

Geologic Map of the Punta de Agua Quadrangle, Torrance County, New Mexico.

By

Jack Oviatt

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Open-file Digital Geologic Map OF-GM 220

Scale 1:24,000

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New Mexico Bureau of Geology and Mineral Resources
801 Leroy Place, Socorro, New Mexico, 87801-4796

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GEOLOGY OF THE PUNTA DE AGUA 7.5-MINUTE QUADRANGLE, TORRANCE COUNTY, NEW MEXICO

Charles G. (Jack) Oviatt

ABSTRACT

The Punta de Agua quadrangle in central New Mexico, is dominated by broad rolling surfaces capped by alluvial gravel from the Manzano Mountains. Low hills of sandstone are present in the northern part of the quadrangle, and valleys and mesas of sandstone, mudstone, gypsum, and limestone are present in the south. Altitudes range from over 7300 ft (2200 m) near the northwest corner of the quadrangle, to about 6400 ft (1950 m) along the southern map edge. Tributaries of Abo Arroyo, which flows westward to the Rio Grande valley, drain the southern third of the map area; the northern two thirds of the quadrangle drain to the east into Estancia Valley. Bedrock units exposed at the surface consist of the Lower Permian Abo Formation, and the Arroyo de Alamillo and Los Vallos Formations of the Yeso Group. Coarse gravel of late Cenozoic age, derived from the Manzano Mountains directly to the west, caps surfaces eroded into the Permian bedrock. Geologic structure in the Punta de Agua quadrangle is simple, with gentle southeasterly dips in the Permian bedrock, and a reverse-fault zone having total displacement of less than 200 ft (60 m) in the southwestern corner of the quadrangle.

INTRODUCTION

The Punta de Agua quadrangle is dominated by gently rolling to flat surfaces capped by gravel deposits of Pleistocene age. The gravels were derived from the Manzano Mountains directly to the west of the quadrangle, and they overlie Lower Permian rocks that are more easily weathered and eroded than the gravels. Outcrops of Permian red sandstones are present in areas where the gravel caps have been eroded, notably in the southern third of the quadrangle, and in low hills in the northwestern part of the quadrangle. The town of Mountainair lies at the far southeastern corner of the quadrangle, and the small villages of Punta de Agua and El Gato lie along Highway 14 in the northern third of the quadrangle. The Quarai unit of Salinas Pueblo Missions National Monument, and Manzano Mountains State Park, are in the northern third of the quadrangle. Numerous isolated homes and ranches are distributed throughout the quadrangle.

Tributaries of Abo Arroyo, which flows westward to the Rio Grande valley, drain the southern third of the map area, and the northern two thirds of the quadrangle drain to the east into Estancia Valley. Altitudes range from over 7300 ft (2200 m) near the northwest corner of the quadrangle, to about 6400 ft (1950 m) along the southern map edge.

Exposed bedrock in the quadrangle is Early Permian (Wolfcampian to Leonardian) in age, and consists of the Abo Formation and the Yeso Group. Red sandstones dominate the Abo and Yeso units. Coarse fluvial gravel of Pleistocene age covers the Permian rocks in most of the quadrangle, and is composed of igneous and metamorphic clasts derived from the Manzano Mountains. The bedrock structure is relatively simple, with gently dipping to horizontal bedding broken by two faults in the far southwestern corner of the quadrangle.

The Punta de Agua quadrangle is bounded on the west by the Manzano Peak quadrangle, the geology of which has been mapped by Baer et al. (2003). Myers (1977) and Scott et al. (2005) have mapped the geology of the Scholle quadrangle, which touches the Punta de Agua quadrangle at its southwestern corner. Oviatt (2010) has mapped the geology of the Abo

quadrangle, which adjoins the Punta de Agua quadrangle along its southern boundary. No other quadrangles adjacent to the Punta de Agua quadrangle have been mapped.

Along the western edge of the Punta de Agua quadrangle, Quaternary alluvium (Qa) is roughly equivalent to the units Qaa, Qa, and Qay of Baer et al. (2003), and geologic contacts on the two maps match reasonably well in canyons tributary to Cañon Espinoso, Cañon Barranco, Cañon Gotera, and Cañon Colorado. Geologic contacts of the Quaternary gravel deposits (Qgm) also match reasonably well with those of the unit referred to as Qp1 by Baer et al. (2003).

The Arroyo de Alamillo (Pya) and Los Vallos (Pyl) Formations of the Yeso Group (Lucas et al., 2005) are mapped on the Punta de Agua quadrangle. These formations were not recognized at the time of mapping by Baer et al. (2003), so their map does not show the Arroyo de Alamillo Formation where it crosses the quadrangle boundary in the southeastern corner of the Manzano Peak quadrangle. Baer et al. (2003) mapped the Arroyo de Alamillo Formation as part of the Abo Formation.

Some additional references to previous geologic studies in the vicinity of the Punta de Agua quadrangle include: Lee (1909), Darton (1928), Needham and Bates (1943), Machette (1978), Hatchell et al. (1982); Myers (1982), Machette and McGimsey (1983), McLemore (2000), and Lueth et al. (2009).

STRATIGRAPHY AND DESCRIPTION OF MAP UNITS

In the Punta de Agua quadrangle, exposed bedrock sedimentary units are Early Permian in age, and consist of sandstone, mudstone, siltstone, limestone and dolomite, and gypsum. Stratigraphic units, in order of decreasing age, are the Abo Formation, and the Yeso Group, which includes the Arroyo de Alamillo and Los Vallos Formations. Most sandstones in the Abo and Yeso are red to orange, and these colors dominate roadcuts, natural exposures, and the younger alluvium derived from these rocks.

Cenozoic

Qa Stream alluvium (late Holocene to late Pleistocene) – poorly sorted, sandy to gravelly alluvium along valley bottoms; includes deposits underlying low stream terraces along some of the major drainages. Most Qa sediments are reddish in color. Thickness is less than 30 ft (10 m) in most places.

Qgm Gravel derived from Manzano Mountains sources (Pleistocene) – poorly sorted alluvial gravel, including clasts ranging in size from small pebbles to large boulders. Clasts include metamorphic crystalline rocks (Precambrian gneiss, schist, quartzite) exposed in the Manzano Mountains to the west, and sedimentary rocks of Pennsylvanian and Early Permian age (limestone eroded from Pennsylvanian formations and from the Permian Bursum Formation; sandstone from the Permian Abo Formation). Broad surfaces capped by Qgm slope to the east and southeast and overlie rocks of the Abo Formation and Yeso Group. The surfaces mapped as Qgm have a wind-blown silt (loess) cap that may be a meter or more thick. Thickness of Qgm is less than 30 ft (10 m) in most places.

Paleozoic

Pyl Los Vallos Formation, Yeso Group (Lower Permian or Leonardian) – reddish sandstone and mudstone, gray dolomite and limestone, and gypsum. The basal contact of Pyl is marked by a widespread 2-m thick gray dolomite or limestone unit, which is locally well

exposed in the southwestern quarter of the Punta de Agua quadrangle. Members of the Los Vallos Formation, the Torres, Cañas, and Joyita Members (Lucas et al., 2005), are not discriminated on the Punta de Agua quadrangle because the contacts are poorly exposed. Thickness about 750 ft (230) m. Some areas mapped as Permian bedrock (Pyl, Pya, Pa, Pu) include small areas of Quaternary alluvium (Qa) and/or Quaternary gravel (Qgm).

- Pya** Arroyo de Alamillo Formation, Yeso Group (Lower Permian or Leonardian) – dominated by orange to reddish sandstone and minor mudstone; includes some yellowish to pinkish white sandstones near the top of the unit. The Arroyo de Alamillo Formation was previously mapped in this area as the Meseta Blanca Formation (Myers, 1977), but has been redefined and renamed by Lucas et al. (2005). A good description of the contrast between sandstones of the Arroyo de Alamillo Formation and those of the Abo Formation is given by Lueth et al. (2009, p. 89): “The differences between the Abo and the [Arroyo de Alamillo] are obvious. The orange color of the [Arroyo de Alamillo] contrasts sharply with the red Abo. The [Arroyo de Alamillo] contains a larger percentage of sandstone than the Abo, and [Arroyo de Alamillo] sandstones are slightly coarser-grained and have a greater lateral uniformity of thickness. Abo sandstones have basal stratigraphic relief and fill scours, whereas [Arroyo de Alamillo] sandstones have constructional, dune-shaped relief on upper bedding surfaces. Planar laminations and small-scale cross laminations are abundant in the [Arroyo de Alamillo]. Many bedding surfaces are rippled, and some bear tracks and trails. Interference ripples are common. A shallow marine to beach environment is suggested for the [Arroyo de Alamillo].” Thickness about 210 ft (60 m). Some areas mapped as Permian bedrock (Pyl, Pya, Pa, Pu) include small areas of Quaternary alluvium (Qa) and/or Quaternary gravel (Qgm).
- Pa** Abo Formation (Lower Permian or Wolfcampian) – red sandstone and mudstone; the upper member (Cañon de Espinoso Member of Lucas et al., 2005) is mudstone dominated, but contains sheet-like sandstone bodies that are ripple- and climbing-ripple laminated. White reduction spots, 1-3 cm in diameter, which are almost perfectly circular in cross section, are abundant in some of the red sandstone beds of the Abo. The Cañon de Espinoso Member is exposed in the Punta de Agua quadrangle. Thickness about 1000 ft (300 m) (Lucas et al., 2005). Some areas mapped as Permian bedrock (Pyl, Pya, Pa, Pu) include small areas of Quaternary alluvium (Qa) and/or Quaternary gravel (Qgm).
- Pu** Arroyo de Alamillo and Abo Formations, undifferentiated (Lower Permian or Wolfcampian) – red sandstones of the two formations where they cannot be separated easily on the ground, including in areas where exposures are not good, and in steep-walled canyons where the units cannot be easily separated at a scale of 1:24,000. Some areas mapped as Permian bedrock (Pyl, Pya, Pa, Pu) include small areas of Quaternary alluvium (Qa) and/or Quaternary gravel (Qgm).
- Pb** Bursum Formation (Lower Permian or Wolfcampian) – not exposed in the Punta de Agua quadrangle; shown on the cross section. In the neighboring Scholle quadrangle the Bursum Formation contains limestones and shales (Scott et al., 2005). Thickness about 115 ft (35 m) (Krainer et al., 2009).

IPu Pennsylvanian stratigraphic units, undifferentiated (Pennsylvanian) – not exposed in the Punta de Agua quadrangle; shown on the cross section. Rocks include limestone, sandstone, siltstone, and mudstone Scott et al. (2005). Total thickness of Pennsylvanian rocks about 2100 ft (650 m).

PC Precambrian rock units, undifferentiated (Precambrian) – not exposed in the Punta de Agua quadrangle; shown on the cross section. Rocks include metamorphic rocks, such as quartzite, schist, and gneiss, and igneous rocks, such as granite (Baer et al., 2003; Scott et al., 2005).

STRUCTURAL GEOLOGY

Rocks in the Punta de Agua quadrangle are flat-lying to gently dipping. In the southwestern quarter of the quadrangle, some dips are as great as 45° in fault zones, but dips flatten to nearly horizontal in the rest of the map area. Anomalous dips of some dolomite, limestone, and sandstone outcrops of the Los Vallos Formation are caused by local collapse related to subsurface gypsum dissolution. Gentle dips to the southeast of less than 5° are common in most of the quadrangle.

Two faults are mapped in the southwestern corner of the quadrangle; their sense of displacement is inferred from the relative ages of rocks displaced by them. The dip of one of the faults can be seen in exposures at Cottonwood Spring (approximately 376200 E, 3819900 N); at this locality, the fault zone dips to the east, and the sense of motion on the fault seems to be dip slip, with the hanging wall up relative to the footwall. The other fault is not well exposed in the quadrangle so its kinematics have not been determined. It is shown as a vertical fault on the cross section. Estimated total displacement along each of these faults ranges from negligible to greater than 200 ft (60 m).

Machette (1978) and Machette and McGimsey (1983) have mapped a Quaternary fault zone across the Punta de Agua quadrangle from southwest to northeast cutting Quaternary gravel (Qgm), however, I have not observed scarps in the Qgm surface. Observations that could be interpreted as evidence for a fault zone in the bedrock along the trace mapped by Machette and McGimsey (1983) come from a topographic gap between surfaces capped by Qgm near the common corner of sections 29, 30, 31, and 32, township 4 north, range 6 east (near 376500 E, 3822300 N). In this area, the bedrock, which consists of sandstone of the Arroyo de Alamillo Formation, dips about 25° to the east, a dip that is greater than the general dip of rocks in this area, and which could indicate that the rocks are in or near a fault zone. Several low hills in Qgm gravel in sections 9 and 16, T 4 N, R 6 E (378000 to 380000 E, 3825000 to 3828000 N) could be interpreted as up-thrown blocks on the east side of a northeast-striking fault zone, but the hills could be interpreted in alternative ways that are equally probable (e.g., differential erosion of underlying bedrock prior to gravel deposition at different levels). Considering these observations and interpretations, I have not shown a Quaternary fault on the Punta de Agua quadrangle along the trace proposed by Machette and McGimsey (1983). Although it is possible the bedrock units are deformed in a pre-Quaternary fault zone, subsurface investigations would be required to determine this.

ACKNOWLEDGEMENTS

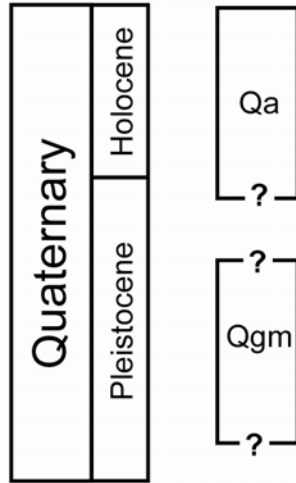
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REFERENCES CITED

- Baer, S., Karlstrom, K.E., Bauer, P., and Connell, S.D., 2003, Geology of the Manzano Peak 7.5-minute quadrangle, Torrance and Valencia Counties, New Mexico: New Mexico Bureau of Mines and Mineral Resources Open-File Report OF-GM-61, 1:24,000.
- Darton, N.H., 1928, "Red beds" and associated formations of New Mexico: U.S. Geological Survey Bulletin 794, 356 p.
- Hatchell, W.O., Blagbrough, J.W., and Hill, J.M., 1982 Stratigraphy and copper deposits of the Abo Formation, Abo Canyon area, central New Mexico, *in* Grambling, J.A., and Wells, S.A., eds., New Mexico Geological Society, 33rd Field Conference Albuquerque Country II: New Mexico Geological Society, Socorro, NM, p. 249-260.
- Krainer, K., Lucas, S.G., and Vachard, D., 2009. The Upper Carboniferous Bursum Formation at Abo Pass, Socorro County, New Mexico, *in* Lueth, V.W., Lucas, S.G., and Chamberlin, R.M., eds., Geology of Chupadera Mesa: New Mexico Geological Society, 60th Annual Field Conference, October 7-10, 2009, New Mexico Geological Society, Socorro, NM, p. 98-102.
- Lee, W.T., 1909, The Manzano group of the Rio Grande valley, New Mexico: Stratigraphy of the Manzano Group: U.S. Geological Survey Bulletin 389, p. 5-40.
- Lucas, S.P., Krainer, K., and Colpitts, R.M., Jr., 2005, Abo-Yeso (Lower Permian) stratigraphy in central New Mexico, *in* Lucas, S.G., Zeigler, K.E., and Spielmann, J.A., eds., The Permian of central New Mexico: New Mexico Museum of Natural History and Science Bulletin No. 31, p. 101-117.
- Lucas, S.G., and Zeigler, K.E., 2004, Permian stratigraphy in the Lucero uplift, central New Mexico, *in* Lucas, S.G., and Zeigler, K.E., eds., Carboniferous-Permian transition at Carrizo Arroyo, central New Mexico: New Mexico Museum of Natural History and Science Bulletin No. 25, p. 71-79.
- Lueth, V.W., Lucas, S.G., Cather, S.M., Chamberlin, R.M., Love, D., McGraw, D., Luther, A., Krainer, K., and Spielmann, J.A., 2009, Northern Chupadera Mesa: Third-day road log from Socorro to Gran Quivira via Abo Pass, *in* Lueth, V.W., Lucas, S.G., and Chamberlin, R.M., eds., 2009, Geology of Chupadera Mesa: New Mexico Geological Society, 60th Annual Field Conference, October 7-10, 2009, New Mexico Geological Society, Socorro, NM, p. 75-108.
- Machette, M.N., compiler, 1978, Preliminary geologic map of the Socorro 1° X 2° quadrangle, central New Mexico: U.S. Geological Survey Open-File Report 78-607, 1 sheet, 1:250,000.
- Machette, M.N., and McGimsey, R.G., 1983, Map of Quaternary and Pliocene faults in the Socorro and western part of the Fort Sumner 1° X 2° quadrangles, central New Mexico: U.S. Geological Survey Miscellaneous Field Studies Map MF-1465-A, 12 p. pamphlet, 1 sheet, 1:250,000.
- McLemore, V., 2000, Manzano Mountains State Park and Abó and Quarai units of the Salinas Pueblo Missions National Monument: New Mexico Geology, v. 22, no. 4, p. 108-112.
- Myers, D.A., 1977, Geologic map of the Scholle quadrangle, Valencia, and Torrance Counties, New Mexico: U.S. Geological Survey Geologic Quadrangle Map GQ-1412, 1:24,000.
- Myers, D.A., 1982, Stratigraphic summary of Pennsylvanian and Lower Permian rocks, Manzano Mountains, New Mexico, *in* Grambling, J.A., and Wells, S.A., eds., New Mexico

- Geological Society, 33rd Field Conference Albuquerque Country II: New Mexico Geological Society, Socorro, NM, p. 233-237.
- Needham, C.E., and Bates, R.L., 1943, Permian type sections in central New Mexico: Geological Society of America Bulletin, v. 54, p. 1653-1668.
- Oviatt, C.G., 2010, Preliminary geologic map of the Abo quadrangle, Torrance County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-file Geologic Map 199, <http://geoinfo.nmt.edu/publications/maps/geologic/ofgm/details.cfm?Volume=199>
- Scott, L.A., Elrick, M., Connell, S., and Karlstrom, K., 2005, Geology of the Scholle 7.5-minute quadrangle, Socorro, Torrance, and Valencia Counties, New Mexico: New Mexico Bureau of Mines and Mineral Resources Open-File Report OF-GM-99, 1:24,000.

CORRELATION OF UNITS



UNCONFORMITY

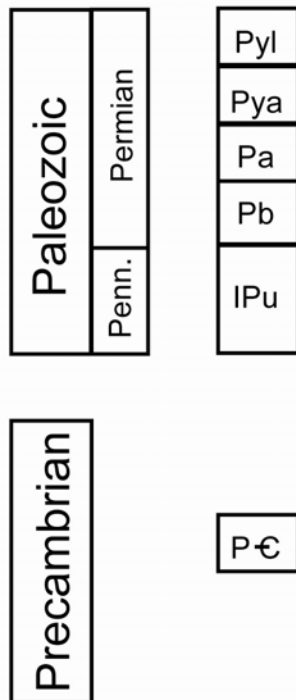
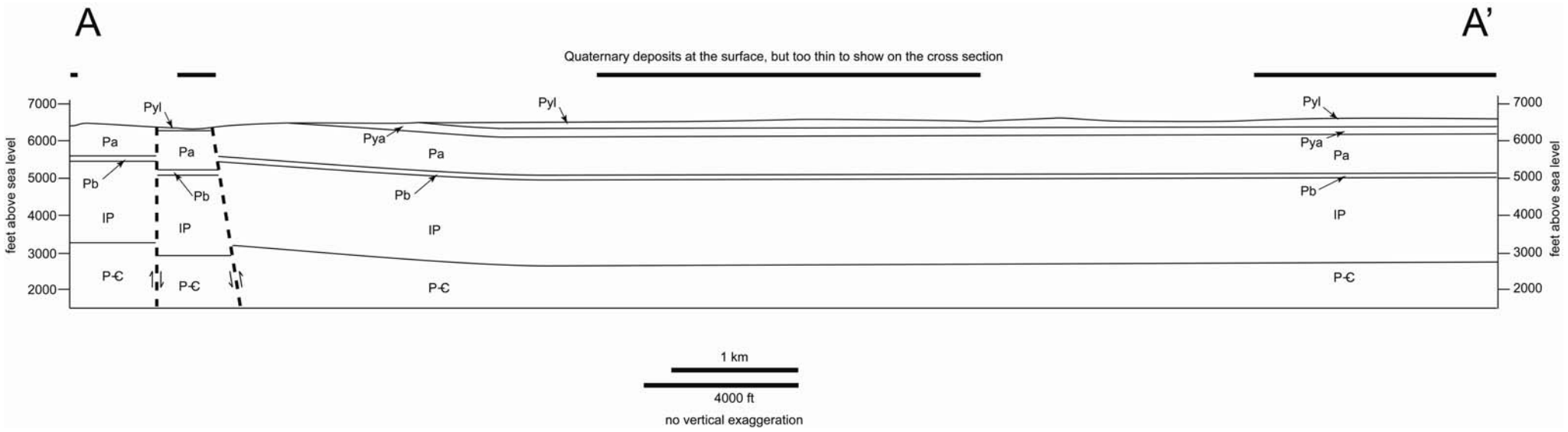


Table of locations for dip measurements on the Punta de Agua quadrangle. Note that these are all for Permian bedrock units; any that fall within areas of Qa on the map represent small outcrops of bedrock exposed beneath alluvium.

UTM E (NAD27)	UTM N (NAD27)	dip angle	dip direction	map unit
375275	3818528	20	150	Pa
375299	3818848	45	95	Pa
375716	3819099	4	100	Pya
376097	3819240	25	95	Pa
375674	3819319	10	140	Pa
375993	3819579	0	---	Pya
374091	3819623	15	170	Pa
382041	3819738	5	180	Pyl
375178	3819744	5	175	Pya
373805	3819813	5	80	Pya
376172	3819907	5	85	Pya
376568	3820845	3	120	Pya
374681	3821299	5	130	Pa
376485	3821589	3	330	Pya
375034	3821638	2	160	Pya
378427	3821756	5	150	Pya
376178	3822112	10	180	Pya
375138	3822156	7	80	Pya
376550	3822322	25	110	Pya
375127	3822431	0	---	Pya
374837	3824189	5	90	Pya
374906	3829140	7	145	Pa
381086	3830251	12	70	Pa
381491	3830668	7	300	Pya



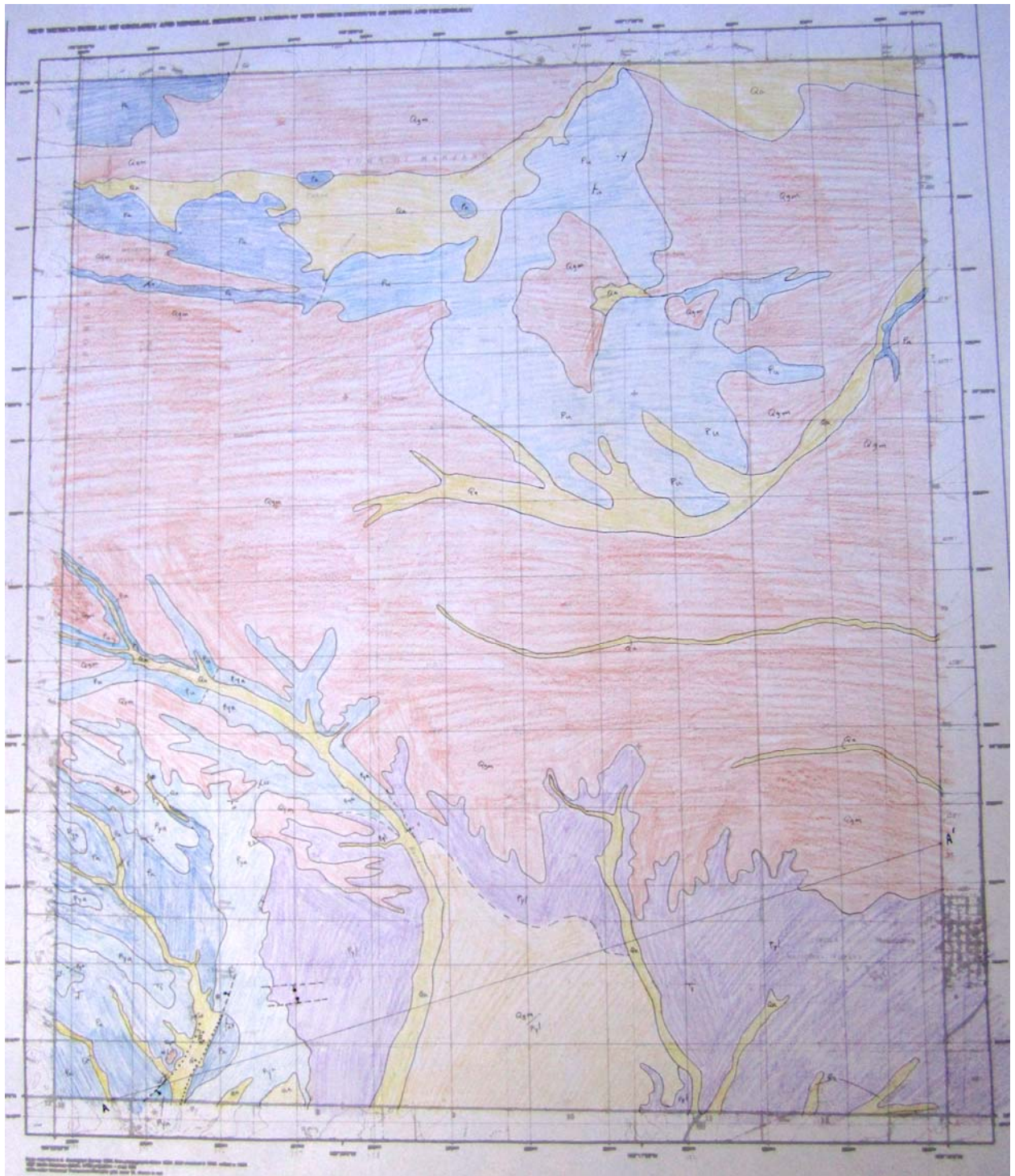


photo of hand-colored draft map