Rocks at the Reception Counter
of the Great Basin Science Sample and Records Library

All the rocks in the wooden core boxes on the front of the reception counter are from Nevada. They include some geologically and historically significant rocks: the Nevada State Rock (sandstone), one of the oldest rocks in Nevada (2.5-billion-year-old gneiss from Angel Lake), rocks from the "Great Unconformity" separating Precambrian gneiss and Cambrian sandstone (from Frenchman Mountain, where rocks like those at the base of the Grand Canyon are exposed), ore from the Comstock Lode at Virginia City (important in statehood, our nickname, the *Silver State*, and the motto "Battle Born"), rock from the top of Slide Mountain (which, as measured by high-precision global positioning system instruments, moved up and to the northeast in 2003 in response to probable magma injection at the north end of Lake Tahoe), and some of the youngest rocks in Nevada (caliche from Las Vegas Valley and ferricrete from Geiger Grade). These rocks have been cut to simulate diamond drill core. The Great Basin Science Sample and Records Library houses many boxes of core and cuttings from various mineral, oil, geothermal, and water exploration holes drilled in the State. Slabs of a few different background rocks provide contrast with the Nevada-shaped pieces. The countertop itself is polished Juparana Columbo "granite," which is actually, by geological definitions, a gneiss; it comes from India and looks somewhat like 1.7-billion-year-old gneiss from southern Nevada. Except where noted, the samples were collected by Jon Price, State Geologist and Director of the Nevada Bureau of Mines and Geology.

BACKGROUND ROCKS

On the top, above the Nevada shapes, mostly

Granodiorite (Cretaceous age)
From the Mount Rose Highway, Washoe County, collected by David Davis.

with lesser amounts of

Granite (Cretaceous age)
From the shaft dug for the 12.5-kiloton underground nuclear test, 367 meters below the surface, detonated on 26 October 1963, Project Shoal, Sand Springs Range, Churchill County
REFERENCE

LaPointe, D.D., Davis, D., Price, J.G., and Price, E.M., 2005, The great Highway 50 rock tour, 2005 Earth science week field trip: Nevada Bureau of Mines and Geology Special Educational Series E-44, 10 p.

On the bottom, below the Nevada shapes, mostly

Basalt (Quaternary age)
Mustang area, Washoe County, collected by David Davis.
REFERENCE

LaPointe, D.D., and Price, J.G., 2008, No child left inside, A field trip for families and rockhounds, Earth science week 2008: Nevada Bureau of Mines and Geology Special Educational Series E-47, 10 p.

with lesser amounts of

Basalt (Miocene age)
From the Martin Marietta quarry in the Mustang area, Washoe County
REFERENCE

LaPointe, D.D., and Price, J.G., 2008, No child left inside, A field trip for families and rockhounds, Earth science week 2008: Nevada Bureau of Mines and Geology Special Educational Series E-47, 10 p.

NEVADA SHAPES

The number refers to the column, starting at the left; the letter refers to the row, starting at the top.

1 J. Rhyolite tuff or ignimbrite
partially altered to green celadonite, $K(Mg,Fe^{2+})(Fe^{3+},Al)Si_4O_{10}(OH)_2$,
Windous Butte Formation, Grant Range, Nye County
(an Oligocene volcanic-rock reservoir in the Trap Spring oil field
in nearby Railroad Valley).

2 I. Rhyolite vitric tuff or ignimbrite (Tertiary age). Black pumice fragments occur in this brick-red-colored welded tuff, Jackpot, Elko County.

3 H. Epidote, $Ca_2Al_2FeSi_30_{12}(OH)$,
in hydrothermally altered Cretaceous granitic rock
from the Pine Nut Mountains,
found in a boulder in Quaternary sediments
Carson Valley, Douglas County.

4 G. Piemontite-bearing ignimbrite (Triassic-Jurassic age). Piemontite (also spelled piedmontite, $Ca_2(Al,Mn,Fe)_3(SiO4)_3(OH)$, a manganese-rich epidote) occurs as bright-red crystals; the general red color of the rock is from hematite, Fe_2O_3.
Collected from the northwest side of Peavine Peak, Washoe County.

5 F. Quartz, SiO_2, that has replaced bladed crystals of calcite, $CaCO_3$. Sample from Tuscarora, Elko County, collected by Steve Castor.
REFERENCES:

Henry, C.D., Boden, D.R., and Castor, S.C., 1999, Geologic map of the Tuscarora Quadrangle, Nevada: Nevada Bureau of Mines and Geology Map 116, 1:24,000 scale, with text, 20 p.

5 G. Tourmaline breccia. Breccia fragments of Triassic felsic volcanic rock, Buckskin Range, Lyon County.

6 G. Feldspar Porphyry (Eocene age)
with feldspar crystals partially replaced by **malachite**, $Cu_2CO_3(OH)_2$
from the Phoenix Project, Battle Mountain district, Lander County.

7 H. Conglomerate (Tertiary age). This sample was silicified (partially replaced and cements with quartz, SiO_2) and, presumably later, pebbles and grains in the matrix were colored red with coatings of hematite, Fe_2O_3, sample collected south of Eagle's House, Churchill County.

8 I. Chrysocolla. Vein of quartz, SiO_2, chrysocolla, $(Cu^{2+},Al)_2H_2Si_2O_5(OH)_4{\cdot}nH_2O$, and goethite, FeO(OH), plus perhaps malachite, $Cu_2(CO_3)(OH)_2$, Contact, Elko County.

9J. Sandstone (Oligocene age). Sandstone with volcanic fragments, Wadsworth area, Washoe County.

10 J. Rhyolite tuff or ignimbrite (Tertiary age), Lincoln County.

10 K. Copper vein in granodiorite (Jurassic age). Vein of quartz, SiO_2, and chrysocolla, $(Cu^{2+},Al)_2H_2Si_2O_5(OH)_4{\cdot}nH_2O$, plus perhaps malachite, $Cu_2(CO_3)(OH)_2$, Contact, Elko County.

11 J. Sandstone (Aztec Sandstone, Jurassic age)
collected near Colorrock quarry, Muddy Mountains, southwest of Valley of Fire, Clark County.
This sample contains one small (4 mm diameter) hematite (Fe_2O_3) concretion.

11 K. Pebble-rich sandstone (Tapeats Sandstone, Cambrian age)
collected above the "Great Unconformity" (between the Precambrian and Paleozoic eras)
at the base of Frenchman Mountain, south of Lake Mead Boulevard, Las Vegas, Clark County.
This sample contains small pebbles.

11 L. Gneiss (Precambrian age), dominated by felsic minerals (orthoclase, $KAlSi_3O_8$, plagioclase, $NaAlSi_3O_8$-$CaAl_2Si_2O_8$, and quartz, SiO_2) with less biotite, $K(Mg,Fe)_3AlSi_3O_{10}(OH)_2$);
collected below the "Great Unconformity" (between the Precambrian and Paleozoic eras)
at the base of Frenchman Mountain, south of Lake Mead Boulevard, Las Vegas, Clark County.
REFERENCE:

Tingley, J.V., Purkey, B.W., Duebendorfer, E.M., Smith, E.I., Price, J.G., and Castor, S.B., 2008, Geologic tours in the Las Vegas area, expanded edition with GPS coordinates: Nevada Bureau of Mines and Geology Special Publication 16, 144 p.

12 J. Sandstone (Aztec Sandstone, Jurassic age)
collected by Dennis Bryan near Red Rock Canyon, Spring Mountains, Clark County.
REFERENCE:

Tingley, J.V., Purkey, B.W., Duebendorfer, E.M., Smith, E.I., Price, J.G., and Castor, S.B., 2008, Geologic tours in the Las Vegas area, expanded edition with GPS coordinates: Nevada Bureau of Mines and Geology Special Publication 16, 144 p.

12 K. Sandstone (Tapeats Sandstone, Cambrian age)
collected above the "Great Unconformity" (between the Precambrian and Paleozoic eras)
at the base of Frenchman Mountain, south of Lake Mead Boulevard, Las Vegas, Clark County.
This sample contains splotches of brown goethite (FeO(OH)).

12 L. Mafic gneiss (Precambrian age), dominated by biotite, $K(Mg,Fe)_3AlSi_3O_{10}(OH)_2$) with lesser amounts of felsic minerals (orthoclase, $KAlSi_3O_8$, plagioclase, $NaAlSi_3O_8$-$CaAl_2Si_2O_8$, and quartz, SiO_2);
collected below the "Great Unconformity" (between the Precambrian and Paleozoic eras)
at the base of Frenchman Mountain, south of Lake Mead Boulevard, Las Vegas, Clark County.
REFERENCE:

Tingley, J.V., Purkey, B.W., Duebendorfer, E.M., Smith, E.I., Price, J.G., and Castor, S.B., 2008, Geologic tours in the Las Vegas area, expanded edition with GPS coordinates: Nevada Bureau of Mines and Geology Special Publication 16, 144 p.

13 J. Dumortierite, $Al_7O_3(BO_3)(SiO_4)_3$,
is the blue- and lavender-colored mineral, with andalusite, Al_2SiO_5, and quartz, SiO_2, in this metamorphosed Rochester Rhyolite, Triassic Koipato Group, Champion mine, Humboldt Range, Pershing County.
(sample donated by John Fulton, son of John A. Fulton, Director of the Nevada Bureau of Mines from 1929 to 1939)

13 K. Dumortierite, $Al_7O_3(BO_3)(SiO_4)_3$,
is the purple mineral, with andalusite, Al_2SiO_5, and quartz, SiO_2, in this metamorphosed Rochester Rhyolite, part of the Triassic Koipato Group, Lincoln Hill, Humboldt Range, Pershing County.

14 J. Porphyritic rhyolite (Eocene age)
with phenocrysts of **plagioclase**, $(Na,Ca,K)(Al,Si)_2Si_2O_8$, **quartz**, SiO_2,
hornblende, $(Ca,Na,K)_{2-3}(Mg,Fe,Mn)_3(Al,Fe)_{2-1}(Si,Al)_8O_{22}(O,OH,F)_2$,
biotite, $K(Fe,Mg)_3AlSi_3O_{10}(OH)_2$, and **sanidine**, $(K,Na,Ca)(Si,Al)_2Si_2O_8$,
Tuscarora Mountains, Elko County.
This 39 million-year-old rock is approximately the same age as gold mineralization along the Carlin trend and many other major gold-producing areas in Nevada.
REFERENCES:

Henry, C.D., and Boden, D.R., 1998, Geologic map of the Mount Blitzen Quadrangle, Nevada: Nevada Bureau of Mines and Geology Map 110, 1:24,000 scale, with text, 20 p.

Ressel, M.W., and Henry, C.D., 2006, Igneous geology of the Carlin trend, Nevada: Development of the Eocene plutonic complex and significance for Carlin-type Gold deposits: Economic Geology, v. 101, p. 347-383.

15 I. Tuff of Castle Peak (Miocene age), Monte Cristo Range, Esmeralda County.
REFERENCES:

Price, J.G., and Price, E.M., 2006, Volcanic and sedimentary rocks of the Monte Cristo range, Esmeralda County, Nevada: EarthCache site, available at http://www.nbmg.unr.edu/earthcache/MonteCristoRange.pdf.

Stewart, J.H., Kelleher, P.C., and Zorich, E.A., 1994, Geologic map of the Monte Cristo Range area, Esmeralda and Mineral Counties, Nevada: U.S. Geological Survey Miscellaneous Field Studies Map MF-2260, 1:62,500 scale, with text, 15 p.

16 H. Tuff of Hoover Dam (Tertiary age). From the walls of Hoover Dam, Clark County.

17 G. Flow-banded rhyolite (Tertiary age), Elko County.

18 F. Rhyolite (Miocene age)
with quartz, SiO_2, blackened by alpha radiation damage
Toano Range, Elko County.
REFERENCE: Price, J.G., Castor, S.B., and Miller, D.M., 1992, Highly radioactive topaz rhyolites of the Toano Range, northeastern Nevada: American Mineralogist, v. 77, p. 1067-1073.

19 E. Granite (Cretaceous age). From the shaft dug for the 12.5-kiloton underground nuclear test, 367 meters below the surface, detonated on 26 October 1963, Project Shoal, Sand Springs Range, Churchill County.
REFERENCE

LaPointe, D.D., Davis, D., Price, J.G., and Price, E.M., 2005, The great Highway 50 rock tour, 2005 Earth science week field trip: Nevada Bureau of Mines and Geology Special Educational Series E-44, 10 p.

20 D. Anhydrite (Jurassic age). Ca_2S0_4, metamorphosed Jurassic marine gypsum, $Ca_2S0_4{\cdot}2H_2O$, from the Empire gypsum mine, Pershing County.

21 C. Anhydrite (Jurassic age). Ca_2S0_4, metamorphosed Jurassic marine gypsum, $Ca_2S0_4{\cdot}2H_2O$, from the Adams Claim (Art Wilson Co.) gypsum mine, Virginia Range, Lyon County.

21 D. Basalt (Miocene age), From the Martin Marietta quarry near Mustang, Washoe County.

22 D. Barite, $BaSO_4$ (Paleozoic age, bedded, sedimentary). Sample from the P&S mine, Nye County, collected by Steve Castor.
REFERENCE:

Papke, K.G., 1984, Barite in Nevada: Nevada Bureau of Mines and Geology Bulletin 98, 125 p.

23 E. Chert (Mississippian age). Monte Cristo Formation, Clark County; sample donated by Rachel Dolbier, Administrator of the W.M. Keck Earth Science and Mineral Engineering Museum, Mackay School of Earth Sciences and Engineering, University of Nevada, Reno.

24 F. Nevada Wonder Stone = rhyolitic air-fall tuff (Miocene age)

This volcanic rock has an unusual origin that is tied to much of Nevada's history. Collectors call this rock "Nevada Wonder Stone." It occurs in several areas of Nevada, but this sample was found south of Eagles House in the Lahontan Mountains, southeast of Fallon, near Grimes Point, in Churchill County. The rock is a rhyolitic air-fall tuff, material ejected from a volcano about 12 million years ago. Volcanoes in western Nevada at that time were part of what is now the Cascade Mountains.

The rock has been altered by hot waters, much like hot springs, that deposited pyrite (FeS_2) and quartz (SiO_2). Hot springs are still common in Nevada; some are used by geothermal power plants to produce electricity for use here and in California. This type of hydrothermal alteration is commonly associated with the gold and silver deposits that have been so important to Nevada. Nevada, the Silver

State, entered the Union in 1864 because its rich silver deposits on the Comstock Lode were needed for the war (hence the mottoes "Battle Born" on the state flag and "All for Our Country" on the state seal). We are currently in the midst of the biggest gold-mining boom in American history. Nevada leads the nation in gold production and accounts for approximately 8% of current world production of gold.

Rainwater penetrated the rock and oxidized the pyrite to form liesegang bands of red hematite (Fe_2O_3) and orange and brown goethite (FeO(OH)). Erosion broke pieces of the rock from its outcrop, and streams carried pebbles to the shore of Lake Lahontan, which covered much of western Nevada during the Pleistocene Epoch. The pebbles were tumbled and polished by the streams and by wave action along the shore of the lake about 13,000 years ago. Today, remnants of ancient Lake Lahontan include Pyramid Lake and Walker Lake.

Prehistoric people, who hunted and drew petroglyphs along the shore of the lake, occasionally used this rock for stone tools. Smooth pebbles reportedly have therapeutic value as worry stones.

25 E. Flow-banded rhyolite (Miocene age). From the Martin Marietta quarry near Mustang, Washoe County.

26 D. Algal limestone (Miocene age). Sample from the Horse Spring Formation, White Basin, Clark County, collected by Steve Castor.

REFERENCE:

Castor, S.B., 1993, Borates in the Muddy Mountains, Clark County, Nevada: Nevada Bureau of Mines and Geology Bulletin 107, 31 p.

26 E. Flow-banded rhyolite (Miocene age), Monte Cristo Range, Esmeralda County.

27 E. Aplite (Cretaceous rock, metamorphosed during Tertiary extension), Drinkwater pit, Mineral Ridge, Esmeralda County.

28 F. Ore from the Comstock Lode at Virginia City, Storey County (Miocene age). This piece of the Comstock Lode, with quartz, SiO_2, with pyrite, FeS_2, and possibly argentite, Ag_2S, came from the Loring cut near the Fourth Ward School. Silver from the Comstock was vital for Nevada's statehood in 1864; it gave rise to our nickname, the *Silver State*, and the motto "Battle Born."

REFERENCE:

Hudson, D.M., Castor, S.B., and Garside, L.J., 2002, Preliminary geologic map of the Virginia City Quadrangle, Nevada: Nevada Bureau of Mines and Geology Open-File Report 03-15, 1:24,000 scale.

29 G. Veinlet of quartz, SiO_2, with sphalerite, ZnS, chalcopyrite, $CuFeS_2$, and galena, PbS, in altered andesite from the ore stockpile at the Kendall cut on the Comstock Lode, Virginia City, Storey County. The ore is Miocene in age.

REFERENCE:

Hudson, D.M., Castor, S.B., and Garside, L.J., 2002, Preliminary geologic map of the Virginia City Quadrangle, Nevada: Nevada Bureau of Mines and Geology Open-File Report 03-15, 1:24,000 scale.

30 H. Andesitic breccia (Miocene age). Sample of propylitic alteration (characterized by pistachio-green epidote, $Ca_2Al_2FeSi_30_{12}(OH)$, and dark green chlorite, $(Mg,Fe,Al)_3(Al,Si)_4O_{10}(OH)_2{\cdot}(Mg,Fe)_3(OH)_6$, that is characteristic of the country rock in the vicinity of the Comstock Lode, Virginia City, Storey County. This rock, a probable lahar or mud-flow breccia composed of various volcanic rock fragments, is part of the Silver City suite.

REFERENCE:

Hudson, D.M., Castor, S.B., and Garside, L.J., 2002, Preliminary geologic map of the Virginia City Quadrangle, Nevada: Nevada Bureau of Mines and Geology Open-File Report 03-15, 1:24,000 scale.

31 I. Rhyolite tuff or ignimbrite (Tertiary age), Storey County. Santiago Canyon Tuff, erupted from central Nevada and deposited in the Virginia City area; later altered with green chlorite, $(Mg,Fe,Al)_3(Al,Si)_4O_{10}(OH)_2{\cdot}(Mg,Fe)_3(OH)_6$, replacing some of the pumice fragments. This propylitic alteration occurs in a wide area around the Comstock Lode.

REFERENCE:

Hudson, D.M., Castor, S.B., and Garside, L.J., 2002, Preliminary geologic map of the Virginia City Quadrangle, Nevada: Nevada Bureau of Mines and Geology Open-File Report 03-15, 1:24,000 scale.

32 J. Diorite (Miocene age). Sample of the Davidson Diorite collected from the Loring cut near the Fourth Ward School in Virginia City, Storey County. This rock, as are many rocks near the Comstock Lode, is characteristic of propylitic alternation, with patches of white albite, $NaAlSi_3O_8$, and dark green chlorite, $(Mg,Fe,Al)_3(Al,Si)_4O_{10}(OH)_2 \cdot (Mg,Fe)_3(OH)_6$.

REFERENCE:

Hudson, D.M., Castor, S.B., and Garside, L.J., 2002, Preliminary geologic map of the Virginia City Quadrangle, Nevada: Nevada Bureau of Mines and Geology Open-File Report 03-15, 1:24,000 scale.

33 K. Ferricrete, a rock composd of fragments of other rock cemented with iron oxide (hematite, Fe_2O_3) or iron oxyhydroxide (goethite, FeO(OH), from Geiger Grade, Washoe County. The fragments are hydrothermally altered Miocene volcanic rocks that have been cemented with goethite and perhaps hematite that precipitated from natural acid-rock drainage from a nearby pyrite-rich occurrence. The ferricrete is Quaternary in age.

34 L. Sinter (Quaternary age). Red cinnabar, HgS, and quartz, SiO_2, and possible opal, $SiO_2 \cdot nH_2O$, where the new limited access portion of U.S. Highway 395 crosses the Steamboat hot springs, Washoe County.

35 L. Conglomerate (probably Quaternary age). Silicified and pyritized congrlomerate from the Lewis and Crofoot gold mine, Sulphur, Humboldt County.

35 M. Quartz monzonite (Jurassic age), Austin, Lander County.

36 L. Tufa (calcite, $CaCO_3$), Quaternary age, collected east of Grimes Point, Churchill County.

REFERENCE

LaPointe, D.D., and Price, J.G., 2008, No child left inside, A field trip for families and rockhounds, Earth science week 2008: Nevada Bureau of Mines and Geology Special Educational Series E-47, 10 p.

36 M. Skarn

a contact metamorphosed Mesozoic carbonate rock along the contact with a Cretaceous granitic rock, with **thulite, manganese-rich clinozoisite**, $Ca_2(Al,Mn)_3Si_30_{12}(OH)$ – the pink mineral, and **diopside**, $CaMgSi_2O_6$ – the green mineral

Gabbs Valley Range, north of Luning, Mineral County.

36 N. Molybdenum vein in granodiorite (Cretaceous age). Vein of quartz, SiO_2, pyrite, FeS_2, molybdenite, MoS_2, and orthoclase, $KAlSi_3O_8$, in granodiorite, Springer mine, Eugene Mountains, Humboldt County.

REFERENCE:

Thole, R.H., and Prihar, D.W., 1998, Geological map of the Eugene Mountains, northwestern Nevada: Nevada Bureau of Mines and Geology Map 115, 1:24,000-scale.

37 L. Coquina (freshwater limestone composed almost entirely of gastropod fossils, cemented by calcite, $CaCO_3$), Pleistocene age, Mopung Hills, Churchill County

REFERENCE

LaPointe, D.D., and Price, J.G., 2008, No child left inside, A field trip for families and rockhounds, Earth science week 2008: Nevada Bureau of Mines and Geology Special Educational Series E-47, 10 p.

37 M. Tourmaline breccia. Breccia fragments of Triassic(?) mafic igneous rock are cemented by finely intergrown quartz (SiO_2) and black tourmaline (schorl, $NaFe_3Al_6(B0_3)_3Si_6O_{18}(0H)_4$) in a vein exposed about 3 km northeast of Mound House (east of Carson City), Lyon County. Coarsely crystalline pink calcite is also found as cement. The mafic igneous rock fragments are lightened (probably albitized – replace with albite, $NaAlSi_3O_8$) along and in the vein. Fragments of the vein are found in gravel under ~27 Ma ash-flow tuff about 2 km to the east. Sample number GRE-129C, donated by Larry Garside.

REFERENCES:
Bingler, E.C., 1977, Geologic map of the New Empire Quadrangle, Nevada: Nevada Bureau of Mines and Geology Map 59.
Gianella, V.P., 1936, Geology of the Silver City District and the southern portion of the Comstock Lode, Nevada: Nevada Bureau of Mines and Geology Bulletin 29 [University of Nevada Bulletin, v. 30, no 9], 108 p.

37 N. Gneiss (Archean age, 2.5 billion years old), Angel Lake, East Humboldt Range, Elko County.
REFERENCE
Lush, A. P., A. J. McGrew, A. W. Snoke, and J. E. Wright, 1988, Allochthonous Archean basement in the East Humboldt Range, Nevada: Geology v. 16, p. 349-353.

38 L. Caliche (Quaternary age). Summerlin subdivision, Las Vegas Valley, with pebbles of Paleozoic limestone, sandstone, and chert and Jurassic sandstone eroded from the Spring Mountains to the west, Clark County.

38 M. Andesite (Tertiary age). Monte Cristo range, Esmeralda County.
REFERENCES:
Price, J.G., and Price, E.M., 2006, Volcanic and sedimentary rocks of the Monte Cristo range, Esmeralda County, Nevada: EarthCache site, available at http://www.nbmg.unr.edu/earthcache/MonteCristoRange.pdf.
Stewart, J.H., Kelleher, P.C., and Zorich, E.A., 1994, Geologic map of the Monte Cristo Range area, Esmeralda and Mineral Counties, Nevada: U.S. Geological Survey Miscellaneous Field Studies Map MF-2260, 1:62,500 scale, with text, 15 p.

38 N. Gneiss (age uncertain – perhaps Cretaceous or Tertiary). Ruby Mountains, Elko County.

39 L. Basalt (Quaternary age). Sample from Lunar crater, Nye County, collected by Steve Castor. This sample contains large crystals of olivine, $(Mg,Fe)_2SiO_4$, and clinopyroxene, $(Mg,Fe,Ca)SiO_3$.
REFERENCE:
Price, J.G., and Price, E.M., 2006, Easy Chair crater: EarthCache site, available at http://www.nbmg.unr.edu/earthcache/EasyChairCrater.pdf.

39 M. Dolomite (Cambrian age). Notch Peak Dolomite, Pequop Mountains, Elko County. This rock exhibits "zebra dolomite" texture in which the original (sedimentary-diagenetic) dolomite has been partially recrystallized to form white bands or course dolomite. The sample also contains chert.

40 L. Siltstone (Eocene age). This tuffaceous siltstone from the Dead Horse Tuff, contains leaf fossils. Copper Basin, Lander County. The sample was collected and donated by Steve Fechner, U.S. Forest Service.

41 K. Dolomite (Devonian age). Simonson Dolomite, with *Amphipora* fossils (a reservoir rock for oil in other parts of Nevada), from the Bruffey Canyon area in the Piñon Range, Eureka County.

42 J. Siltstone (Triassic age). Rasberry Formation, with fossil clams (*Monotis subcircularis*), Eugene Mountains, Humboldt County. Sample collected by D.D. La Pointe.
REFERENCE:
Thole, R.H., and Prihar, D.W., 1998, Geological map of the Eugene Mountains, northwestern Nevada: Nevada Bureau of Mines and Geology Map 115, 1:24,000-scale.

43 I. Limestone breccia
(limestone of the Devonian Nevada Formation, mineralized during the Eocene Epoch), with goethite, $FeO(OH)$, and hematite, Fe_2O_3, staining from oxidation of pyrite, FeS_2, Gold Bar mine, Roberts Mountains, Eureka County.

44 H. Conglomerate
Pennsylvanian Battle Formation from the Fortitude Mine, Battle Mountain district, Lander County.

45 G. Granodiorite (Cretaceous age). Collected from the top of Slide Mountain, Washoe County. Researchers at the Nevada Bureau of Mines and Geology and the Nevada Seismological Laboratory, in collaboration with colleagues from Caltech and the Smithsonian Institution, documented that Slide Mountain moved to the northeast 6 millimeters and upward 8 millimeters during an earthquake swarm late in 2003 deep in the Earth's crust at the northwest end of Lake Tahoe. The best explanation for the geodetic and seismic observations is magma injection.

REFERENCES

LaPointe, D.D., Price, J.G., Henry, C.D., Hammond, W., Smith, K., and Price, E.M., 2007, Taking the Pulse of the Earth, Slide Mountain, Steamboat Geothermal Area, and Rilite Aggregate Quarry in the Virginia Foothills, Guide for Earth Science Week Field Trip, October 20 or 21, 2007: Nevada Bureau of Mines and Geology Educational Series E-46.

Smith, K.D., von Seggern, D., Blewitt, G., Preston, L., Anderson, J.G., Wernicke, B.P., and Davis, J.L., 2004, Evidence for deep magma injection beneath Lake Tahoe, Nevada-California: Science, doi:10.1126/science.1101304, 2004.

45 H. Rhyolite tuff (Tertiary age). This rock, the Caetano Tuff, erupted 33.8 million years ago from a caldera located south of the Pipeline and Cortez Hills gold deposits in Lander and Eureka Counties. Collected by Chris Henry.

REFERENCES

Colgan, J.P., John, D.A., Henry, C.D., and Fleck, R.J., 2008, Large-magnitude Miocene extension of the Eocene Caetano caldera, Shoshone and Toiyabe Ranges, Nevada: Geosphere, v. 4, p. 107-131.

Gilluly, J., and Masursky, H., 1965, Geology of the Cortez Quadrangle, Nevada: U.S. Geological Survey Bulletin 1175, 117 p.

John, D.A., Henry, C.D., and Colgan, J.P., 2008, Magmatic and tectonic evolution of the Caetano caldera, north-central Nevada: A tilted mid-Tertiary eruptive center and source of the Caetano Tuff: Geosphere, v. 4, p. 75-106.

46 H. Fluorite, CaF_2 (Tertiary age). Sample from the Daisy mine, Fluorspar Canyon, northern part of Bare Mountain, Nye County, collected by Steve Castor. According to Papke (1979), the fluorspar occurs as hydrothermal replacement bodies in dolomite of the Cambrian Nopah Formation.

REFERENCE:

Papke, K.G., 1979, Fluorspar in Nevada: Nevada Bureau of Mines and Geology Bulletin 93, 77 p.

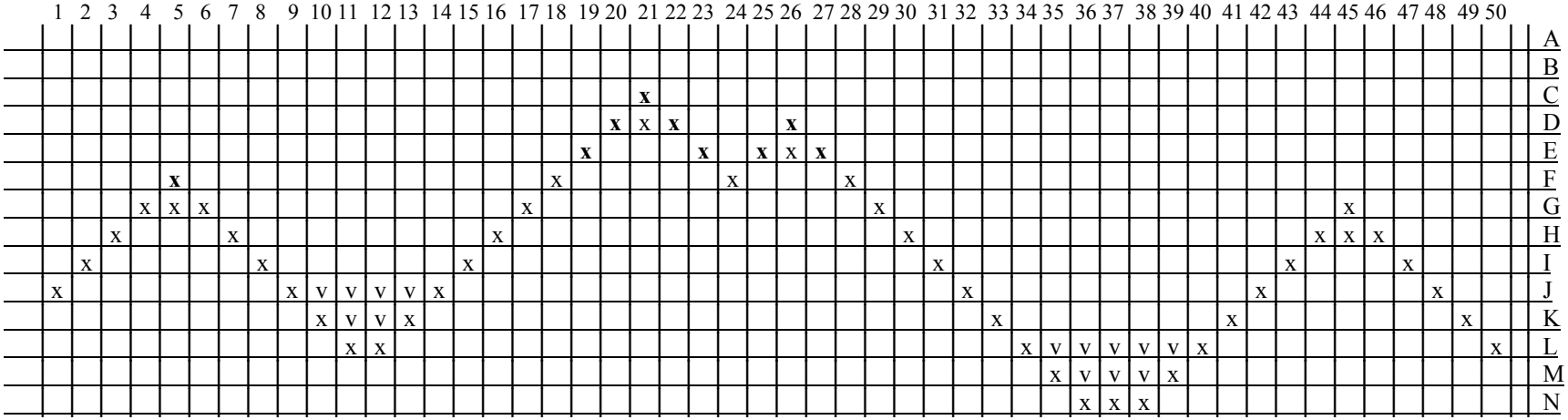
47 I. Magnetite ore. This rock is composed primarily of magnetite, Fe_3O_4, and apatite, $Ca_5(PO4)_3(OH,F,Cl)$. The ore is from a hydrothermal deposit associated with the Jurassic Humboldt loppolith, a large mafic intrusion, Buena Vista mine, Churchill County.

48 J. Massive sulfide ore (Paleozoic age). This rock is composed primarily of pyrrhotite, $Fe_{1-x}S$, with minor amounts of sphalerite, ZnS, and chalcopyrite, $CuFeS_2$. Rio Tinto mine, Elko County.

49 K. Hematite, Fe_2O_3, vein in a
Jurassic volcanic rock (**andesite**),
Buckskin Range, Lyon County.

50 L. Andesite (Miocene age)
underlying the Great Basin Science Sample and Records Library, Washoe County.
This rock contains 58.7% silica and is typical of andesites in continental arc settings. About 10 to 20 million years ago, this part of Nevada was probably part of what today is the Cascade Range of active volcanoes.

Columns


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
A
B
C
D
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M
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