

- Craig, L. C., Holmes, C. N., Cadigan, R. A., Freeman, V. L., Mullens, T. E., and Weir, G. W., 1955, Stratigraphy of the Morrison and related formations, Colorado Plateau region—a preliminary report: U.S. Geological Survey, Bulletin 1009-E, pp. 125-168.
- Flesch, G. A., 1974, Stratigraphy and sedimentology of the Morrison Formation (Jurassic), Ojito Spring quadrangle, Sandoval County, New Mexico—a preliminary discussion: New Mexico Geological Society, Guidebook to 25th Field Conference, pp. 185-195.
- , 1975, Stratigraphy, sedimentology, and environments of deposition of the Morrison (Upper Jurassic) Formation, Ojito Spring quadrangle, Sandoval County, New Mexico: Unpublished M.S. thesis, University of New Mexico, 106 pp.
- Freeman, V. L., and Hilpert, L. S., 1956, Stratigraphy of the Morrison Formation in part of northwestern New Mexico: U.S. Geological Survey, Bulletin 1030-J, pp. 309-334.
- Galloway, W. E., 1979, Morrison Formation of the Colorado Plateau; in Galloway, W. E., et al. (eds.), Depositional and ground-water flow systems in the exploration for uranium: University of Texas (Austin), Bureau of Economic Geology, pp. 214-228.
- Harland, W. B., Cox, A. V., Llewellyn, P. G., Pickton, C. A. G., Smith, A. G., and Walters, R., 1982, A geologic time scale: Cambridge, U.K., Cambridge University Press, 131 pp.
- Kozuschik, R. G., and Saucier, A. E., 1980, The Bernabe Montano uranium deposit, Sandoval County; in Rautman, C. A. (compiler), Geology and mineral technology of the Grants uranium region 1979: New Mexico Bureau of Mines and Mineral Resources, Memoir 38, pp. 262-268.
- Lee, M. J., and Brookins, D. G., 1978, Rubidium-strontium minimum ages of sedimentation, uranium mineralization, and provenance, Morrison Formation (Upper Jurassic), Grants mineral belt, New Mexico: American Association of Petroleum Geologists, Bulletin, v. 62, no. 9, pp. 1673-1683.
- Lupe, Robert, 1983, Stratigraphic sections of subsurface Jurassic rocks in the San Juan Basin, New Mexico, Colorado, Utah, and Arizona: U.S. Geological Survey, Oil and Gas Investigations Chart 118, 2 sheets.
- Maxwell, C. H., 1982, Mesozoic stratigraphy of the Laguna-Grants region: New Mexico Geological Society, Guidebook to 33rd Field Conference, pp. 261-266.
- McBride, E. F., 1963, A classification of common sandstones: Journal of Sedimentary Petrology, v. 33, pp. 664-669.
- McLemore, V. T., 1982, Uranium in the Albuquerque area, New Mexico: New Mexico Geological Society, Guidebook to 33rd Field Conference, pp. 305-311.
- Moench, R. H., 1963, Geologic map of the Laguna quadrangle, New Mexico: U.S. Geological Survey, Geologic Quadrangle Map 208, 1 sheet.
- Moench, R. H., and Puffett, W. P., 1963a, Geologic map of the Mesa Gigante quadrangle, New Mexico: U.S. Geological Survey, Geologic Quadrangle Map 212, 1 sheet.
- , 1963b, Geologic map of the Arch Mesa quadrangle, New Mexico: U.S. Geological Survey, Geologic Quadrangle Map 211, 1 sheet.
- Moench, R. H., and Schlee, J. S., 1967, Geology and uranium deposits of the Laguna district, New Mexico: U.S. Geological Survey, Professional Paper 519, 117 pp.
- Nash, J. T., 1968, Uranium deposits in the Jackpile sandstone, New Mexico: Economic Geology, v. 63, pp. 737-750.
- North American Commission on Stratigraphic Nomenclature, 1983, North American stratigraphic code: American Association of Petroleum Geologists, Bulletin, v. 67, no. 5, pp. 841-875.
- Odin, G. S. (ed.), 1982a, Numerical dating in stratigraphy: New York, John Wiley and Sons, 1040 pp.
- Odin, G. S., 1982b, The Phanerozoic time scale revisited: Episodes, v. 1982, pp. 3-9.
- Owen, D. E., 1982, Correlation and paleoenvironments of the Jackpile sandstone (Upper Jurassic) and intertongued Dakota Sandstone-Lower Mancos Shale (Upper Cretaceous) in west-central New Mexico: New Mexico Geological Society, Guidebook to 33rd Field Conference, pp. 267-270.
- Owen, D. E., and Siemers, C. T., 1977, Lithologic correlation of the Dakota Sandstone and adjacent units along the eastern flank of the San Juan Basin, New Mexico: New Mexico Geological Society, Guidebook to 28th Field Conference, pp. 179-183.
- Palmer, A. R., 1983, The decade of North American geology, 1983 geologic time scale: Geological Society of America, Geology, v. 11, pp. 503-504.
- Santos, E. S., 1975, Lithology and uranium potential of Jurassic formations in the San Ysidro-Cuba and Majors Ranch areas, northwestern New Mexico: U.S. Geological Survey, Bulletin 1329, 22 pp.
- Saucier, A. E., 1974, Stratigraphy and uranium potential of the Burro Canyon Formation in the southern Chama Basin, New Mexico: New Mexico Geological Society, Guidebook to 25th Field Conference, pp. 211-217.
- , 1976, Tectonic influence on uraniumiferous trends in the Late Jurassic Morrison Formation: New Mexico Geological Society, Special Publication no. 6, pp. 151-157.
- Schlee, J. S., and Moench, R. H., 1961, Properties and genesis of "Jackpile" sandstone, Laguna, New Mexico; in Peterson, J. A., and Osmond, J. C. (eds.), Geometry of sandstone bodies: American Association of Petroleum Geologists, pp. 134-150.
- , 1963a, Geologic map of the Moquino quadrangle, New Mexico: U.S. Geological Survey, Geologic Quadrangle Map 209, 1 sheet.
- , 1963b, Geologic map of the Mesita quadrangle, New Mexico: U.S. Geological Survey, Geologic Quadrangle Map 210, 1 sheet.
- Siemers, C. T., King, N. R., and Mannhard, G. W., 1975, Upper Jurassic and Upper Cretaceous stratigraphy and sedimentology—eastern San Juan Basin, New Mexico; in Field trips to central New Mexico—Rocky Mountain Section: American Association of Petroleum Geologists and Society of Economic Paleontologists and Mineralogists, pp. 1-98.
- Swift, E. R., 1956, Study of the Morrison Formation and related strata, north-central New Mexico: Unpublished M.S. thesis, University of New Mexico, 79 pp.
- van Hinte, J. E., 1976a, A Jurassic time scale: American Association of Petroleum Geologists, Bulletin, v. 60, no. 4, pp. 489-497.
- , 1976b, A Cretaceous time scale: American Association of Petroleum Geologists, Bulletin, v. 60, no. 4, pp. 498-516.
- Woodward, L. A., and Schumacher, O. L., 1973, Morrison Formation of southeastern San Juan Basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Circular 129, 8 pp. □

MINING REGISTRATIONS
(OCTOBER 25, 1983 THROUGH APRIL 16, 1984)

State Mine Inspector 2340 Menaul N.E. Albuquerque, NM 87107

| Date and operation | Operators and owners | Location |
|-----------------------------|--|--|
| 10-25-83 clay | Operator—Garrett Mine, D'Appolonia Consulting Engineers, 2340 Alamo SE, Suite 306, Albuquerque, NM 87106; Gen. Mgr.—Dr. A. K. Kuhn, same address, phone: 842-0835; Person in charge—Bruce W. Hassinger, same address and phone; Gen. Supt.—Jerry Farris, P.O. Box 687, Grants, NM 87020; Property owner—Frank J. Burke, P.O. Box 278, Gallup, NM 87301 | McKinley Co.; sec. 22, T. 15 N., R. 18 W.; Gallup mining district; private land; drift-abandoned; no material to be mined; existing adits to be opened in order to investigate subsidence problems; directions to mine: immediately east of NM-32, 0.5 mi south of the intersection of NM-32 and NM-40 in Gallup, NM |
| 10-25-83 mill | Operator—Ambrosia Lake Mill, Quivera Mining Co., P.O. Box 218, Grants, NM 87020; Supt.—Charley Stanley, same address; Gen. Mgr.—Arthur Gebeau, same address; Other officials—Rob Luke, Rod Tregembo, Billy Stevens, Kerr-McGee Center, Oklahoma City, OK 73125 | McKinley Co.; sec. 31, T. 14 N., R. 9 W.; Grants mining district; private land; ores milled—uranium; custom milling; capacity of mill—7,000 tons per day; directions to mill: approximately 21 mi north of Grants, NM on NM-509 spur |
| 12-20-83 gold, silver | Operator—U.S. Treasury, St. Cloud Mining Co., P.O. Box 1670, Truth or Consequences, NM 87901, phone: 744-5215; Gen. Mgr.—P. S. Freeman, 1006 Kopra St., Truth or Consequences, NM, 87901, phone: 894-7739; Gen. Supt.—James Ray Nations, General Delivery, Winston, NM, phone: 894-7495; Other official—Walter Palass, Admin. Mgr., Box 1670, Truth or Consequences, NM 87901; Property owner—The Goldfield Corp., P. O. Box 1899, Melbourne, FL 32901 | Sierra Co.; sec. 25, T. 11 S., R. 9 W.; private land; directions to mine: 12 mi SW of Winston, NM, past St. Cloud mill, follow signs |
| 12-20-83 mill | Operator—St. Cloud Mill, The St. Cloud Mining Co., P.O. Box 1670, Truth or Consequences, NM 87901, phone: (505) 744-5215; Supt.—John Gilson, same address and phone; Gen. Mgr.—Patrick Freeman, same address and phone; Other official—Walter Palass, Admin. Mgr., same address and phone; Property owner—The Goldfield Corp., P.O. Box 1899, Melbourne, FL 32901 | Sierra Co.; sec. 4, T. 12 S., R. 8 W.; Chloride mining district; private land; ore milled—copper, silver, and gold; capacity of mill—400 tons per day; directions to mill: 10 mi SW of Winston |
| 1-18-84 silver | Operator—Black Silver Venture, Gold-Silver Exploration, Inc., 631 Broadway, Truth or Consequences, NM 87901; Gen. Mgr.—Dan Medley, 631 Broadway, phone: 894-2121; Person in charge—Arthur Misquez, 1315 Caballo Rd., Truth or Consequences, NM 87901, phone: 894-3943; Gen. Supt.—A. D. Richins, P.O. Box 155, Hillsboro, NM 88042, phone: 895-5694; Property owner—Black Silver Venture, 631 Broadway, Truth or Consequences, NM 87901 | Sierra Co.; sec. 13, T. 15 S., R. 9 W.; Kingstons mining district; federal land; directions to mine: turn north on forest road 157 halfway between Hillsboro and Kingstons, go 9.5 mi to mine |

Wyoming Geological Association

Fall field conference and symposium

The Wyoming Geological Association will hold its annual field conference and symposium entitled *The Permian and Pennsylvanian geology of Wyoming* September 23-26, 1984, at the Hilton Inn, Casper, Wyoming. The tentative schedule is: Bighorns field trip and evening icebreaker on Sunday, September 23; symposium on Monday, September 24; and Hartville Uplift and Black Hills field trip (overnight in Newcastle, Wyoming) on Tuesday and Wednesday, September 25-26. Some of the subjects to be discussed at the symposium are the Goose Egg salts and the Tensleep, Casper, Leo, and Minnelusa Formations. For further information contact Paul Trump, % Mitchell Energy Corp., 1670 Broadway, Suite 3200, Denver, CO 80202 (303-861-2226) or Alec Steele, % Marathon Oil Co., P.O. Box 2659, Casper, WY 82602 (307-577-1555).

continued on page 55

A temperature of about 230°C (uncorrected for pressure) for quartz and calcite deposition at the current top of the Faney vein requires a pressure of more than 27 bars to prevent boiling (Haas, 1971). In a vein open to the surface this corresponds to a hydrostatic depth of more than 325 m. The top of the Faney vein today is higher topographically (170 m) than the part of the Eberle vein that was sampled. If one assumes there was no structural adjustment after mineralization, then the thickness of cover during Eberle mineralization could have been 500 m or more.

The hydrothermal fluids responsible for the Cenozoic mineralization in the Mogollon mining district had temperatures that varied with time from greater than 270°C to 180°C. They had a constant salinity of about 3.3 equivalent weight percent NaCl with Na/K ratios of 0.6 to 2.5. The temperatures and minimum depth estimates of mineralization and the abundance of base-metal sulfide minerals in the Mogollon mining district are typical of those found in the deeper levels of precious-metal deposits associated with volcanic terranes (Buchanan, 1981).

ACKNOWLEDGMENTS—We thank S. D. McDowell and S. P. Halsor, Michigan Tech, for their constructive criticism of this manuscript. One of us (Kent) wishes to thank the New Mexico Bureau of Mines and Mineral Resources, Socorro, New Mexico, and the Center of Mining and Minerals Research, Michigan Tech, for financial support. Dick Manning and Challenge Mining Company allowed us access to the Eberle mine and other mine dumps in the Mogollon district. Norbert Blum and Albrecht Schneider, Technische Hochschule Aachen, West Germany, graciously provided us with samples from outside of the Mogollon district. Ted Eggleston, New Mexico Tech, reviewed this manuscript.

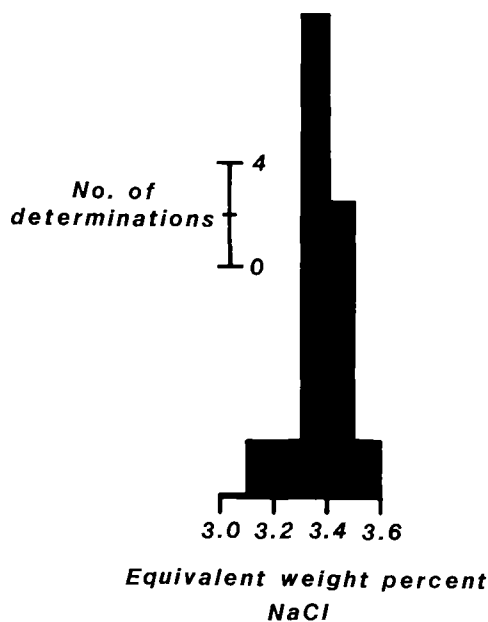


FIGURE 3—Histogram of equivalent weight percent NaCl determined from the freezing-point depression of fluid inclusions.

References

- Ballmer, G. J., 1932, Native tellurium from northwest of Silver City, New Mexico: *American Mineralogist*, v. 17, pp. 491-492.
- Buchanan, L. J., 1981, Precious metal deposits associated with volcanic environments in the southwest: *Arizona Geological Society Digest*, v. 16, pp. 237-262.
- Elston, W. E., and Erb, E. E., 1979, Tertiary geology of Hidalgo County, New Mexico—guide to metals, industrial minerals, petroleum and geothermal resources: *New Mexico Geology*, v. 1, no. 1, pp. 1-6.
- Elston, W. E., Rhodes, R. C., and Erb, E. E., 1976, Control of mineralization by mid-Tertiary volcanic centers, southwestern New Mexico: *New Mexico Geological Society, Special Publication No. 5*, pp. 125-130.
- Ferguson, H. G., 1927, Geology and ore deposits of the Mogollon mining district, New Mexico: *U.S. Geological Survey, Bulletin 787*, 100 pp.
- Haas, J. L., Jr., 1971, The effect of salinity on the maximum thermal gradient of a hydrothermal system at hydrostatic pressure: *Economic Geology*, v. 66, pp. 940-946.
- Kent, G. R., 1983, Temperature and age of precious metal

- vein mineralization and geochemistry of host rock alteration at the Eberle mine, Mogollon mining district, southwestern New Mexico: Unpublished M.S. thesis, Michigan Technological University, Houghton, Michigan, 84 pp.
- Ratté, J. C., 1981, Geologic map of the Mogollon quadrangle, Catron County, New Mexico: *U.S. Geological Survey, Geologic Quadrangle Map 1557*, scale 1:24,000.
- Ratté, J. C., Gaskill, D. L., Eaton, G. P., Peterson, D. L., Stotelmeyer, R. B., and Meeves, H. C., 1979, Mineral resources of the Gila primitive area and Gila Wilderness, New Mexico: *U.S. Geological Survey, Bulletin 1451*, 229 pp.
- Ratté, J. C., Marvin, R. F., Naeser, C. W., Brooks, W. E., and Finnell, T. L., 1983, Volcanic history of southwestern Mogollon-Datil volcanic field as recorded along the Morenci lineament, New Mexico and Arizona: *Geological Society of America, Abstracts with Programs*, v. 15, p. 303.
- Roedder, E., 1979, Fluid inclusions as samples of ore fluids; in Barnes, H. L. (ed.), *Geochemistry of hydrothermal ore deposits*, 2nd edition: John Wiley and Sons, pp. 648-737. □

continued from page 52

- 1-18-84 mill Operator—Mica Mill, Mica Mine, Mica Inc., Box 2403, Santa Fe, NM 87504; Supt.—Wayne Brown, phone: 852-2727; Other official—George Rosen, Box 2422, Santa Fe, NM 87504
- 2-3-84 limestone Operator—Herzog Contracting Corp., 1900 Garfield Ave., St. Joseph, MO 64503; Gen. Mgr.—Stan Herzog, 1900 Garfield Ave., St. Joseph, MO 64503, phone (816) 233-9001; Person in charge—Frank Storbakken, P.O. Box 1936, Deming, NM, phone: (505) 546-2770; Gen. Supt.—Arnold Shipp, 1900 Garfield Ave., St. Joseph, MO 64503; Other official—Randy Herzog, 1900 Garfield Ave., St. Joseph, MO 64503, phone (816) 233-9001; Property owner—U.S. Government, Bureau of Land Management, 1705 Valley Drive, Las Cruces, NM 88005
- 2-3-84 uranium Operator—Crownpoint, Westinghouse Electric Corp., Uranium Resources Div., Penn Center 3-400, P.O. Box 355, Pittsburgh, PA 15230; Gen. Mgr.—E. J. Miles, Westinghouse Electric Corp., P.O. Box 355, Pittsburgh, PA 15230; Gen. Supt.—Salvador Chavez, Westinghouse Electric Corp., Crownpoint Project, P.O. Box 777, Crownpoint, NM 87313; Other official—T. H. Ritner, Westinghouse Electric Corp., P.O. Box 355, Pittsburgh, PA 15230; Property owner—Westinghouse Electric Corporation
- 2-10-84 Silver, lead, zinc Operator—Prospect N, PICOM Corp., Ltd., P.O. Box 361, El Prado, NM 87529 (company change of name); Gen. Mgr.—James R. Grainger, same address; Person in charge—James R. Grainger, same address; Property Owner—James R. Grainger
- 2-16-84 sodium Operator—New Mexico Salt & Minerals Corp., P.O. Box 2262, Carlsbad, NM 88220; Gen. Mgr.—Dale W. Janway, Minesite, NM-31, phone: 745-3658; Gen. Supt.—Herman Justice, same address; Other officials—Marvin Watts and Bill Buzbee, Carlsbad, NM; Property owner—New Mexico Salt & Minerals Corp.
- 2-16-84 silica Operator—LeRoy Jones Mining Co., 1812 Mesquite, Lordsburg, NM; Gen. Mgr.—Leroy Jones, same address, phone: 542-9525
- 3-5-84 clay Operator—Kight Clay Pit, Kight Construction, P.O. Box 413, Hatch, NM 87937; Gen. Mgr.—Claude Kight, same address, phone: 267-4653; Gen. Supt.—Earl Kight, E. Herrera Rd., Hatch, NM, phone: 267-4962; Property Owner—U.S. Dept. of the Interior, Bureau of Land Management, Las Cruces, NM 88001
- 4-3-84 gold Operator—Clinken Dagger, Bickerstaff pit, 8513 Marquette NE, Albuquerque, NM 87108; Gen. Mgr.—Hanze Janoltona, same address, phone: 268-2269; Property owner—Hanze Janoltona
- 4-16-84 copper Operator—Burro Chief Copper Co., Drawer B, Tyrone, NM 88065; Gen. Mgr.—Richard E. Rhoades; same address; Gen. Supt.—T. R. Snider; same address; Property owner—Burro Chief Copper Co., 2600 N. Central Ave., Phoenix, AZ 85004-3015

Rio Arriba Co.; private land; ores milled or refined—mica; capacity of mill—50,000 tons per day; directions to mill: 12 mi north of Espanola on NM-68

Grant Co.; sec. 17, T. 24 S., R. 14 W.; Deming mining district; federal land; directions to mine: 1.7 mi north of the intersection of US-10 and NM-81

McKinley Co.; sec. 24, T. 17 N., R. 13 W.; private land; directions to mine: 0.5 mi northwest of Crownpoint, NM, on Church Road

Sierra Co.; sec. 12, T. 13 S., R. 9 W.; Hermosa mining district; federal land; underground; directions to mine: 0.5 mi east on forest road 157 at Wagonbed Spring, 20 mi south of Winston, NM, and 1 mi north of Hermosa, NM

Eddy Co.; sec. 18, T. 23 S., R. 29 E.; Eddy mining district; private land; directions to mine: on NM-31 5 mi east of Loving, NM

Hidalgo Co.; sec. 36, T. 21 S., R. 17 W.; Gold Hill mining district; federal land; directions to mine: 1 mi southeast of WD Ranch

Doña Ana Co.; sec. 23, T. 19 S., R. 4 W., state land; directions to pit: 3 mi west on NM-28 on south side of road

Bernalillo Co.; T. 10 N., R. 6 E.; private property; directions to mine: go south 8 mi on NM-214, east 5 mi to Juan Thomas, north 2.25 mi

Grant Co.; sec. 15, T. 19 S., R. 15 W.; private land; directions to mine: approximately 1 mi southwest of Phelps Dodge Corp.

(TO BE CONTINUED NEXT ISSUE)