

CLAY DEPOSIT ADJACENT TO NM-44 NORTH OF BERNALILLO

George S. Austin
New Mexico Bureau of Mines and Mineral Resources
Socorro, New Mexico 87801

INTRODUCTION

A 50-60-cm-thick clay bed crops out in roadcuts along NM-44 which passes through the Santa Ana Pueblo north of Bernalillo, NM. The clay is a moist, pale-greenish yellow, soft, fissile claystone with some black manganese oxide spots. It is flat-lying in loosely consolidated sand of the Zia Formation (Manley, 1978), which is part of the Santa Fe Group in SE¼ secs. 29 and 32 T14N R3E (Fig. 1). Tedford (1981) indicates the age of the unit is Late Barstovian (11.3-14.5 m.y.) The bed is exposed from 0.2 miles northwest of the intersection of the road to the Santa Ana Pueblo to 1.2 miles to the south of that intersection. The elevation is about 5380 ft above sea level. Although only exposures adjacent to NM-44 were closely examined, the bed is exposed in an arroyo wall 0.3 miles south of the southernmost exposure in the SE¼ sec. 32 and may be exposed about 0.7 miles west of the highway in west-central sec. 32. Manley (1978) mentions "two phenocryst-poor ash beds that do not overlie each other" in the area that are locally "almost entirely altered to clay." She indicates that these bed are distinguishable by their glass shard characteristics.

R. 3 E.

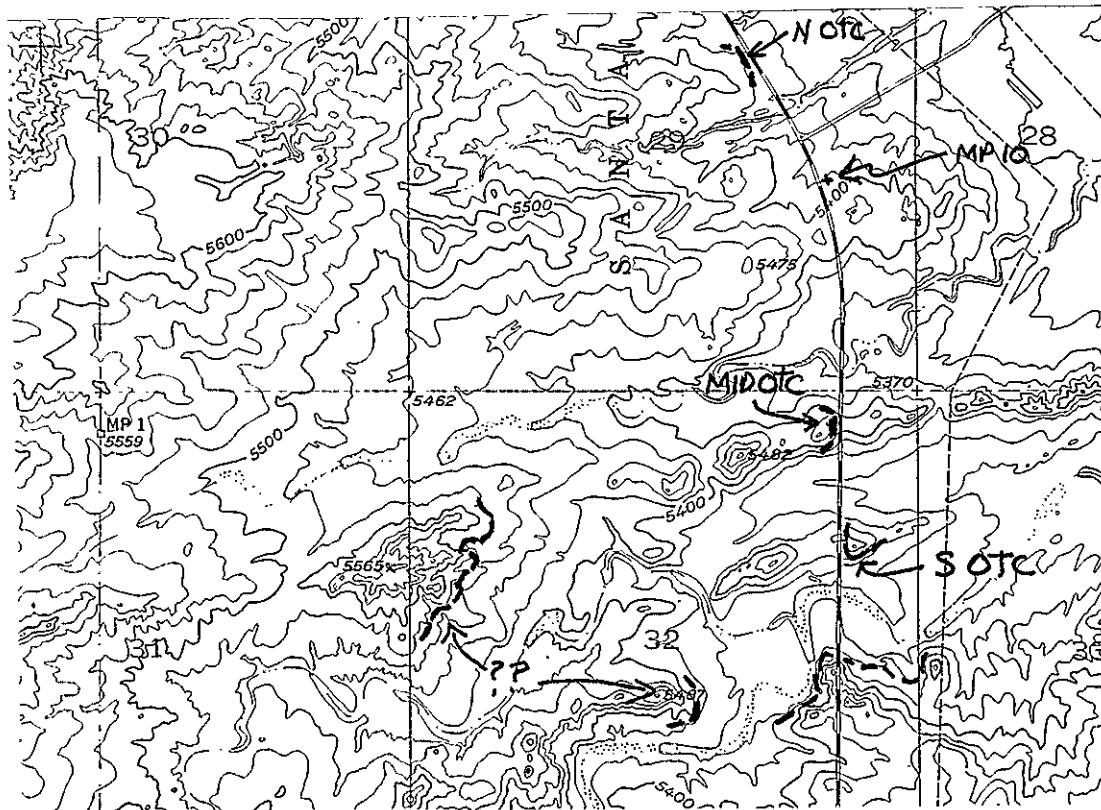


FIGURE 1. Part of the Bernalillo NW topographic sheet (scale 1:24,000) with outcrop locations (OTC) of the clay bed (dashed) in relation to NM-44 (NM44) and Santa Ana Grant, and milepost 10 (MP 10). Santa Ana Pueblo lies 0.8 miles to northeast of the map.

PROCEDURES

In 1993, three sections were measured at the NM-44 roadcuts. The first (N OTC) is southwest of NM-44 0.2 mi west of the NM-44-Santa-Ana-Pueblo-road intersection. Two channel samples were taken: GA93049 (basal one-half) and GA93050 (upper one-half), which together totaled 50 cm. The second (MID OTC) is west of NM-44 0.5 mi south of the same intersection. A single sample (GA93033) was taken of the entire 55-cm-thick clay bed (Fig. 2). The third 60-cm-thick exposure (S OTC) is east of NM-44 1.0 mi south of the same intersection and 10 m north of the northern end of the guard rail adjacent to the highway. Three samples were taken: GA93051 (top 20 cm), GA93052 (middle 20 cm), and GA93053 (bottom 20 cm). Bedrock exposures across the highway from the first two locations do not contain the clay bed and it may be only a local occurrence. However, rock strata in an east-west-trending arroyo south of the southern outcrop expose the bed and there it appears to be continuous (Fig. 3). Three views of MID OTC (Fig. 4) show the overlying unconsolidated sand and the underlying carbonate-cemented sandstone.

FIGURE 2. A view of the fresh and weathered fissile claystone at the middle outcrop.



FIGURE 3. A view from the south outcrop to the southeast across an arroyo to the clay bed (white) cropping out along the south bank.



FIGURE 4. Three views of the middle outcrop on the west side of NM-44. The full thickness of the bed is exposed between the loose orange sand of the Zia Formation above and the hard CaCO_3 -cemented sandstone below.

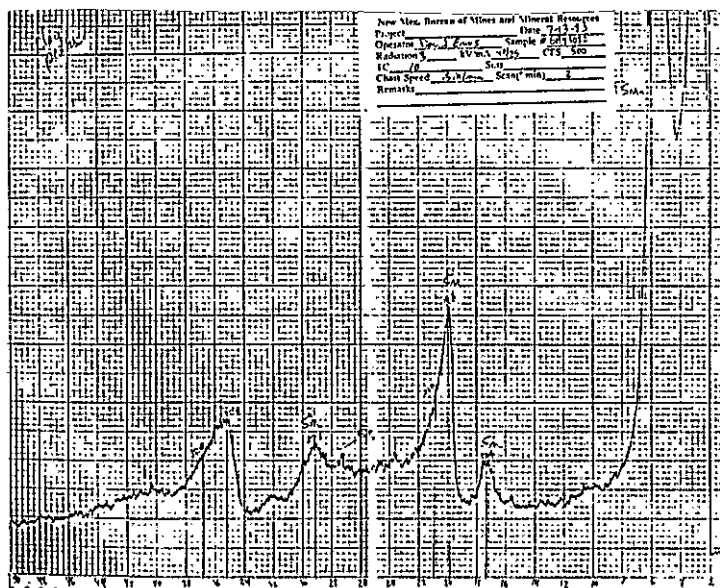


RESULTS

The x-ray traces for bulk mineral and clay mineral analyses of sample GA93033 are compared below with a traces for a similar claystone known as the Cheto clay mined near Chambers, AZ (GA93032). Bulk mineral and clay mineral for samples GA93049-GA93053 are shown on pages 5 and 6, respectively. Analyses of the data indicate that all samples are substantially the same.

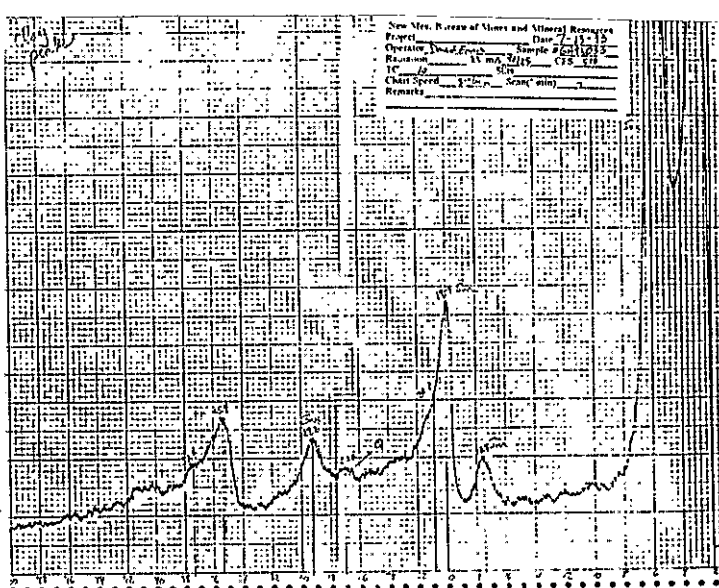
BULK X-RAY ANALYSIS

GA93032 (Cheto)



Analysis: Calcium smectite
with minor quartz

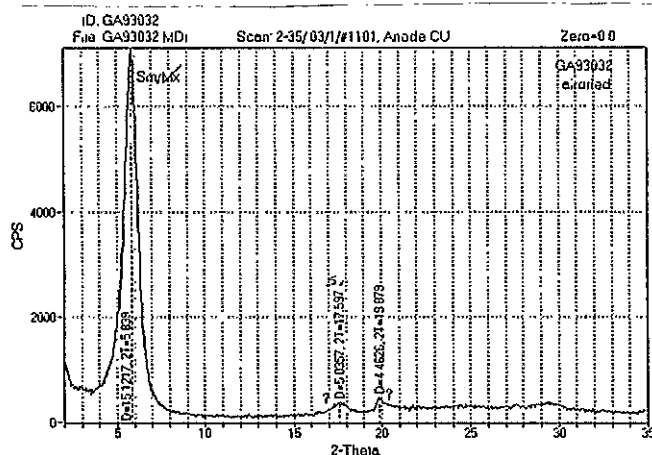
GA93033 (Santa Ana)



Analysis: Calcium smectite
with minor quartz

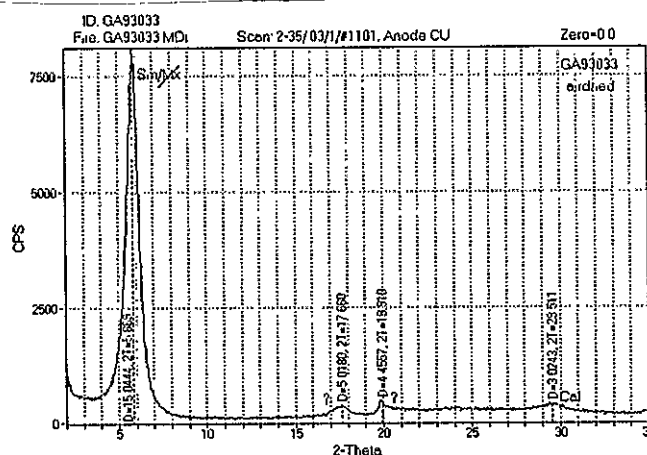
CLAY MINERAL ANALYSIS

GA93032 (Cheto)



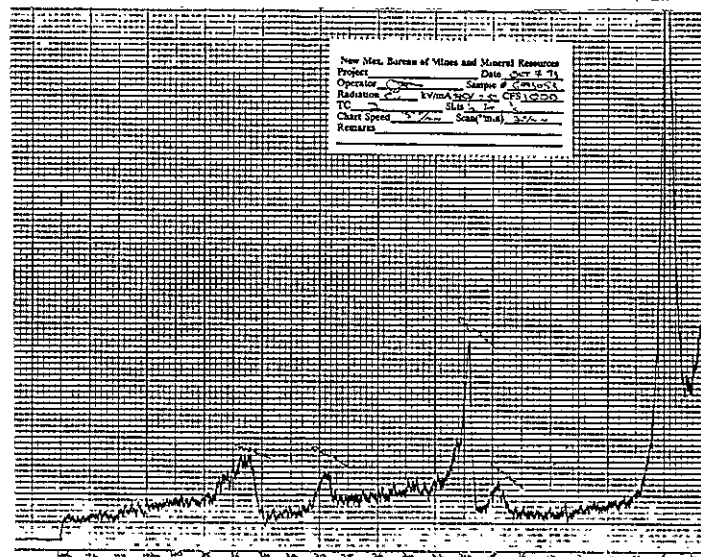
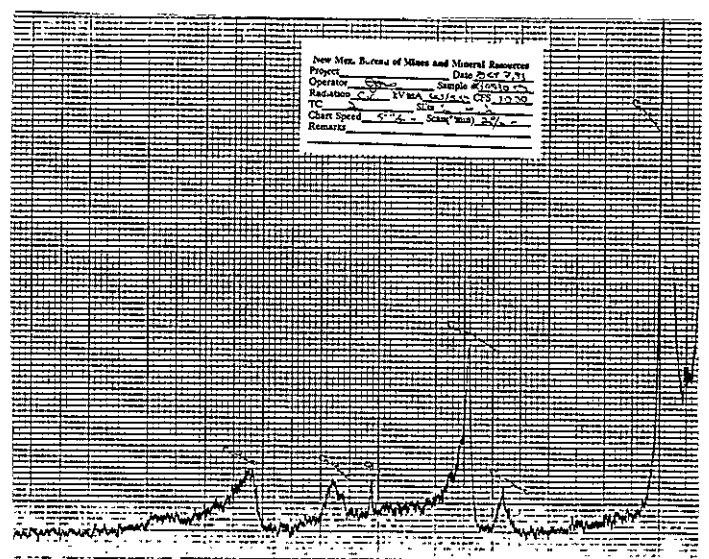
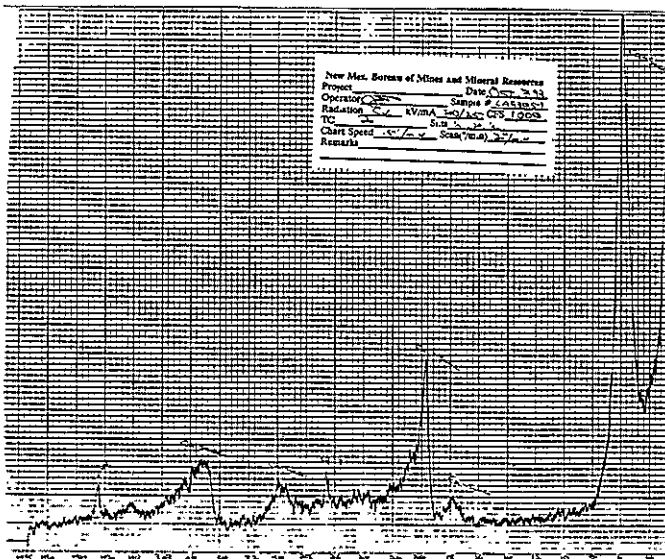
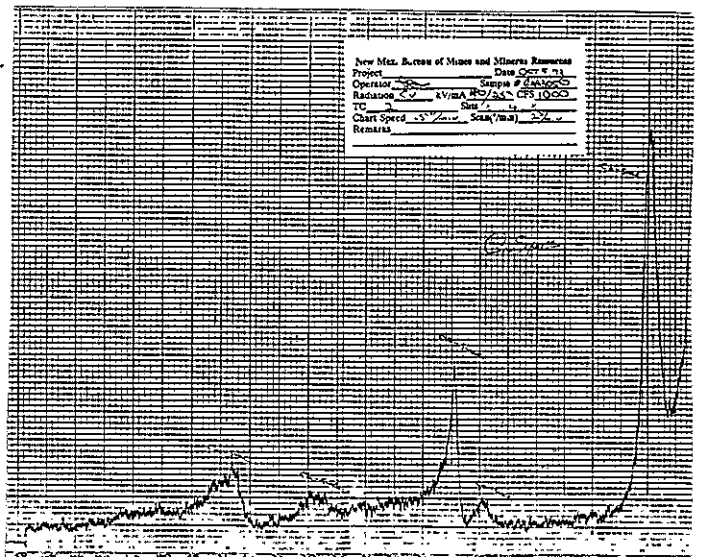
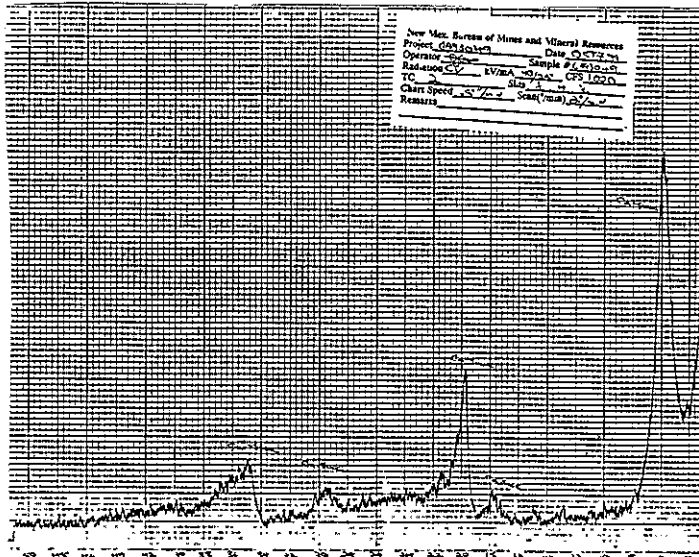
Analysis: Calcium smectite with
minor quartz and calcite(?)

GA93033 (Santa Ana)

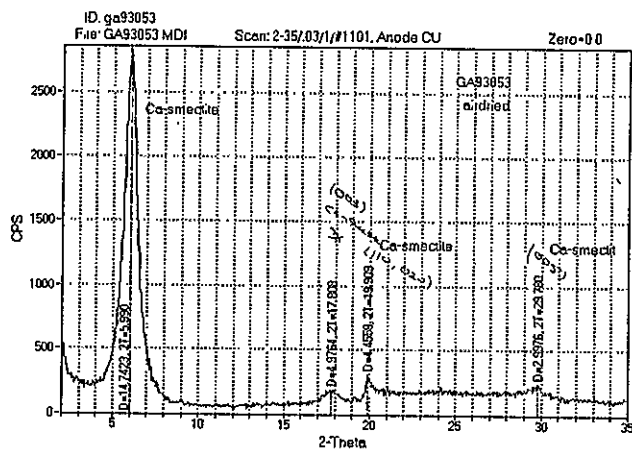
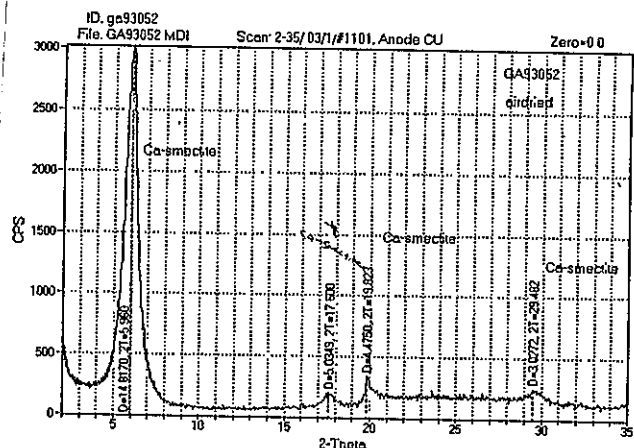
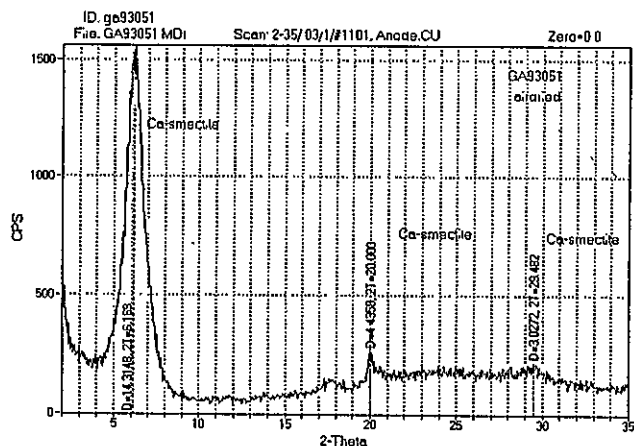
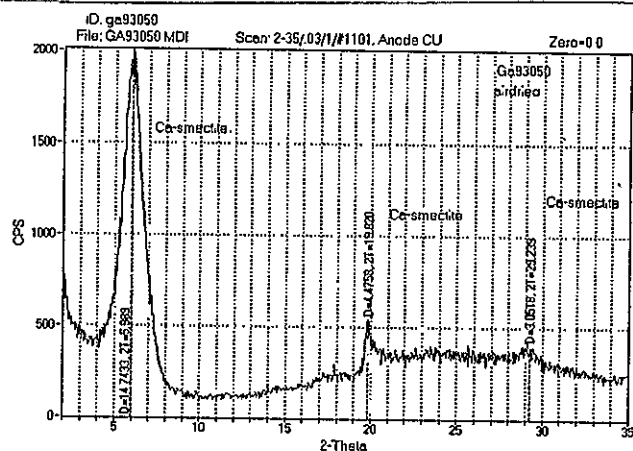
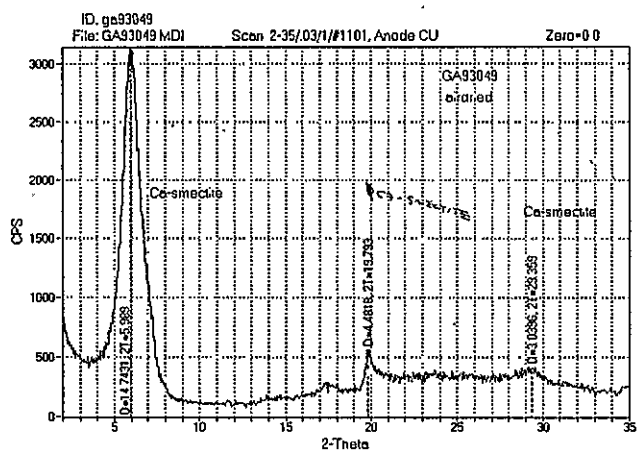


Analysis: Calcium smectite with
minor quartz and calcite(?)

Additional Bulk X-ray Traces



Additional Clay Mineral X-ray Traces



CHEMICAL ANALYSES

| | (Cheto) | (Santa Ana) | | | | | |
|----------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | <u>GA93032</u> | <u>GA93033</u> | <u>GA93049</u> | <u>GA93050</u> | <u>GA93051</u> | <u>GA93052</u> | <u>GA93053</u> |
| SiO ₂ | 59.2 | 60.2 | 59.4 | 60.1 | 63.7 | 58.1 | 58.3 |
| Al ₂ O ₃ | 18.4 | 17.5 | 17.2 | 17.1 | 17.2 | 17.0 | 16.9 |
| MgO | 7.07 | 8.38 | 5.67 | 6.08 | 5.14 | 5.05 | 5.35 |
| CaO | 2.97 | 3.19 | 3.04 | 3.16 | 3.08 | 3.11 | 3.20 |
| Fe ₂ O ₃ t | 1.77 | 3.19 | 3.36 | 3.38 | 3.32 | 3.40 | 3.31 |
| TiO ₂ | 0.25 | 0.49 | 0.49 | 0.50 | 0.50 | 0.50 | 0.48 |
| K ₂ O | 0.20 | 0.08 | 0.16 | 0.09 | 0.30 | 0.06 | 0.12 |
| MnO | 0.14 | 0.06 | 0.06 | 0.05 | 0.03 | 0.02 | 0.03 |
| P ₂ O ₅ | 0.05 | 0.07 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 |
| Na ₂ O | ND | ND | 0.56 | 0.43 | 0.68 | 0.29 | 0.46 |
| S | - | - | - | - | - | - | - |
| LOI | <u>9.52</u> | <u>7.91</u> | <u>11.53</u> | <u>9.91</u> | <u>6.80</u> | <u>11.73</u> | <u>12.50</u> |
| Total | 99.57 | 101.07 | 101.52 | 100.87 | 100.78 | 99.28 | 100.75 |

CHEMICAL ANALYSES RECAST TO ANHYDROUS STATE = 100%

| | (Cheto) | (Santa Ana) | | | | | |
|----------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | <u>GA93032</u> | <u>GA93033</u> | <u>GA93049</u> | <u>GA93050</u> | <u>GA93051</u> | <u>GA93052</u> | <u>GA93053</u> |
| SiO ₂ | 65.7 | 64.6 | 66.0 | 66.5 | 67.8 | 66.3 | 66.1 |
| Al ₂ O ₃ | 20.4 | 18.8 | 19.1 | 18.8 | 18.3 | 19.4 | 19.2 |
| MgO | 7.85 | 9.00 | 6.30 | 6.69 | 5.47 | 5.77 | 6.07 |
| CaO | 3.30 | 3.42 | 3.38 | 3.48 | 3.28 | 3.55 | 3.63 |
| Fe ₂ O ₃ t | 1.97 | 3.42 | 3.73 | 3.71 | 3.53 | 3.88 | 3.75 |
| TiO ₂ | 0.28 | 0.52 | 0.55 | 0.55 | 0.53 | 0.57 | 0.55 |
| K ₂ O | 0.22 | 0.09 | 0.17 | 0.10 | 0.32 | 0.07 | 0.14 |
| MnO | 0.16 | 0.06 | 0.07 | 0.05 | 0.04 | 0.03 | 0.04 |
| P ₂ O ₅ | 0.06 | 0.08 | 0.06 | 0.05 | 0.07 | 0.07 | 0.08 |
| Na ₂ O | ND | ND | 0.63 | 0.47 | 0.72 | 0.33 | 0.52 |
| S | - | - | - | - | - | - | - |
| LOI | <u>NA</u> | <u>NA</u> | <u>NA</u> | <u>NA</u> | <u>NA</u> | <u>NA</u> | <u>NA</u> |
| Total | 99.94 | 99.99 | 99.99 | 99.40 | 100.06 | 99.97 | 100.08 |

*Analyses by the New Mexico Bureau of Mines and Mineral Resources X-ray Facility and by x-ray fluorescence.

LEACHING ANALYSIS - PERCENT INSOLUBLE

(Boiled for 4hr in EDTA solution)

| (Cheto) | (Santa Ana) | | | | | |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| <u>GA93032</u> | <u>GA93033</u> | <u>GA93049</u> | <u>GA93050</u> | <u>GA93051</u> | <u>GA93052</u> | <u>GA93053</u> |
| 96% | 93% | 95% | 95% | 96% | 95% | 98% |

PARTICLE SIZE ANALYSIS

| | (Cheto) | (Santa Ana) | | | | | |
|------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | <u>GA93032</u> | <u>GA93033</u> | <u>GA93049</u> | <u>GA93050</u> | <u>GA93051</u> | <u>GA93052</u> | <u>GA93053</u> |
| Sand+-size | 1% | 1% | 0% | 0% | 6% | 0% | 1% |
| Silt-size | 87% | 92% | 61% | 62% | 50% | 56% | 56% |
| Clay-size | <u>12%</u> | <u>7%</u> | <u>39%</u> | <u>38%</u> | <u>44%</u> | <u>44%</u> | <u>43%</u> |
| TOTAL | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

CONCLUSIONS

The New Mexico bedded fissile claystone consists almost entirely of clay minerals (calcium smectite). Major element chemical analysis indicates that the Santa Ana clay is similar to the Cheto clay, but slightly more iron- and titanium-rich and more aluminum-, potassium- and manganese-poor. With the exception of sample GA93051, the sand-and-larger-size fraction (sand+) is less than 1%. Although the silt- and clay-size fractions of the sample appear to vary considerably, this may be a result of the difficulty of dispersing the finer solids in distilled water and may not be significant.

The New Mexico claystone is similar in particle size, mineralogy, and chemistry to the Cheto claystone of eastern Arizona. The Cheto is processed to be a high-grade desiccant at the United Desiccants plant near Belen, NM.

REFERENCES

- Manley, K., 1978, Geologic map of the Bernalillo NW Quadrangle, Sandoval County, New Mexico: U.S. Geological Survey, Geologic Map GQ-1446, scale 1:24,000.
- Tedford, R. H., 1981, Mammalian biochronology of the late Cenozoic basins, New Mexico: Geological Society of America Bulletin, Part I, v. 92, p. 1008-1022.