Text and references accompanying Nevada Bureau of Mines and Geology Open-File Report 16-2

Preliminary Surficial Geologic Map of Selected Parts of Clayton Valley and the Northwest Montezuma Range Piedmont, Esmeralda County, Nevada

by

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INTRODUCTION

Mapping efforts were focused in the southeastern portion of Clayton Valley, where the surface trace of the Clayton Valley fault is best expressed in the late Quaternary stratigraphy. Mapping was conducted using 1-m-resolution color orthorectified aerial photographs from the U.S. Department of Agriculture as a base map and aided by aerial stereo photographs provided by the Bureau of Land Management. Alluvial fans were divided on the basis of well-established criteria, such as height above the active channel, development of desert varnish and pavement, degree of rubification, soil development, degree of fan dissection, and bar and swale surface morphology (e.g., Bull, 1991; Ritter et al., 1993; Frankel and Dolan, 2007). Eight alluvial fan units were mapped, each of which are consistent with the western North American alluvial stratigraphic framework established by Bull (1968, 1991). From oldest to youngest, the fan units are as follows: Q2a, Q2b, Q2c, Q2d, Q3a, Q3b, Q3c, and Q4. Surfaces of Q3b age are further subdivided into separate map units due to the fact that the southern portion of the map area contains extensive Q3b deposits with cryptobiotic soil on the fan surface. Undivided bedrock and volcanic ash units were mapped through portions of the valley, some of which also appear to have been deformed by earlier Cenozoic faults. However, the main focus of mapping efforts herein was the Quaternary alluvium and associated faults, and thus the bedrock units have not been divided.

In addition, some of the displaced fan units were dated using terrestrial cosmogenic nuclide (TCN) 10Be depth profiles to determine a surface exposure age of the unit. Details of the TCN dating can be found in Foy (2011) and Foy et al. (2012).

UNIT DESCRIPTIONS

Alluvial Deposits

Q4 Alluvium (latest Holocene) Unit Q4 includes the active and most recently abandoned stream channels. Deposits consist of poorly-sorted sub-angular pebble, gravel, and cobble sized clasts mixed with silt and sand. Clasts lack varnish or rubification with no desert pavement development. Q4 surfaces are characterized by strong depositional morphology with gravelly bars and sandy swales and a lack of soil development. Amplitude of bar and swale morphology is ~1 m.

Q3c Alluvium (Holocene) Q3c surfaces preserve strong bar and swale morphology similar to Q4 but stand stratigraphically higher (~0.5 to 1 m above the active channel). Q3c surfaces contain large amounts of silt and sparse vegetation.

Q3b Alluvium (Holocene to late Pleistocene) Q3b surfaces stand ~1 to 2 m above the active channel. Bar and swale morphology is more subdued relative to Q3c and Q4. Q3b is also distinguished by an immature soil development (< 5 cm thick A horizon) and locally immature varnish and desert pavement development. Q3b soils are characterized by Stage II pedogenic carbonate development.

$Q3b_c$ Alluvium (Holocene to late Pleistocene) $Q3b_c$ surfaces share the same characteristics described above

for Q3b, but are also characterized by the presence of crypto-biotic soil.

Q3a Alluvium (late Pleistocene) Q3a surfaces stand ~1.5 to 2.5 m above the active channel, are well-sorted, and display a strong desert pavement. Surface clasts are strongly varnished and have a strong orange-red rubification on their undersides. A subdued bar and swale morphology is still preserved (< 0.5 m of relief). A relatively well-developed soil is present beneath Q3a surfaces with a ~5- to 10-cm-thick A horizon.

Q2d Alluvium (late Pleistocene) Q2d surfaces occur ~2 to 4 m above the active channel and have mature desert pavement with strong varnish and rubification. Locally, however, surfaces have a less strongly-interlocking pavement with higher preservation of depositional bar and swale morphology. Soils are very silty and display Stage I pedogenic carbonate development. The TCN 10Be exposure age of the Q2d fan deposit is 91 +13/-12 ka (Foy, 2011; Foy et al., 2012).

Q2c Alluvium (late Pleistocene) Q2c surfaces typically occur ~2 to 4 m above the active channel and display the classic flat, planar desert pavement surface. Surface clasts are heavily varnished, well-sorted, and display dark orange-red rubification on their undersides. Surface clasts are tightly-packed and completely interlocking. Original bar and swale morphology is very subdued to nonexistent. Soils are well-developed with a ~10- to 15-cm-thick A horizon and Stage III pedogenic carbonate development. The TCN 10Be exposure age of the Q2d fan deposit is 96 +9/-8 ka (Foy, 2011; Foy et al., 2012).

Q2b Alluvium (late Pleistocene) Q2b surfaces are stratigraphically and topographically higher than younger deposits (~3 to 9 m above the active channel) and are best characterized by their strongly dissected nature and the fact that they are beginning to round off and diffuse into the surrounding landscape. Strong varnish and rubification can still be found on surface clasts but desert pavement is beginning to wear away and clasts are no longer as strongly interlocking as with the Q2c surface. Surface clasts are often weathered, and little or no depositional morphology is preserved. Q2b surfaces also contain a well-developed, bouldery soil with ~10- to 20-cm-thick A horizon and Stage III pedogenic carbonate development. Q2b surfaces are concentrated in the southern portion of Clayton Valley and are more heavily vegetated than surfaces farther north. The TCN 10Be exposure age of the Q2d fan deposit is 137 +10/-11 ka (Foy, 2011; Foy et al., 2012).

Q2a Alluvium (middle to late Pleistocene) Q2a deposits are the oldest alluvial units described in this portion of Clayton Valley and stand highest above the active channel (~6 to 10+ m). Q2a surfaces are generally sharp crests with little or no depositional morphology preserved. A mature soil is formed beneath the surface consisting of a ~10- to 20- cm thick A horizon. Surfaces have a similar morphology to Q2b but are strongly weathered and dissected. Surface clasts are moderately to heavily varnished and strongly rubified.

Other Deposits

Qs Eolian sand (Holocene to late Pleistocene) Unconsolidated eolian deposits of tan-yellow sand and silt. Eolian deposits include large sand dunes near the center of the valley and surrounding areas that are covered by unconsolidated sand deposits.

Qp Playa deposits (Holocene to late Pleistocene) Playa deposits consisting of gray-brown sand, silt, and clay. The playa is vegetated and is the remnant of late Quaternary pluvial lake(s) in Clayton Valley.

B Bedrock (undivided) White-tan sedimentary rocks of unknown age consisting of sandstone, shale, marl, conglomerate, and breccia.

V Extrusive volcanic rocks (undivided) White volcanic ash deposits of unknown age.

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