Surficial Landform Map of Eolian Activity in Silver State Valley and Paradise Valley Portions of the Winnemucca Dune Complex, Humboldt County, Nevada, USA

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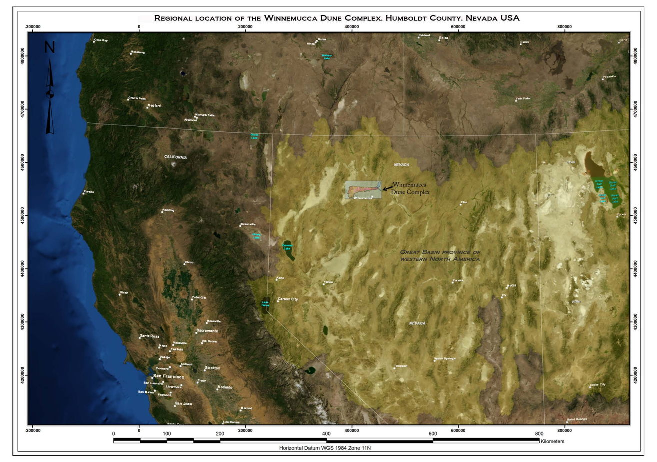
Base image layer provided by:
Environmental Systems Research Institute (ESRI)Seamless color mosiac generated by ESRI with best available imagery from 2012-13 using various sources; DigitalGlobe & Aerials Express (0.3m and 0.6m), GeoEye Ikonos & I-cubed (1m) & USGS Landsat.

References:
Compton, R.R., 1960. Contact metamorphism in the Santa Rosa Range, Nevada: Geological Society of America Bulletin, vol. 71, no. 9, p. 1383-1416.
Harrill, J.R., Moore, D.O., 1970. Effects of Groundwater Development on the Water Regime of Paradise Valley, Humboldt County, Nevada, 1949-1969: *Water Resources Bulletin*, no. 39, Nevada Dept. of Conservation and Natural Resources, 123 p.
NAIP 1994, 2006: National Argicultural Imagery Program, United States Department of Argriculture, Digital Orthoquadrangles, partial to full coverage of WDC in Humbodlt County, Nevada.
Prudic, D.E., Hermen, M.E., 1996. Groundwater flow and simulated effects of development in Pardise Valey: *U.S.G.S. professional paper 1409-F*, 90 p.
Stewart, J.W., Carlson, J.E., 1978. Geologic Map of Nevada: Nevada Bureau of Mines and Geology Map, scale 1:500,000.
USGS 1981-1982: United States Geological Survey, Provisional Edition 24k topographic quads; *Barrett Springs,* 41117-A8-TM-024, *Bloody Run Peak* 41117-B7-TM-024, *Golconda Butte,* 41117-A5-TM-024, *Silver State Draw,* 41117-B8-TM-024, *Weso*, 41117-A6-TM-024, *Winnemucca Mountain*, 41117-A7-TM-024. Note: published mapes are based upon field investigations performed in 1977 with dune field planimetry for the final map series was revised using 1980 aerial photographs.

Map Scale 1:16,429
Horizontal Datum: WGS 1984 Zone 11N

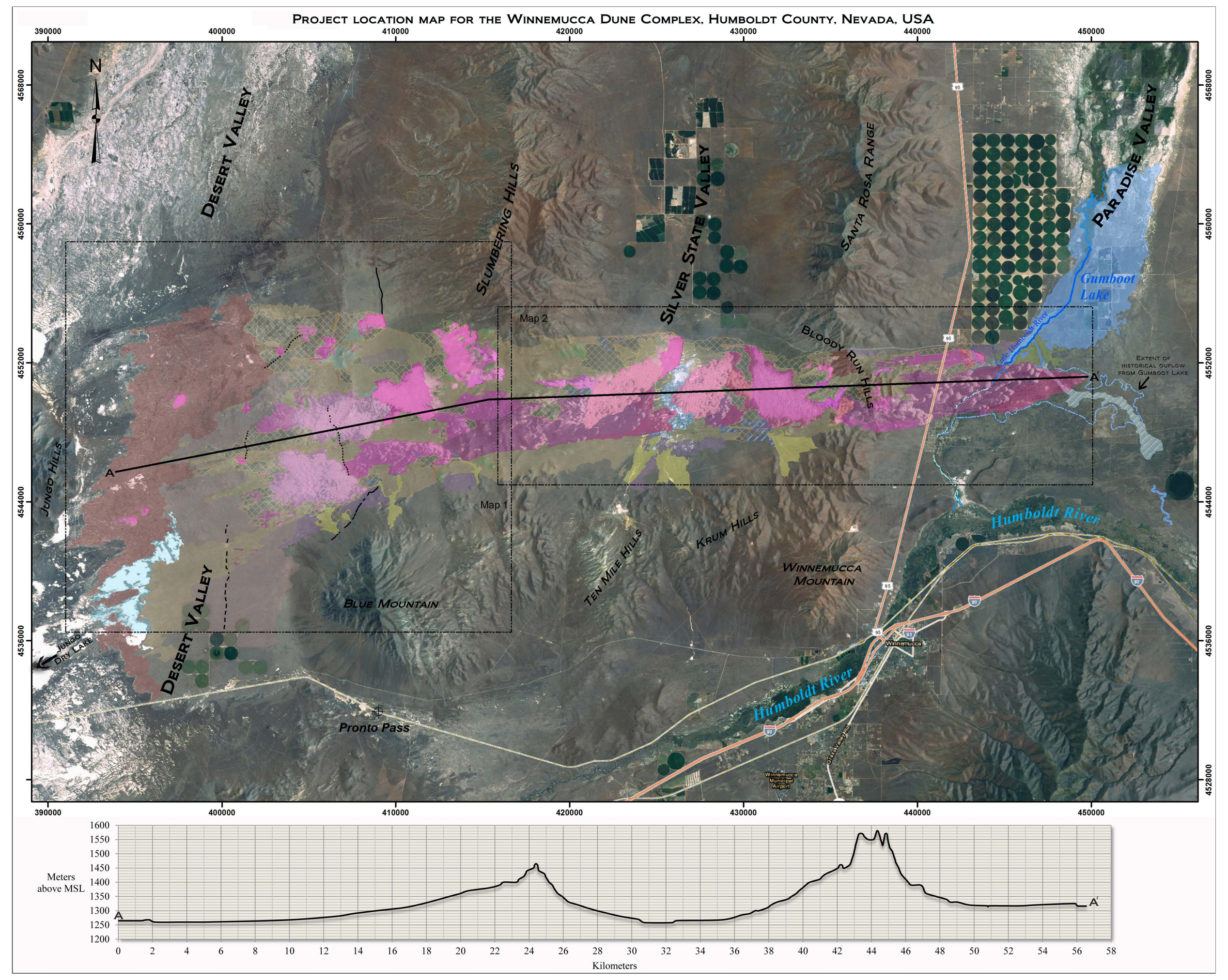
0 — 2.5 — 5 — 10 — 15 — 20 — 25 — 30 Kilometers

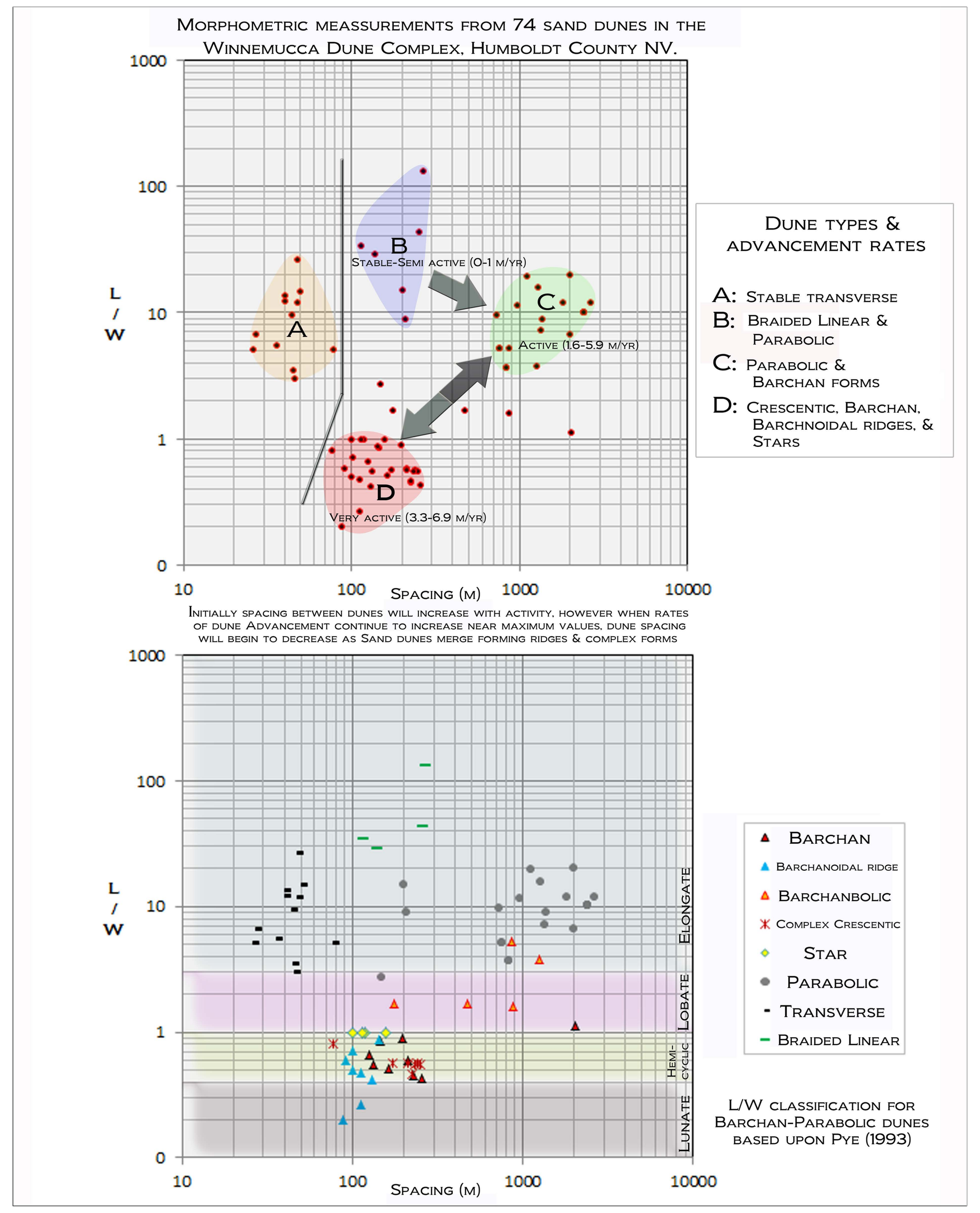


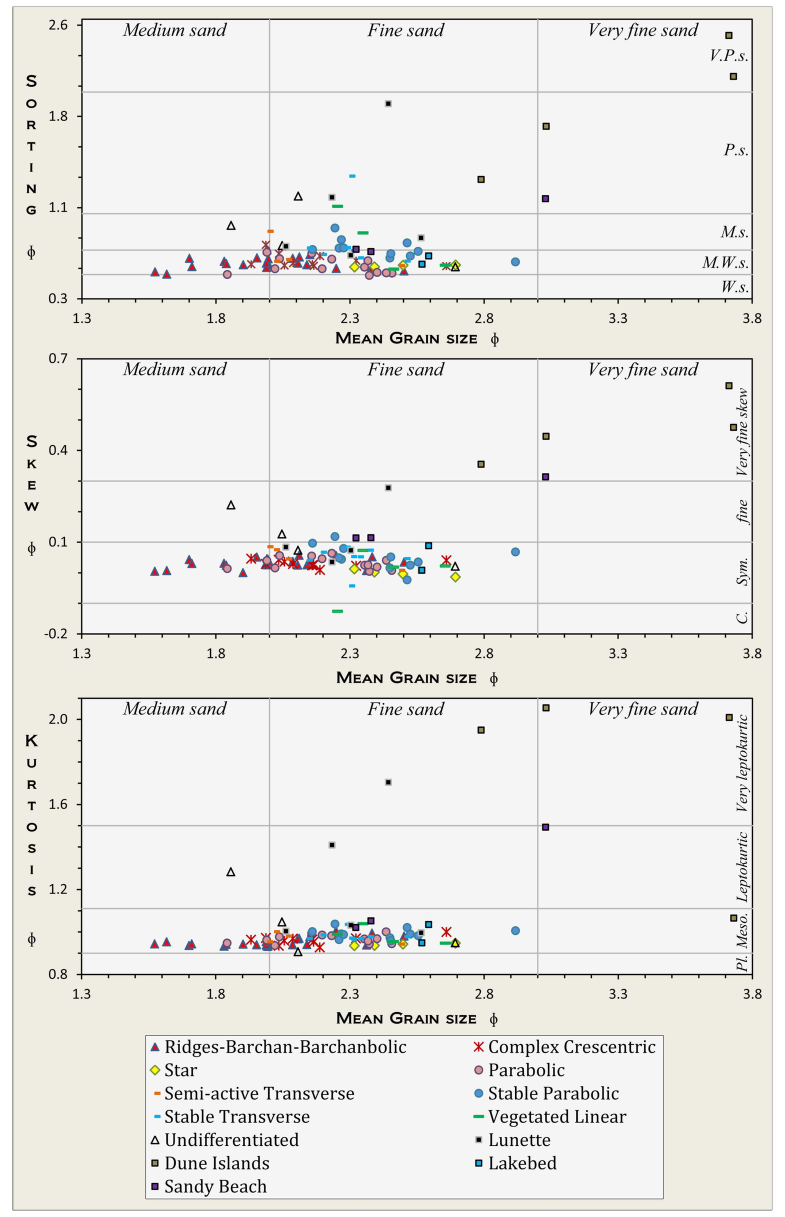
The Winnemucca Dune Complex (WDC) is the largest dune area (472 km^2) in Nevada and the Great Basin Province of western North America. Wind-blown sand deposits extend west to east for 60 km from Desert Valley through Silver State Valley and Paradise Valley and cross the intervening Slumbering Hills and Bloody Run Hills. Mapping of the eolian deposits provides the framework for studies of mineral composition and sources of sand, as well as for future research, including luminescence dating of deposits and landforms and the relationships between climate change and dunefield dynamics.

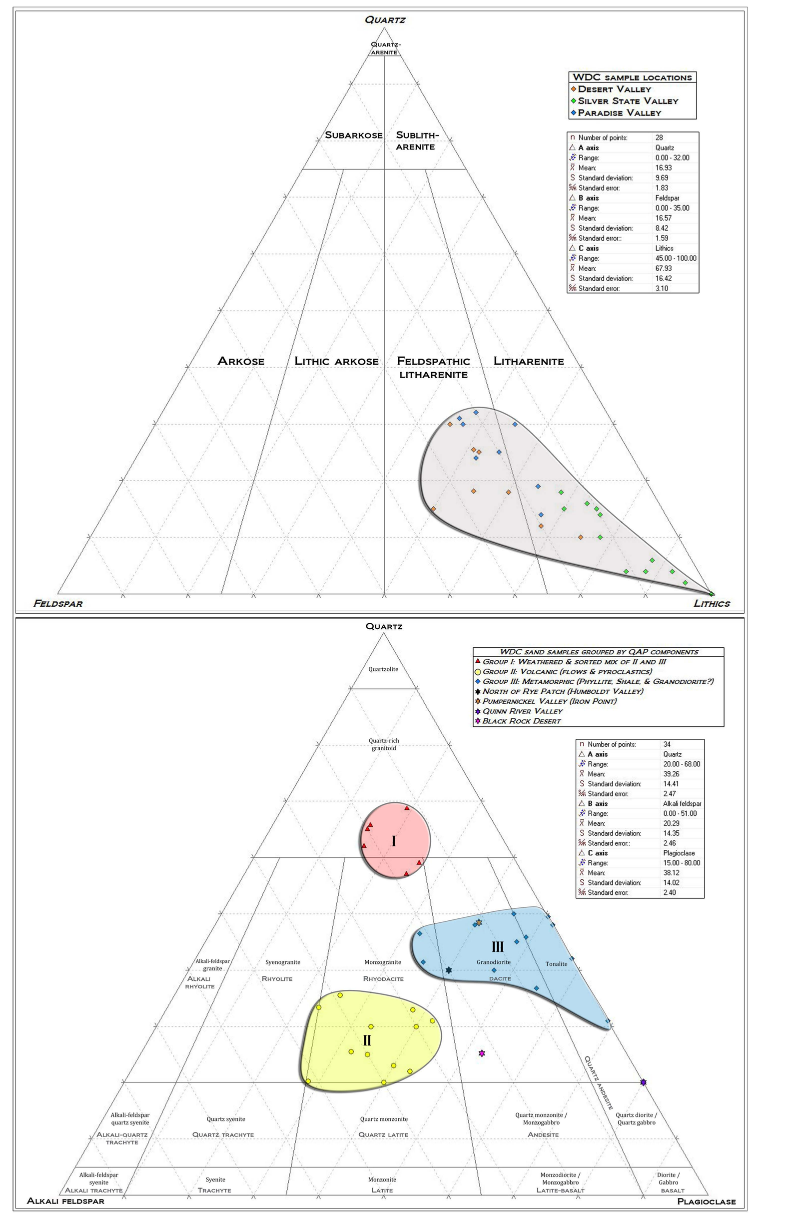
WDC exhibits a range of dune types including areas of active crescentic ridges and barchan-parabolic (barchanbolic) dunes (162 km^2) interlaced with stabilized to semi-active sand sheets, parabolic, transverse and linear dunes (310 km^2). Measurements from satellite imagery, historical aerial photographs, and topographic maps reveal that between the years 1980 to 2013 the direction and rate of sand dune advancement has fluctuated in space and time. Sand dunes in Silver State Valley and Paradise Valley shown on the surficial landform map have been advancing in the direction of 35-130^0 at rates varying from 0.2 to 6 m/yr.

Laser Granulometer analysis, X-ray Diffractometry, micro-stereoscopic inspection of standard thin sections, and Quartz (mono-polycrystalline) - Feldspar - Rock lithic ternary diagrams indicate that dune sediments physically weather from Very Pale Brown Litharenite medium sand into Pale Brown Feldspathic litharenite fine sand. Quartz - Alkali feldspar - Plagioclase ternary diagrams and X-ray Diffractometry demonstrated that during the process of dune stabilization and mineralogical maturation of dune sand the relative weight percent of total Quartz will increase 20 to 68% and the percent relative abundance of lithic material will decrease 100 to 45%. Quartz - Alkali feldspar - Plagioclase ternary diagrams and micro-stereoscopic inspection of thin sections also suggests dune sand is supplied by multiple local sources including volcanic, metamorphic, plutonic bedrock and lacustrine deposits.









Map Description:

⊕ Relevant geographic location

SS-00 **SS-00** Sand sample number and location (*Italic*) Particle size granulometer analysis (**Bold**) Particle size & X-ray diffractometry analysis, including stereoscopic evaluation of stained standard thin sections

Direction of sand transport interpreted from dune form on 2012 base imagery

min (m/yr) max (m/yr) Direction of sand transport with minimum and maximum rates of dune advancement shown in meters per year. Measured using base imagery, *1994 NAIP* (18yr. avg) no indicator *1980 USGS* (32yr. avg) quote `

Intermittent drainage channel
Little Humboldt River
Canal

Youngest ↑ … Oldest ↓

Qp3 Extent of playa and shoreline for ephemeral Gumboot Lake (occurs in late Winter to early Spring every 3 - 5 years).

Qfl2 Recent floodplain and playettes prone to sheetwash and ponding water from run-off and snowmelt

ATV BLM All-Terrain Vehicle Park.

Dist MF Sandman Project mining disturbance & burn-scar.

Dist? Potential livestock disturbance.

Qp2 Approximate extent of shoreline from 1952 highstand of Gumboot Lake. (*Prudic 1996*).

Qfl2a Historical outflow channels from Gumboot Lake during large floods on the Little Humboldt River *(Harrill & Moore 1970)*.

Unmapped areas outside project site.

(Qda) white to light grey & very pale brown, moderately well sorted, fine to medium feldspathic litharenite to litharenite sand

Qda1 to Qda9 not in chronological order

Qda1 Wind rippled crescentic sand dune complex. Composed of ridges (transverse & barchanoidal), star and lunate to hemicyclic shaped barchan-barchanbolic-parabolic dunes. Qda1 is comprisded of 3 complexes; Silver State East, West, and Paradise Valley. Dune heights range ~3-28 meters. Max. rate of advancement varies ~3 to 6 m/yr in the direction of 45-120°.

Qda2 Compound barchan-barchanbolic-parabolic dunes with hemicyclic-lobate shape. In the center of each field dunes merge and form transverse & barchanoidal ridges. Dune heights range ~2-28 meters. Qda2 is incised by Qfp & Qp1 in central Silver State Valley forming 2 seperated fields. Maximum rate of advancement varies ~2.3 to 5.6 m/yr in the direction of 81-115°.

Qda3 Compound barchanbolic & parabolic dunes with lobate to elongate shapes. Dune heights range ~2-10 meters. Several portions of Qda3 are stabilized by vegetation and degraded by livestock, ATVs, mining, precipitation, & bio-pedturbation. Max. rate of dune advancement is ~1.6 to 4.6 m/yr in the direction of 72-82°.

Qda4 Individual & compound barchanbolic and parabolic dunes with lobate-elongate shape. Dune heights range ~2-10 meters. Portions of Qda4 are stabilized by vegetation & degraded by livestock, ATVs, wildfires, mining, precipitation, & biopedturbation. Max. rate of advancement varies ~1.4 to 5.8 m/yr in the direction of 35-106°.

Qda5 Parabolic & undifferentiated sand dunes with sheeting sand. Located in areas of re-activated dune activity. Dunes & sheet form on the eastern flank of the Slumbering Hills overlaying several sections of unit Qdd and Qds1.

Qda2b Compound & individual barchanbolic and parabolic dunes with hemicyclic to lobate shape. Located in the Bloody Run Hills and south of the Feed lot in Paradise Valley. Dune heights range ~2-28 meters. Max. rate advancement varies ~2.0 to 4.2 m/yr in the direction of 77-115°.

Qda7 Climbing crescentic sand dunes & transverse ridges. Dunes ascend the SW slopes of the Bloody Run Hills above the Silver State Eastern Complex. Max. rate of advancement varies ~3.1 to 5.3 m/yr in the direction of 64-130°.

Qda8 Descending crescentic sand dunes on the eastern flanks of the Slumbering and Bloody Run Hills. Dunes descend hillslopes & begin stacking near the eastern boundary of the dune field. Max. rate of advancement varies ~1.4 to 4.3 m/yr in the direction of 43-88°.

Qda5b Compound barchanbolic & parabolic dunes forming in areas of re-activated dune activity. Dunes form along the perimeter of Qda1-2b in Silver State Valley & east side of Qda4 in central Paradise Valley overlaying unit Qfl2a. Max. rate of advancement varies ~1.3 to 5.9 m/yr in the direction of 72-102°.

Qda9 Climbing & ramping cliff-top sand dunes transvering the ridgeline of the Bloody Run Hills on the western margin of Paradise Valley. Lee (echo) dunes form between ridges. Max. rate of advancement is 2.3 m/yr in the direction of 87-90°.

(Qdd & Qds) grey to light yellowish pale brown & pale brown, moderately to poorly sorted, fine feldspathic litharenite sand

Qdd Partially to completely degraded sand dunes. Unit Qdd is concentrated on hillslopes & low lying areas in Silver State & Paradise Valleys. Dunes are degraded by precipitation, flooding, and ponding water.

Qds Stablized field boundary of WDC. Composed of relic parabolic dune tails, linear and undifferentiated crescentic dune forms. Qds is incised by Qfl2 and Qfl2a.

Qds1 Vegetated stable sand dunes in older inactive sections of the complex. Mostly parabolic & linear dunes with small sections of transverse dunes. Qds1 occurs along the perimeter & interior of Qda.

Qds2 Vegetated stable sand dunes. Linear dunes transforming to transverse dunes along the southern and northern boundary of WDC. Qds2 is incised by unit Qa at the base of the Krum Hills.

Qp1 *Late Holocene to present*, older to recent playas & playettes in Silver State Valley. Incises active & stable dunes.

Qfl1 *Late Holocene to present*, fluvial channel & floodplain terraces of the Little Humboldt River. Channel obstructed by Qda4.

Qfp *Late Holocene to present*, stable & active dunes degraded by palustrine scour & fill deposits in central Silver State Valley.

Qfc *Late Holocene to present,* fluvial fill-cut terraces of Gumboot Lake & the Little Humboldt River. Undifferentiated deposits comprised of sand dunes, river gravel, silty sand, and some clay. Abundant gastropod shells along contact of Qp3.

TRr **Tv+TRr** *Late Triassic to Early Jurasic* bedrock (TRr) from the metasedimentary Jungo Terrane. *Tertiary* flows of basalt & andesite (Tv) *(Compton 1960; Stewart & Carlson 1978)*. Detailed descriptions on Map 1.

Qa *Middle Holocene - recent* alluvial fans forming along northern flanks of the Ten Mile & Krum Hills. Depositional lobes from Qa degrade, cross-cut, &/or overlay portions of active & stable dunes belonging to Qda, Qdd, Qds, and Qds1 to 2.

Qu *Middle Holocene to present*, undifferentiated sand dune & fluvial deposits. Qu is incised and degraded by intermittent drainages along the SE corner of the Paradise Valley Feed Lot.