PALEONTOLOGICAL INVENTORY AND PROPOSED MITIGATION PROGRAM, SAN JUAN COAL MINE

Submitted by:

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INTRODUCTION

In late 1984, the New Mexico Bureau of Mines and Mineral Resources was contracted by Utah International Inc., and San Juan Coal Company to conduct a paleontological inventory of the San Juan Coal Company mine lease. In addition, the NMBM&MR was asked to provide an assessment of the fossil resources discovered during the inventory and to provide a suitable mitigation plan for those resources. This report describes the results of that inventory and develops a paleontological mitigation program for consideration by Utah International and the San Juan Coal Company.

The paleontological inventory was carried out by a field party consisting of Dr. Donald L. Wolberg, NMBM&MR; Dr. Joseph H. Hartman, University of Minnesota; and Danny Bobrow, NMBM&MR. Wolberg is a vertebrate paleontologist, Hartman is an invertebrate paleontologist, and Bobrow is a field geologist and paleontological laboratory assistant. Liaison and coordination with the San Juan Coal Company was closely maintained through Orlando Estrada, Senior Environmental Engineer. The field party appreciates Mr. Estrada's capable assistance. This study was completed with the approval of Dr. Frank Kottlowski, Director of the NMBM&MR.

GEOLOGIC FRAMEWORK

The study area encompasses the San Juan Coal Company lease and includes an area of approximately slightly more than thirteen sections, or more than 8320 acres and covers about two-thirds of the eastern half of the USGS 1:24,000 Waterflow Quadrangle. The bedrock geology of the Waterflow Quadrangle was described by Hayes and Zapp (1955) as part of a larger scale effort. Strobell, Hayes, and O'Sullivan (1980) treated the surficial geology and made minor revisions of the bedrock geology and published a detailed geologic map at 1:24,000 scale. Figure 1 shows the study area and is taken from Strobell, Hayes and O'Sullivan (1980). Figure 2 is a generalized stratigraphic column for the Waterflow Quadrangle; the Quaternary units recognized by Strobell, Hayes, and O'Sullivan (1980) have not been separated out.

As can be seen in the generalized stratigraphic column, eleven Cretaceous units are recognized in the Waterflow Quadrangle. However, as can be seen in Figure 1, the Fruitland Formation comprises virtually all of the bedrock exposed in the study area. The Pictured Cliffs Sandstone is exposed in the study area, although with comparatively minor exposures. It is unclear whether the Lewis Shale-Pictured Cliffs contact can be seen within the study area. Similarly, although shown on the map of Strobell, Hayes, and O'Sullivan (1980), the lower shale member of the Kirtland Shale, mapped as being present in the southeastern portion of the study area, could not be differentiated in the field.

The Fruitland Formation consists of brownish-gray to gray silty shales, olive-gray shales, silty yellowish sands, gray sands and maroon-weathering crossbedded to massively bedded sandstones, as well as prominent coals and massively bedded coquinas basally. Nodular ironstone concretionary layers are not uncommon in the Fruitland Formation in the study area. Coal beds frequently show clay partings, some of which may be altered volcanic ash layers.

The Pictured Cliffs Sandstone is characterized by rather well-sorted gray to light-gray, medium to massively bedded sandstones. Crossbedding may or may not be present; some thin, silty, shaley beds may be present. Concretionary layers may be present in the Pictured Cliffs.

Within the Waterflow Quadrangle, coal resouces are present in the Menefee Formation and the Fruitland Formation. Fruitland coals comprise the major resource of the study area. Strobell, Hayes, and O'Sullivan (1980) estimated that something more than 30 million tons of Menefee coal in the Waterflow Quadrangle are economically recoverable, although 120 million tons are calculated as being present. These figures can be compared to the estimates for the Fruitland Formation; 309 million tons present, some 85 million tons recoverable.

Additional resources within the Quadrangle include oil and some natural gas. It is interesting to note that the study area has also yielded a potential uranium prospect and been the site of lime production in the past. The Boyd Uranium Prospect was the subject of a detailed report by Chenoweth (1958) and the kilns associated with lime production from coquinas have been the

subject of historic interest. Both the uranium prospect and the lime kilns are associated with paleontologic materials.

Exposures within the study area are rather limited in extent as well as in "quality" from a paleontological perspective. Typical, San Juan Basin types of moderately sloping badlands are very limited. Much of the area is covered by Quaternary surficial deposits and many areas of exposure are characterized by steep slopes upon which fossil material cannot accumulate. Previous prospecting within the study area has resulted in only very limited discovery of fossil material. This relative barreness, paleontologically, of the area has been substantiated by this effort. In spite of rather intensive inspection, we were only able to document the occurrence of less than a score of paleontological localities.

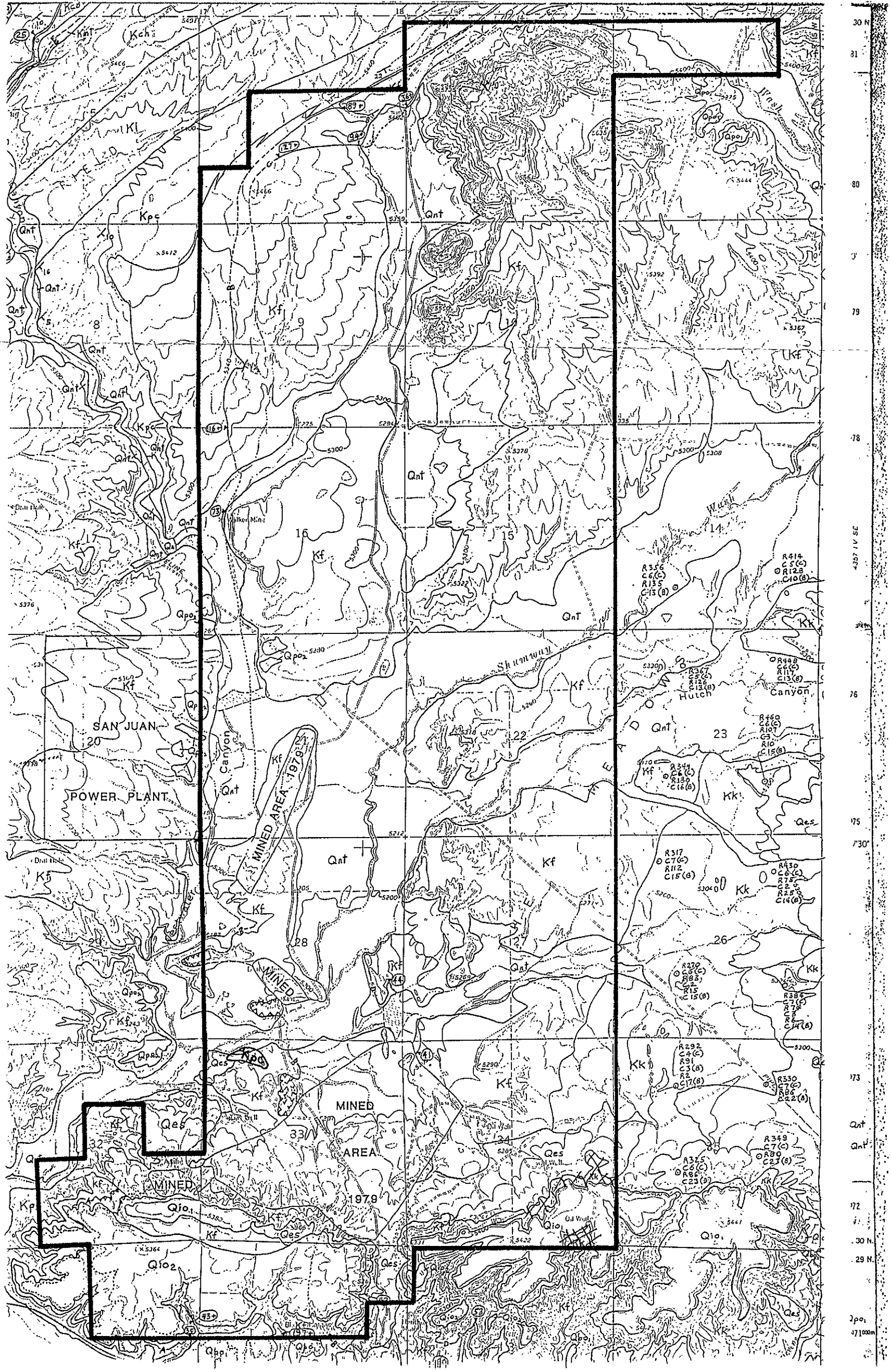
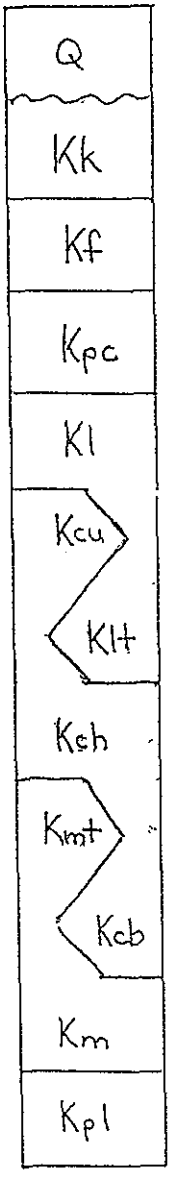


Figure 1. Boundary of the Study Area (after Strobell, Hayes and O'Sullivan, 1980). Abbreviations of stratigraphic units as in Figure 2. Kk in SE sec. 34 considered to be Fruitland Formation; Kpc in NE sec. 33 considered to be Pictured Cliffs Sandstone.

GENERALIZED STRATIGRAPHIC COLUMN WATERFLOW QUADRANGLE
(after Strobell, Hayes and O'Sullivan, 1980)



Q, undifferentiated Quaternary units; Kk, lower shale member of the Kirtland Shale; Kf, Fruitland Formation; Kpc, Pictured Cliffs Sandstone; Kl, Lewis Shale; Klt, unamed tongue; Kch, Cliff House Sandstone; Kcu, Ute Canyon Tongue; Kcb, Beechatuda Tongue; Km, Menefee Formation; Kmt, unamed tongue; Kpl, Point Lookout Sandstone

Figure 2

PALEONTOLOGICAL INVENTORY, PROCEDURES AND SIGNIFICANCE CRITERIA

As applied in this study, paleontological inventory is the detailed listing of fossil materials and the geologic contexts in which they were found. The inventory process can be further defined in terms of scheduling with reference to mining: the inventory can be pre-, during, or post-mining. The present study concentrated on pre-mining but also included inspection of areas presently being mined, as well as areas that have been mined in the past but are as yet not reclaimed. The inventory process is identical to time-honored, baseline paleontological reconnaissance; a delineated field area is appraised in terms of available bedrock exposures, and these exposures are inspected for the presence of fossils, generally in a systematic and uniform fashion. Fossil occurrences are recorded on base maps of appropriate scale together with additional field data and photographic documentation, when needed. Fossil samples may or may not be collected depending on circumstance, and any collected specimens are given field numbers, generally corresponding to a specific locality.

Generally, research-only oriented paleontological reconnaissance is biased towards the particular speciality of the paleontologist involved. Thus, a paleobotanist will usually be most concerned with locating fossil plant sites and not be overly concerned with an oyster bed or bone fragments. Within the context of the present study, directed as it is towards the identification and evaluation of fossil materials potentially

impacted by mining activities, it is necessary to deal with all available fossil categories: paleobotanical, invertebrate, and vertebrate fossils. Because of the availability of geologic cores, this study has also considered micropaleontological materials.

This study was initiated by a review of available published and unpublished data dealing with the Waterflow Quadrangle and other areas. This data included Hayes and Zapp (1955), Strobell, Hayes, and O'Sullivan (1980), Chenoweth (1958), and Beach and Jentgen (1978). One of us (DLW) had previously toured the lease area in part or total on several occasions, and the entire study team toured the lease area when this study was initiated. Discussion with O. J. Estrada provided information about particular localities. The lease tour and study of detailed mine topographic maps delineated areas of bedrock exposure to be investigated. Generally, the field party attempted to prospect all exposed areas. In lease areas of great relief, the party individually prospected high, middle, and low ground. A similar procedure was used for gentler slopes. The party was able to maintain good communication working together in this fashion, and localities discovered were generally collectively appraised and recorded, with J. H. Hartman serving as recorder. When necessary, samples were taken, numbered, and bagged. All invertebrate samples have been shipped to Hartman, except for a sample of fossil-rich coquina. One paleobotanical specimen is in Socorro as is material for screening for vertebrate fossils.

Unlike research-only paleontological field reconnaissance, where discovered localities are likely to remain undisturbed for

long periods of time, mining related reconnaissance (inventory) requires an assessment or prioritizing of localities based on significance, a value-laden determination. Hanson (1979) has noted:

> "The paleontological sensivity, or degree to which a specific geographic area is important to paleontological research, depends primarily on two factors: 1) the proven or expected potential of the area to produce fossils, and 2) the significance of these fossils and their geological context, judged in relation to what is already known or can be expected elsewhere."

In the San Juan Basin, the fossil potential of the rock units occurring in the study area, or very near, is reasonably well understood. The Pictured Cliffs Sandstone is generally a poorly fossiliferous unit; the Fruitland Formation and lower shale member of the Kirtland Shale are often, although not uniformly fossiliferous. The coal-rich portions of the Fruitland Formation are generally very poorly fossiliferous in terms of megafossils, a fact which probably reflects conditions in the coal-forming environment.

Additionally, these stratigraphic units are widespread throughout the San Juan Basin. Thus, within the study area, the non-coal portions of the Fruitland Formation have the best potential for fossiliferous material. How are these materials to be assessed in terms of significance, an especially critical factor upon which any proposed mitigation program must be constructed.

Over the last several years a set of criteria have been developed in New Mexico to evaluate paleontological materials. These criteria are applied to the following materials:

1. Vertebrate material, such as:
    a. complete skull and/or jaw
    b. articulated or complete skeleton
    c. concentration of vertebrate material
    d. unique or rare occurrence, and
    e. intimate association with the paleoenvironment.
2. Invertebrate material, such as:
    a. good to excellent preservation of shell material
    b. concentration of diverse material
    c. unique or rare occurrence
    d. intimate association with the paleoenvironment, and
    e. stratigraphic sequence.
3. Paleobotanical material, such as:
    a. well preserved plant material of any kind
    b. petrified wood
    c. fossil stumps, and
    d. intimate association of fossil plant and animal materials.

Any of these materials are then tested against the following criteria:

1. does the material contribute to faunal or floral lists;
2. does the material contribute to the systematics of the group or groups discovered during the inventory;
3. does the material contribute to our knowledge of the functional anatomy of the organism;

4. does the material contribute to our knowledge of the biostratigraphy, paleoecology or taphonomy of the occurring organisms;
5. can the material contribute to a potential museum exhibit or other significant educational use.

Although we have no doubt that other listing and evaluating methods are possible, we feel that the elements described above are amply sufficient and workable. They have been embodied in the New Mexico Paleontological Mitigation Procedures for Surface Mined Lands, adapted in a cooperative paleontological mitigation program between New Mexico and the U.S. Bureau of Land Management now in draft stage awaiting final approval, and have been incorporated in a mitigation program in draft stage by the U.S. Bureau of Indian Affairs.

As noted above, this study emphasized pre-mining inventory and significance determination. It is apparent that the bulk of useful paleontological work must occur before mining activities begin. However, mining activities can uncover material that may not have been available otherwise, and indeed, inspection of an inactive mine ramp yielded fossil material.

During the course of this study, virtually all areas of major exposure of the Fruitland Formation were inspected. Paleontologically, the Pictured Cliffs Sandstone is rather bleak, and approximately 50% of available exposures of the Pictured Cliffs was looked at with the expected results. As noted above, it remains uncertain whether the lower shale member of the Kirtland Shale is actually present within the study area.

Eighteeen fossil localities were identified and these are shown of Figure 3. Each locality is described in the Locality Register below. All fossil localities are considered to occur within the Fruitland Formation.

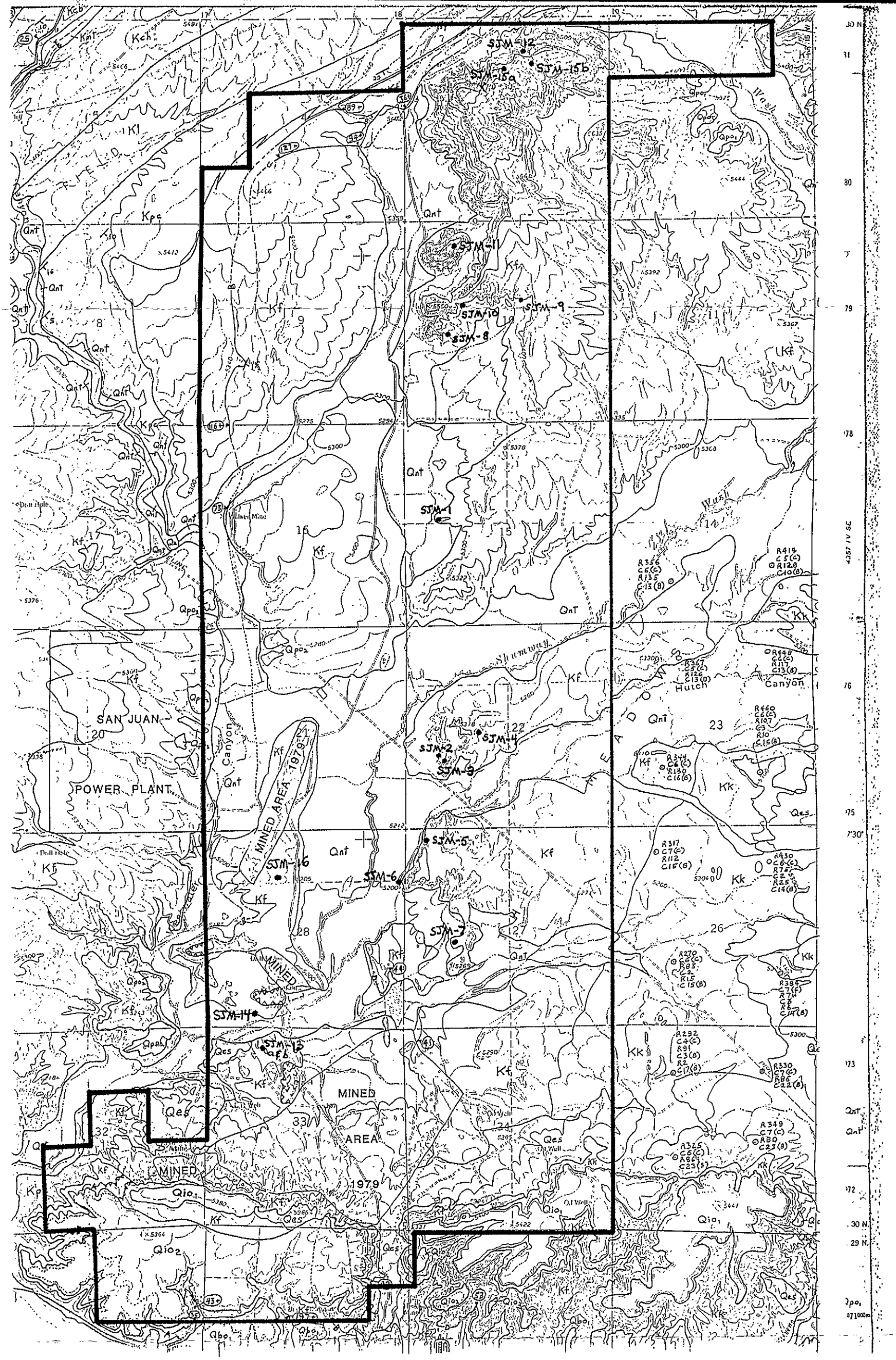


Figure 3. Location of paleontological localities identified.

LOCALITY REGISTER

Locality SJM-1

SJCC Inventory Record, NMBM&MR, 13 Nov., 1984

New locality; nonmarine mollusks and vertebrates

NM Coordinates: 2,116,250 N, 331,100 E

USGS Quad. Loc: 2800 ft N/SSL, 740 E/WSL, sec. 15, T.30N., R.15W.;
SW SE SW NW 15
Elevation 5285 ft
(location and elevation determiend from topogrpahic mine map,
1:12,000, 5 ft contour interval)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Discovered by J. H. Hartman, D. Bobrow, 13 Nov., 1984

Minor collectios made by J. H. Hartman, 17 Nov., 1984

Located in situ and on displaced block of channel-form sandstone forming as east-west trending ridge in pasture. Fossils located near bottom of channel on west end of ridge. The vertebrate material appears scrappy but locality should be periodically inspected. Invertebrates will be analysed by Hartman.

Locality SJM-2

SJCC Inventory Record, NMBM&MR, 14 Nov. 1984

New locality; nonmarine mollusks

NM Coordinates: 2,110,000 N, 331,170 E

USGS Quad. Loc: 1760 ft N/SSL, 860 E/WSL, sec. 22, T.30N., R.15W; NW SE NW SW 22
Mine Topo. Map: 1820 ft N/SSL, 830 E/WSL, sec. 22 (difference due to section line location)
Elevation 5280 ft
(location and elevation determined from mine topographic map, 1:12,000, 5 ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Discovered and collected by D. Bobrow, 14-15, Nov., 1984

Float occurrence and collection from west-facing shale slope, approximately 15 ft below ridge crest. Collection represents one good bivalve and about twelve poor bivalve fragments. Source not located.

Locality SJM-3

SJCC Inventory Record, NMBM&MR, 14 Nov., 1984

New locality; vertebrate

NM Coordinates: 2,109,930 N, 331,240 E

USGS Quad. Loc.: 1720 ft N/SSL, 940 E/WSL, sec. 22, T.30N., R.15W.; NW SE NW SE 22
Mine Topo. Map: 1750 ft N/SSL, 900 E/WSL, sec. 22 (difference due to section line location)
Elevation 5275 ft
(location and elevation determined from topographic mine map, 1:12,000, 5 ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Discovered and collected by D. Bobrow

A few weathered turtle carapace fragments were collected from an east-facing ridge in a shale located approximately 6.9 ft below local top of ridge.

Locality SJM-4

SJCC Inventory Record, NMBM&MR, 14 Nov., 1984

New locality; vertebrate

NM Coordinates: 2,110,660 N, 332,320 E

USGS Quad. Loc.: 2470 ft N/SSL, 1990 E/WSL, sec. 22, T.30N., R.15W.; NW NE NE SW 22
Elevation 5255 ft
(location and elevation determined from topographic mine map, 1:12,000, 5 ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Discovered by D. L. Wolberg: no collections made

Badly weathered dinosaur rib fragments found in little finger of channel-form siltston underlain by a pebble-conglomerate shale on generlaly east-facing hillock exposures.

Locality SJM-5

SJCC Inventory Record, NMBM&MR, 14 Nov., 1984

New locality; paleobotanical

NM Coordinates: 2,107,910 N, 330,850 E

USGS Quad. Loc.: 4930 ft N/SSL, 500 E/WSL, sec. 27, T.30N., R.15W.; NE NW NW NW 27
Elevation 5272 ft; approximate in situ horizon
(location and elevation determined from topographic mine map, 1:12,000, 5 ft contour)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Discovered by J. H. Hartman. Collected by J. H. Hartman, D. Bobrow, and D. L. Wolberg, 14-15 Nov., 1984

A rather large palm frond (approximately 2.5x3.5 ft and 3 ft stem) from two main sandstone blocks together with minor frond fragments on smaller blocks. Found on shaley slopes underlying maroon weathering, indurated, ledge-forming capping sandstone on west-facing mesa bluff.

The specimen has been transported to Socorro for restoration. May possibly be used as a portion of a display at the San Juan Mine.

Locality SJM-6

SJCC Inventory Record, NMBM&MR, 14 Nov., 1984

New locality: nonmarine mollusk

NM Coordinates: 2,106,920 N, 330,290 E

USGS Quad. Loc.: 3940 ft N/SSL, 5230 E/WSL, sec. 28, T.30N., R.15W; SW SW NW NW 27
Mine Topo. Map: 3940 ft N/SSL, 5230 E/WSL, sec. 28 (difference due to section line location)
Elevation 5220 ft
(location and elevation determined from topographic mine map, 1:12,000, 5 ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Discovered by D. L. Wolberg and D. Bobrow, 14 Nov. Collected by D. L. Wolberg, D. Bobrow, and J. H. Hartman, 21 Nov., 1984.

A nonmarine mollusk bed was found on the nose of a west-facing mesa bluff, approximately 8 ft above flats and approximately 50 ft (not measured) from local road drainage ditch. Collections made on 21 Nov. are to be analysed by J. H. Hartman. This locality is worthy of recollection.

Locality SJM-7

SJCC Inventory Record, NMBM&MR, 15 Nov., 1984

New locality; nonmarine mollusks and vertebrates

NM Coordinates: 2,105,220 N, 331,500 E

USGS Quad. Loc.: 2240 ft N/SSL, 1250 E/WSL, sec. 27, T.30N., R.15W.; SE NE NW SW 27
Mine Topo. Map: 2250 ft N/SSL, 1190 E/WSL, sec. 27 (difference due to section line location)
Elevation 5245 ft
(location and elevation determined from topographic mine map, 1:12,000, 5 ft contour, and adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Discovered by D. L. Wolberg, 15 Nov.; collected by D. L. Wolberg, D. Bobrow, and J. H. Hartman, 15 Nov.; and J. H. Hartman, 16 Nov.

This locality essentially is the caprock of a southwest-northeast trending small, narrow ridge. Fossils seem to have been concentrated at either end of the ridge. Fossils collected include bivalves (now with J. H. Hartman), a small carnosaur tooth, broken crocodilian teeth, fragmentary bone, several gar scales. This locality should be recollected.

Locality SJM-8

SJCC Inventory Record, NMBM&MR, 15 Nov., 1984

New locality; brackish water mollusks (exotic--out of place)

NM Coordinates: 2,121,030 N, 331,480 E

USGS Quad. Loc.: 2320 ft N/SSL, 1100E/WSL, sec. 10, T.30N., R.15W., NE NE SW SW 10
Elevation 5350 (meaningless)
(location and elevation determiend from topographic mine map, 1:12,000, 5 ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Discovered by D. L. Wolberg, 15 Nov.; sample taken by D. L. Wolberg and J. H. Hartman

This spurious occurrence consists of a number of coquinoid blocks with brackish water mollusks, mainly bivalves, discovered laying on south-facing shaley, silty exposures in a small amphitheatre. These blocks appear exotic and out of place in that they are not float and are quite obviously not from strata in this area. The question then appears to be why they were placed or dumped at this location.

Locality SJM-9

SJCC Inventory Record, NMBM&MR, 15 Nov., 1984

New locality; nonmarine mollusk locality

NM Coordinates: 2,121,920 N, 333,290 E

USGS Quad. Loc.: 3220 ft N/SSL, 2900 E/WSL, sec. 10, T.30N., R.15W.; NW SE SE NE 10
Elevation 5400
(location and elevation determined from topographic mine map, 1:12,000, 5' ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Discovered by D. L. Wolberg, 15 Nov.; collected by D. L. Wolberg, J. H. Hartman, and D. Bobrow, 17 Nov., 1984

Thin deposit of fragmented bivalves occurring in claystone on east bank of minor drainage, south of east-west ridge. Collected material with J. H. Hartman.

Locality SJM-10

SJCC Inventory Record, NMBM&MR, 15 Nov., 1984

New locality; nonmarine mollusks

NM Coordinates: 2,121,970 N, 331,7890 E

USGS Quad Loc.: 3260 ft N/SSL, 1380 E/WSL, sec. 10, T.30N., R.15W.; NW SW SE NW 10
Elevation approximately 5475 (probable elevation of producing horizon)
(location and elevation determined from topographic mine map, 1:12,000, 5 ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Discovered by J. H. Hartman, 15 Nov.; collected by Hartman, 17 Nov.

Float collection of bivalves from sandstone pebble-conglomerate coquina on south-facing bluff. Fossils likely originating from mesa-capping, channel-form sandstone. However, source was not located.

Locality SJM-11

SJCC Inventory Record, NMBM&MR, 15 Nov., 1984

New locality; nonmarine mollusks

NM Coordinates: 2,123,310 N, 331,630 E

USGS Quad. Loc.: 4610 ft N/SSL, 1220 E/WSL, sec. 10, T.30N., R.15W.; NE SE NW NW 10
Elevation approximately 5515-5520 (elevation of probable source horizon)
(location and elevation determined from topographic mine map, 1:12,000, 5 ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Discovered and collected by D. Bobrow, 15 Nov., 1984

Float block of sandstone collected on south-facing shale and boulder strewn mesa bluff, not far below mesa-capping, channel-form sandstone.

Locality SJM-12

SJCC Inventory Record, NMBM&MR, 16 Nov., 1984

New locality; nonmarine mollusks

NM Coordinates: 2,218,460 N, 333, 450 E

USGS Quad. Loc.: 4460 ft N/SSL, 3020 E/WSL, sec. 3, T.30N., R.15W., NE SW NW NE 3
Elevation approximately 5535 (probable source horizon at approximately 5670)
(location and elevation determined from topographic mine map, 1:12,000, 5 ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Discovered and collected by D. L. Wolberg and D. Bobrow, 16 Nov., 1984

Float blocks of sandstone collected on north-facing shale and sandstone boulder strewn mesa bluff. Material is probably some distance from the source area and horizon.

Locality SJM-13a

SJCC Inventory Record, NMBM&MR, 17 Nov., 1984

New locality; nonmarine mollusks

NM Coordinates: 2,102,520 N, 326,630 E

USGS Quad. Loc.: 4640 ft N/SSL, 1460 E/WSL, sec. 33, T.30N., R.15W.; SW NW NE NW 33
Mine Topo. Map: 4640 ft N/SSL, 1590 E/WSL, sec. 33 (difference due to section line location)
Elevation 5193
(location and elevation determined from topographic mine map, 1:12,000, 5 ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Locality referred by O. J. Estrada (SJCC), 12 Nov. Map located by J. H. Hartman, 17 Nov. Collected by J. H. Hartman, D. L. Wolberg, and D. Bobrow, 18 Nov., 1984.

Brackish-water coquina exposed on west-facing, high exposures along dirt road to Shumway Arroyo (source of collections), and coquinoid exposures facing Shumway Arroyo to north. This locality is of some significnce and will require additional measures.

Locality SJM-13b

SJCC Inventory Record, NMBM&MR, 17 Nov., 1984

New locality; nonmarine mollusks

NM Coordinates: 2,102,190 N, 327,000 E

USGS Quad. Loc.: 4375 ft N/SSL, 1880 E/WSL, sec. 33, T.30N., R.15W.; NW SE NE NW 33
Mine Topo. Map: 4310 ft N/SSL, 1970 E/WSL, sec. 33 (difference due to section line location)
Elevation 5193
(location and elevation determined from topographic mine map, 1:12,000, 5 ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Referred by O. J. Estrada (SJCC), 12 Nov., map located by J. H. Hartman, 17 Nov., collected by J. H. Hartman, D. L. Wolberg, and D. Bobrow, 19 Nov., 1984.

Brackish-water coquina exposed on little hillocks on north side of dirt road between "Scoria Mesa" and oil tanks, and on south side of older dirt road (essentially abandoned). Fossils weathered out and loose. Surface of hillocks well picked. This locality is of some significance and will require additional measures.

Locality SJM-14

SJCC Inventory Record, NMBM&MR, 17 Nov., 1984

New locality; nonmarine mollusks

NM Coordinates: 2,103,320 N, 326,600 E

USGS Quad. Loc.: 250 ft N/SSL, 1530 E/WSL, sec. 28, T.30N., R.15W.; NE SW SE SW 28
Mine Topo. Map: 350 ft N/SSL, 1530 E/WSL, sec. 28 (difference due to section line location)
Elevation 5185
(location and elevation determined from topographic mine map, 1:12,000, 5 ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Referred by O. J. Estrada (SJCC) and D. Clifton (San Juan County Museum Association, Division of Conservation Archeology). Map located by J. H. Hartman, 17 Nov. Collected by J. H. Hartman, D. L. Wolberg, and D. Bobrow, 18 Nov., 1984.

Brackish-water coquina exposed as small island on north-south trending ridge abutting lime kiln on south and overlooking undercutting of Shumway Arroyo. Main haul road on east side and dirt road (crossing Shumway, but impassable) on west. This locality is of some significance and will require additional measures. This locality (limekiln) reported on 6/28/79 by N. Hewitt: "The smelter was possibly wed to slack lime from the fossiliferous sandstone." Ethnographer Fred York reported the construction of the kiln in 1915 by Ed Thurland. Ed Beaumont, Consulting Geologist, told us that he thought that the Shumway family may have constructed the kilns.

Locality SJM-15a

SJCC Inventory Record, NMBM&MR, 20 Nov., 1984

New locality; nonmarine mollusks, dinosaur tooth and bone fragments, turtle shell fragments, crocodilian armor fragments

NM Coordinates: 2,127,930 N, 333,010 E

USGS Quad. Loc.: 3930 ft N/SSL, 2590 E/WSL, sec. 3, T.30N., R.15W.; Center N1/2 3
Elevation 5683
(location and elevation determined from topographic mine map, 1:12,000, 5 ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Rediscovered by D. L. Wolberg, 1982; relocated by Wolberg, 1984; collected by J. H. Hartman, D. L. Wolberg, and D. Bobrow, 20 Nov., 1984.

This locality was originally discovered by W. L. Chenoweth in Sept., 1958, and is unique in that this and an associated locality represents the only or one of the very few Fruitland localities producing uranium as well as fossils. Freshwater and brackish bivalves and gastropods and vertebrate material found in place in the mineralized zone between an underlying varigated shale and overlying channel-form sandstone that is massively bedded. The locality is in the north-facing exposure at a previously worked uranium prospect. Some fossil material has weathered out. This locality is worthy of periodic collection.

Chenoweth reported in 1958 that N. F. Sohl (USGS) had identified the following taxa at this locality:

Campeloma amarillensis Stanton
Goniobasis? subtortosa (Meek and Hayden)
Tulotomops laevibasalis Yen
Corbula sp.
Unio sp.?
or Unio pyramitoides Whitfield? of Stanton

Locality SJM-15b

SJCC Inventory Record, NMBM&MR, 31 December, 1984

New locality; nonmarine mollusks, vertebrate, and paleobotanical

NM Coordinates: (projected) 2,128,080 N, 333,800 E

USGS Quad. Loc.: 4140 ft N/SSL, 3360 E/SSL, sec. 3, T.30N., R.15W.; SW SE NW NE 3
Elevation 5650 (mine topo. map used for determination)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

This locality was not seen during the present survey. Notice of this locality only became apparent upon review of original Atomic Energy Commission reports. From the description of the locality available, this locality should stratigraphically overlie SJM-15a. In 1958, N. Sohl (USGS) identified the following fossils from SJM-15b:

Campeloma amarillensis Stanton
Goniobasis? subtortosa (Meek and Hayden)
Tulotomops laevibasalis Yen
Melanistes reesidei (Stanton)
Indeterminate pelecypod
bone fragments
leaf fragments

A renewed search to relocate this site should be made. However, it is possible that the producing horizon may be covered or have slumped.

Locality SJM-16

SJCC Inventory Record, NMBM&MR, 21 Nov., 1984

New locality; nonmarine mollusks

NM Coordinates: 2,106,270 N, 326,840 E

USGS Quad. Loc.: 3300 ft N/SSL, 1770 E/WSL, sec. 28, T.30N., R.15W.; SE NW SE NW 28
Elevation 5135
(location and elevation determined from topographic mine map, 1:12,000, 5 ft contour; adjusted to USGS Quadrangle specifications)
Waterflow Quad., 1963 (PR 1979), 1:24,000
San Juan County, New Mexico

Fruitland Formation

Discovered and collected by D. L. Wolberg, J. H. Hartman, and D. Bobrow, 21 Nov., 1984

Extensive but displaced brackish-water coquina found on north side of Yucca Ramp 2, near and at level of ramp. Material has clearly been bulldozed into present position. Additional collections would be useful in spite of lack of stratigraphic provenance; this occurrence shows that inspection of spoils piles, when practical and safe, can yield additional paleontologic material.

MITIGATION PROPOSALS

The following sites or localities are determined to require mitigation: SJM-1, SJM-5, SJM-6, SJM-7, SJM-13, SJM-14, SJM-15. Of these localities, SJM-5 is the locality that yielded the large palm frond and stem. This specimen has been removed and will be restored in Socorro. This action is considered to be sufficient for mitigation purposes.

SJM-1 has yielded mollusk and vertebrate material. Although nothing of significance has been obtained at this locality, it is suggested that periodic inspection of indefinite duration be undertaken by the NMBM&MR or paleontologists selected by San Juan Coal Company. It is possible that additional material will be found. SJM-6 contains freshwater bivalves and is the best bivalve deposit discovered during the inventory. The bivalves are relatively well preserved and potentially have taxonomic and biostratigraphic significance. This locality should be excavated to obtain maximum exposure and allow very detailed collecting. Depending upon available equipment and personnel, this could be accomplished in approximately two days.

SJM-7 is a very interesting locality near the topsoil stockpile. This locality has yielded bivalves and vertebrate material in some quantity. Mitigation required at this locality includes surface collection and excavation and removal of the producing horizon(s). Bulk collections of matrix will require washing, screening, and picking. The steep slopes at this locality will probably preclude the use of excavation machinery. It is estimated that at least three days would be required at

this locality.

SJM-13 and SM-14 can be treated as a single locality for mitigation purposes. These sites represent good brackish-water localities, and an effort should be made to maintain them without disturbance. In actuality, it is our understanding that these sites are in no danger of being mined. We suggest that non-mining activities that might impact these sites be minimized. Additionally, we suggest that these sites be kept available for future collecting. If disturbance is unavoidable, we suggest that intensive collecting of these localities be undertaken.

SJM-15a and SJM-15b are interesting invertebrate and vertebrate sites associated with uranium mineralization. SJM-15b has not been actually located in the field as yet, but was documented almost thirty years ago. An effort should be made to relocate SJM-15b (this may or may not be possible). SJM-15a is easily available for additional collection. These sites are not threatened by mining and the only mitigation deemed necessary is for continued access to be made available for additional collection.

The localities described above can be mitigated easily, and at no direct cost to San Juan Coal Company. These localities are of some interest for the educational opportunities that they provide in addition to the scientific interest of the fossil material. A Field Paleontology course is offered during the Summer Session at New Mexico Tech and it is recommended that these localities be allowed further collection by the Field Paleontology class which will be taught by one of the field inventory crew. This course is basically a "methods" course,

providing the secondary school teachers who participate actual hands-on experience in paleontological field techniques that they can translate to the classroom experience. Our past experience with this course shows the participants to be extremely interested in the activities, highly motivated and well organized.

The only participation required from San Juan Coal Company involves safety clearance and procedures for the students, access to hard-hats for the term of activity on mine property, access to the localities and possibly use of digging machinery, if available. Vehicles, gear, and needed supplies are provided by the students or New Mexico Tech.

A final mitigation proposal relates to available geologic cores. Available representative cores will be submitted to the NMBM&MR for permanent storage and cataloging in our core library. Cores are extremely useful for documenting stratigraphic sequences, sedimentologic studies, and micropaleontology. They will also provide a useful permanent record of the stratigraphy in areas that may be or have been mined. Proprietary data will be assured confidentiality.

The following suggestions, although not related to the mitigation of the localities noted above, are in the spirit of the paleontological guidelines developed in New Mexico. It is recommended that mine personnel be encouraged to report fossil discoveries to the Senior Environmental Engineer at SJCC. If the material is thought to be of scientific interest, the Senior Environmental Engineer can then send the specimen(s) to the

NMBM&MR for analysis, or arrangements can be made for a visit to the discovery site.

It is suggested that access to the mine lease continue to be made available for periodic inspection of spoils piles and access ramps. These visits can be coordinated so as not to interfere with operating schedules and with safety foremost in mind. It is our view that paleontological studies and mining activities are not mutually exclusive. It is certain that under special circumstances, mitigation of potential impacts to paleontological materials is required, but it is the basic goal of paleontology to remove fossils for study and/or display, in which case mining activities can generally continue. Only in the most unusual circumstances, is it desireable to maintain paleontological materials in situ.

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