in unit Mal consists of elongate swallowtail plagioclase, pyroxene, Fe-Ti oxides, and dark brown glass (Fig. 6a).

Mas Volcaniclastic sediments and debris flows. Subangular, fine to coarse grained, moderately to well sorted cross-bedded volcaniclastic sediments with clasts of lithics, pumice, quartz, feldspars, pyroxene, and occasional silicified woody material.

Mdf Clast supported debris flow consisting of poorly sorted sub-angular to sub-rounded clasts of a phenocryst-bearing (plagioclase + pyroxene) glassy black andesite in a heavily weathered ashy matrix.

Mdbx Andesitic to dacitic debris flows and lahars that occur in the northern HMA. Mdbx consists of subangular to subrounded, millimeter to meter-sized clasts of hornblende-bearing dacite to andesite. Debris flows and lahars are commonly matrix supported with a light brown to gray muddy matrix with hornblende, sanidine, plagioclase, and quartz. Mdbx commonly has interbedded well sorted, laminated silt, fine to coarse cross-bedded sand, and conglomerate layers all primarily composed of volcaniclastic sediments. In one location, a 5-15 m thick zone of rounded river cobbles of was observed suggesting a small paleochannel developed in the lahar and debris flows.

Mt_5 Candelaria Junction tuff of Speed and Cogbill (1979) with lower and upper cooling units denoted as Mt_5a and Mt_5b respectively. Cliff forming, pale grey to red, phenocryst bearing (plagioclase + sanidine + quartz + sparse biotite) ash-flow tuff with common fiamme. Biotite, sanidine, and plagioclase K/Ar ages from 24 to 22 Ma (Speed and Cogbill 1979).

Japg Granite of Pellisier Flats. Phaneritic hornblende, biotite granite. Biotite K/Ar age of ~157 (Evernden and Kistler, 1970).

Op Palmetto Formation characterized by small knobby outcrops of intensely folded black siltstone and slate with minor marble and quartzite. Though not observed in the HMA, Op is structurally juxtaposed against unit Cm and Cambrian phyllites along a low-angle thrust plane thought to be associated with the Paleozoic Roberts Mountain thrust (Crowder et al., 1972; Stockli et al., 2003; Tincher and Stockli, 2009).

Cm Fine to medium grained white to gray marbles which are tentatively correlated to the Poleta Canyon Formation (Crowder et al., 1972; Tincher and Stockli, 2009).