URANIUM RESOURCE EVALUATION
SHERMAN QUADRANGLE
TEXAS AND OKLAHOMA

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ABSTRACT

Uranium favorability of the Sherman Quadrangle, Texas and Oklahoma, was evaluated using National Uranium Resource Evaluation criteria. Surface and subsurface geologic studies were supplemented by aerial radiometric surveys and hydrogeochemical and stream-sediment reconnaissance studies. A total of 1,537 rock, soil, and stream-sediment samples were analyzed for 30 elements.

Environments favorable for sandstone-type uranium deposits are present in the Cretaceous Antlers and Woodbine Formations, Pennsylvanian arkoses, and the Permian Wichita-Albany Group. The Antlers Formation is locally radioactive, and rock, stream-sediment, and ground-water samples show uranium enrichment. Dip-oriented sand belts may contain subsurface uranium deposits. Arkosic wedges in the Pennsylvanian Strawn, Canyon, and Cisco Groups were partially derived from a favorable Wichita Mountain source, were highly permeable, and contain downdip reductants; gamma-ray logs show some anomalies. The Permian Wichita-Albany Group contains small uranium occurrences. The Woodbine Formation had an excellent uranium source in updip volcaniclastic correlatives, good permeability, and organic precipitants, but there is little direct evidence of uranium occurrences.

Environments considered unfavorable for uranium deposits are limestones and shales of Cambrian to Pennsylvanian age, Pennsylvanian sandstones derived from a Ouachita source, Lower Cretaceous shales, limestones, and sandstones, Upper Cretaceous marine strata, and sparse Cenozoic sediments. Unevaluated environments include Precambrian granites and metasediments of the buried Muenster Arch.

INTRODUCTION

PURPOSE

The Sherman Quadrangle, Texas and Oklahoma (Fig. 1), was evaluated to a depth of 1500 m (5,000 ft) to identify geologic environments and delineate areas that exhibit characteristics favorable for uranium deposits. Selection of a favorable environment is based on the similarity of its geologic characteristics to the National Uranium Resource Evaluation (NURE) recognition criteria described in Mickle and Mathews (eds., 1978). The study was conducted by the Bureau of Economic Geology, The University of Texas at Austin, under subcontract to Bendix Field Engineering Corporation (BFEC) for the NURE program, managed by the Grand Junction Office of the U.S. Department of Energy (DOE).

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SCOPE

The evaluation program for the Sherman Quadrangle began on March 1, 1978, and ended on March 31, 1980. Time spent on literature search and preparation of a work plan was 9 man-months; field work involved 22.5 man-months, and 4.5 man-months were invested in analyzing and reporting data.

PROCEDURES

Examination of both the surface geology and subsurface units to a depth of 1500 m (5,000 ft) was undertaken to evaluate the uranium potential of the Sherman Quadrangle. Surface investigations involved (1) re-examination of all previously reported uranium occurrences, (2) field checking all aerial radiometric anomalies, (3) field checking geochemical anomalies revealed by the Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) Program, and (4) reconnaissance and sampling of all exposed rock units. Rock, stream-sediment, and soil samples were analyzed by the Mineral Studies Laboratory of the Bureau of Economic Geology. Detailed observations were made on the geologic units sampled. A portable scintillometer, the Geometrics Model GR-101A, was used to measure gross gamma counts.

An aerial radiometric and total magnetic field survey was flown over the Red River Block, which includes the Sherman Quadrangle, during August and September, 1976, by Texas Instruments Inc. (1977). Data were collected along east-west flight lines 5 km (3 mi) apart, and north-south lines 30 km (20 mi) apart. Terrain clearance averaged 125 m (200 ft), and aircraft speed averaged 244 km/hr (150 m.p.h.).

Further processing and interpretation by the Data Integration Group of Bendix Field Engineering Corp. (G. J. Indelicato, personal communication, 1979) delineated three areas of equivalent uranium anomalies based on clusters of data points either greater than two standard deviations above the mean or more than double the mean. Principal component analysis was used to distinguish vectors incorporating various degrees of variation in the data. Some strong east-west trends of high equivalent uranium values are clearly flight-line dependent and were disregarded. Lakes produced misleading patterns of anomalies, which were eliminated.

Hydrogeochemical and stream-sediment reconnaissance (HSSR) of the Sherman Quadrangle was conducted by Union Carbide Corporation Nuclear Division (1978) between March and May, 1978. A total of 718 ground-water and 715 stream-sediment samples were prepared and analyzed at the Oak Ridge National Laboratory.

Contour maps of raw elemental analyses, ratios of thorium to uranium, ratios of uranium to conductivity, and various statistical parameters such as factor scores, delineate clusters of anomalous samples (D. L. Shettel, Jr., personal communication, 1979).

Rock samples were crushed, pulverized, and then fused with lithium tetraborate, and then dissolved in nitric acid. Soil and sediment samples were dissolved in nitric acid, which was then diluted. Multiple-element analyses involved use of an Inductively Coupled Plasma Atomic Emission Spectrometer equipped with a minicomputer for data storage and processing. Analysis was preceded by digestion of the sample in acid, centrifuging, decomposition of the residue, and acid dissolution.

Subsurface environments were investigated by detailed examination of geophysical logs on file at the Texas Department of Water Resources and the Bureau of Economic Geology, both in Austin, Texas. Cross sections and subsurface maps were constructed for important units. All available gamma-ray logs were examined for anomalies. Cores in the Well Sample and Core Library of the Bureau of Economic Geology were examined for lithological characteristics and possible radioactivity. Thin sections from representative rock samples were examined, and unconsolidated deposits were observed under a binocular microscope.

GEOLOGIC SETTING

Outcropping units in the Sherman Quadrangle are predominantly Cretaceous strata, with subordinate areas of Pennsylvanian and Permian in the west. The subsurface geology is more complex, largely as a result of Late Mississippian and Early Pennsylvanian faulting contemporaneous with sedimentation.

This area was part of the Arbuckle Embayment during early and middle Paleozoic time. Carbonate platform facies grade eastward into starved basin deposits of the Ouachita Geosyncline. The Cambro-Ordovician succession possibly attains a thickness of over 1100 m (3,500 ft) in the eastern part of the Fort Worth Basin (Flawn and others, 1961), and the Ordovician alone is 2500 m (8,000 ft) thick in the Marietta Basin (Bradfield, 1957).

With the onset of Late Mississippian and Early Pennsylvanian tectonic activity in the Ouachita Geosyncline, the Fort Worth, Marietta, and Ardmore Basins became well-defined structural entities separated by the Muenster and Criner Hills Arches (Fig. 2). The Muenster Arch underwent uplift of 1500 m (5,000 ft) along its faulted south-western flank, shedding thick arkosic wedges. Large volumes of clastic sediment built westward across the Marietta and Fort Worth Basins from the Ouachita foldbelt. Morrow and Atoka units attain thicknesses of more than 1800 m (6,000 ft) along the Ouachita front (Turner, 1958). As tectonic conditions stabilized, deltaic deposition characterized the early Desmoinesian Strawn Group. Uplift of the eastern margin of the Fort Worth Basin during early Missourian time led to erosion of Atoka sediments, which were transported westward by fluvial and deltaic systems (Cleaves, 1975). In the Marietta Basin, deposition of lower Strawn sediments from local sources was succeeded by influx from the Ouachita highlands.

Along the Ouachita orogenic front, rocks of the lower Paleozoic Ouachita facies were thrust westward over Atoka deposits of the Fort Worth Basin; in the Grayson County area of the Marietta Basin, overthrusting occurred during or immediately following Strawn deposition (Flawn and others, 1961).

Missourian Canyon deposition was dominated by three principal phases of delta progradation from a Ouachita source. Sediments that were shed contemporaneously southward as a result of the Arbuckle orogeny accumulated as arkosic wedges along the faulted basin margins (Erxleben, 1975). Minor Virgilian rejuvenation of the Ouachita foldbelt caused progradation of numerous, thin Cisco delta sequences across the shelf (Brown and others, 1973). Coarser sediment continued to be shed intermittently from the northern block-faulted terrain. The upper Cisco and Wichita-Albany Groups record an episode of mixed-load fluvial aggradation in the Sherman Quadrangle area.

Continued subsidence of the southerly extension of the Ouachita structural belt resulted in establishment of the East Texas Embayment by Jurassic time. Early Cretaceous downwarping generated a series of small alluvial fans along the Wichita-Arbuckle-Ouachita highland front. These conglomeratic deposits of the lower Antlers Formation were followed by the accumulation of recycled Paleozoic and Triassic sediments that were transported eastward across the Wichita Paleoplain, together with sediments contributed from the northeast. Major fluvial trends followed synclinal axes and terminated distally in marine-dominated delta systems. Clastic accumulation was temporarily interrupted by Glen Rose marine transgression.

Minor episodic uplifts of the eroding hinterland, accompanied by basinal subsidence, continued through Cretaceous time, resulting in alternating conditions of shoreline progradation and marine transgression. The Upper Cretaceous Woodbine Formation represents a major regressive interval during which bed-load-dominated streams flowed southwestward, terminating in marine-reworked deltas. Shallow marine conditions returned with the Eagle Ford transgression and prevailed through deposition of the Austin, Taylor, and Navarro Groups. The relatively thin Blossom Sand and Nacatoch Formations represent two nearshore sand units in a succession dominated by marine carbonates and clays (Fig. 3).

ENVIRONMENTS FAVORABLE FOR URANIUM DEPOSITS

In the Sherman Quadrangle, environments favorable for sandstone deposits (Class 240, Austin and D'Andrea, 1978) occur in the Cretaceous Antlers and Woodbine Formations, the Pennsylvanian Canyon Group, and the Permian Wichita-Albany Group (Pl. 1).

ANTLERS FORMATION

The Lower Cretaceous Antlers Formation is an environment favorable for Subclass 242 uranium deposits because of:

--a coastal plain depositional setting

--highly permeable dip-oriented fluvial sands

--associated volcanic ash

--reducing interchannel muds

The Antlers Formation of the basal Trinity Group overlies Paleozoic basement rocks of moderate relief around the northern margin of the East Texas Embayment. The formation thins northward and shows abrupt local changes in thickness and facies composition in response to major structural features in the basement. Maximum subsurface thickness of the Antlers Formation in the area of the Sherman Quadrangle is 300 m (1,000 ft).

Division into (1) a lower unit of medium-grained sand with chert gravel, (2) a middle unit of varicolored clays with fine-grained sand, and (3) an upper unit of fine-grained sand with interbedded clays was noted by Fisher and Rodda (1966) in northern Wise and southern Montague Counties. This three-fold division is not recognized farther north around the Red River, where there are marked vertical and lateral changes in facies characteristics. In northern Montague and Cooke Counties, basal gravels are overlain by 150 m (500 ft) of fine-grained sand and clay, transected locally by southward-elongated fluvial sandbodies. Lenticular units of gravelly sand are present near the top of the Antlers Formation in northern Grayson County. Fluvial channel-fill deposits dominate the entire Antlers succession in Love County.

South of Decatur in Wise County, the clastic succession is interrupted by the northward-thinning Glen Rose Limestone (Fig. 4), which separates the Twin Mountains Formation below from the Paluxy Sand above. Subsurface study extended downdip into these clastic correlatives of the Antlers Formation.

Basal gravel units are composed mainly of subrounded pebbles of chert, vein quartz, jasper, and quartzite, ranging from 1 to 4 cm in diameter. Sheetlike gravel fans along the highland front extended southward into narrow gravel tongues, which interfinger with mixed-load stream deposits. This brief episode of coarse-grained influx from the Wichita, Arbuckle, and Ouachita Mountains was succeeded by deposition of mature, sandy sediments derived from eroded Paleozoic and Triassic strata to the west and from an unknown source to the northeast (Fig. 5).

Basement structures exercised considerable influence on Antlers Formation sedimentation patterns in the Sherman Quadrangle. Axes of maximum fluvial sand thickness overlie the Kingston Syncline and extend along both flanks of the Muenster Arch. These dip-oriented sand belts terminate near the Glen Rose pinch-out, where strike-oriented sand trends of strandplain origin (Caughey, 1977) are conspicuous. Shallow inundation and coastal reworking extended temporarily northward to the latitude of the Red River during the Glen Rose transgression.

Fluvial deposits over the Kingston Syncline are well exposed along the shores of Lake Texoma in Grayson County (Fig. 6). These deposits commonly display the typical upward-fining motif of mixed-load meandering-stream deposits; there are, however, several departures from this classical model, including some evidence of mid-channel bars or islands characteristic of a braided configuration. The channels were probably undivided and sinuous during high-river stage, but divided around emergent sandbars at low-river stage. Abandoned channel and floodbasin deposits include green-gray clayey silt along with sporadic overbank sands and discontinuous carbonaceous clay units.

Specific evidence of uranium favorability in the Antlers Formation is provided by (1) rare occurrences of high radioactivity and associated high uranium values, (2) a few rock samples that show enrichment in uranium in proportion to potassium and thorium (Pls. 14 and 15), and (3) anomalous uranium values in ground-water and stream-sediment samples (Pl. 4). Anomaly I in the aerial radiometric data is mainly aligned along the Walnut Clay outcrop belt, but in places extends a short distance into the Antlers Formation.

Ten ground-water samples, mainly from the Antlers Formation, define a potentially favorable area (Pl. 4). These samples have uranium concentrations of greater than 20 ppb and uranium/conductivity ratios greater than 0.05. This is an area of poor exposure, and detailed field checking failed to reveal any uranium occurrences. Two stream-sediment samples from rivers draining areas of Antlers outcrop show a combination of anomalous uranium concentrations and high positive multiple-regression residuals (Pl. 4).

Relatively small exposures of the uppermost part of the Antlers Formation in Grayson County show high radioactivity in an organic-rich clay unit immediately below the erosive contact of an upward-fining channel-fill sequence. Scintillometer readings of up to 410 counts per second and uranium values of up to 200 ppm (MGX-064) are recorded in the organic-rich clay. These values are by far the highest in the Sherman Quadrangle.

A combination of uranium recognition criteria points to the possibility of significant epigenetic uranium concentration in downdip subsurface sands. The fluvial sands are highly permeable, particularly in the coarse-grained, pebbly lower part, and would have provided an excellent conduit for ground-water flow. High uranium values in the subjacent clays in contact with the coarse channel lag are attributed to scavenging of dissolved uranium transported down the channel axis by oxidized ground waters. There are no recognizable uranium minerals, and precipitation was probably as uranyl humates. The channel-fill sands in outcrop show no significant radioactivity.

Coarse, mixed-load fluvial systems such as the Antlers Formation provide a favorable framework for transport of uranium that was liberated in updip areas of ground-water recharge (Galloway and others, 1979). Montmorillonite in the Antlers Formation was probably derived from layers of volcanic ash (Al-Shaieb, personal communication, 1979). Uranium may have been released by a combination of freshwater leaching, pedogenic argillation, and shallow diagenesis (Galloway and others, 1979). The lithological maturity of the gravels and sands suggest that granitic sources in the mountains of southeastern Oklahoma provided little or no uranium.

The initial southerly topographic gradient would have been enhanced by continued downwarping of the East Texas Embayment, promoting ground-water flow down the highly transmissive fluvial sand axes over the Kingston Syncline.

Paleoclimatic conditions were potentially favorable for uranium mineralization. The subtropical lowland environment (Gallup, 1975) probably experienced seasonal aridity, as evidenced by Cretaceous caliches in central Texas (Stricklin and others, 1971). These conditions would have permitted effective ground-water recharge through a thick, aerated phreatic zone (Galloway and others, 1979) occurring along the inner coastal plain.

Downdip from the localized surface mineralization at Lake Texoma, uranium may have been precipitated at the geochemical gradients produced by cross-flow from the oxidized, permeable fluvial sands into bounding, less permeable fine-grained deposits. Alternatively, the locally abundant specks of organic debris within the channel sands and the coarser vegetal detritus within the basal channel lag may have furnished the appropriate reducing conditions for the development of mineralization fronts or smaller peneconcordant uranium deposits.

Dip-oriented, fluvial sands of the Antlers Formation intercalate basinward with strandplain, barrier-lagoon, deltaic, and carbonate shelf systems. Downdip extension of structurally-controlled fluvial axes over the Sherman or Kingston Synclines might provide the most favorable setting for more substantial mineralization. The location of any uranium front or peneconcordant deposit could only be established after a considerable amount of closely spaced drilling. A core was requested to supplement field observations.

The geologic environmental criteria correspond with the roll-type deposits of south Texas (Subclass 242), but also have some resemblance to peneconcordant deposits hosted by distinct, easily recognized channels (Subclass 243, Austin and D'Andrea, 1978). The projected surface area (Pl. 1, area A) of the favorable environment is 735 km^2 (270 mi^2); thickness of the Antlers Formation within this area averages 210 m (700 ft), giving a volume of 1.54×10^{11} m^3 (5.27×10^{12} ft^3). Apart from a narrow strip along Lake Texoma which is controlled by the U.S. Army Corps of Engineers, most of this land is under private ownership.

PENNSYLVANIAN ARKOSIC WEDGES

Although they are restricted to the subsurface and show no specific evidence of uranium mineralization apart from scattered gamma-ray anomalies, southward-thinning arkosic wedges in the Strawn, Canyon, and Cisco Groups display a favorable combination of uranium recognition criteria. These environments are favorable for Subclass 244 uranium deposits because of:

--a paleogeographic situation close to fault-bounded granitic highlands

--permeable, blanket-like feldspathic sandstones of wet alluvial fan origin

--permeability control by bounding siltstone and mudstone units

The arkosic units, which occur more extensively in adjacent areas to the west, are present to a depth of more than 1500 m (5,000 ft) in the northwestern part of the Sherman Quadrangle area.

During upper Strawn deposition, sediments were shed westward from the uplifted Ouachita foldbelt, and coarse wedges (Pl. 21) built southward from mountainous terrain in southern Oklahoma. Two phases of Arbuckle orogeny (late Desmoinesian and late Missourian through Virgilian) shed aprons of granite wash (Edwards, 1959); fan deltas rapidly filled the shallow Ardmore and Marietta Basins, extending across the Muenster Arch into the northern Fort Worth Basin (Cleaves, 1975; Erxleben, 1975). Contemporaneous subsidence along bounding faults of the Fort Worth Basin permitted the accumulation of thick arkosic wedges.

Deposits of deltas that prograded westward from the Ouachita foldbelt are not regarded as favorable uranium host rocks because of the absence of an adequate uranium source. However, granite and rhyolite of the Wichita Mountains currently show good potential as a uranium source (Al-Shaieb and others, 1977a); these rocks have a uranium content more than double that of the Arbuckle Mountains, and are locally highly radioactive (Stanton and others, 1977).

Ground waters emanating from these granitic highlands and percolating through the oxidized, feldspathic detritus could have liberated and transported uranium through these highly transmissive fan systems. Precipitation of uranium could have been accomplished by organic matter, presently preserved as coal; alternatively precipitation could have been effected by extrinsic reductants such as hydrocarbons or sulfide-bearing waters that flowed up fault zones.

Fan-delta lobes in Cooke County were derived from the Arbuckle Mountains and are not regarded as being as favorable as those in the subsurface of Montague County, which were in part derived from the more uraniferous Wichita Mountain source (Stanton and others, 1977). There are, nevertheless, a few gamma-ray anomalies in the Strawn and Canyon Groups of Cooke County (Pls. 27 and 28), whereas none were observed in logs from Montague County.

Net sandstone values from the Wolf Mountain, Placid, and Colony Creek clastic lobes of the Canyon Group delineate patterns of southward and southwestward progradation into Montague and Clay Counties (Pls. 22, 23, and 24). One anomaly (Pl. 28) was recognized in gamma-ray logs from these intervals in the Sherman Quadrangle area. The Henrietta fan delta lobes (Erxleben, 1975) within the Graford, Brad, and Caddo Creek Formations display a good combination of uranium recognition criteria in northern Montague County. A uranium source was available in the Wichita Mountains; the coarse, arkosic sediments provided a highly permeable conduit, and coals indicate that reducing agents were present (Erxleben, 1975).

As a result of another tectonic pulse, Virgilian deposition of the Cisco Group was marked by renewed influx from the Wichita-Arbuckle highlands. The Wichita Mountains maintained considerable relief during Virgilian time (Tomlinson and McBee, 1962) and were therefore a major sediment source for the Marietta Basin (Stanton and others, 1977). The Jefferson County area is regarded as favorable because of the uraniferous provenance and good permeability of the sediments. There are several radioactive anomalies in gamma-ray logs from areas adjacent to Sherman Quadrangle (Stanton and others, 1977). No anomalies are present in logs examined from the Sherman Quadrangle area.

These favorable Pennsylvanian environments extend from the surface to a maximum depth of more than 1500 m (5,000 ft). The area underlain by these deposits (Pl. 1, area B) is 1762 km^2 (647 mi^2) and is largely privately owned. The volume of these rocks is estimated as approximately 6.01×10^{11} m^3 (2.02×10^{13} ft^3). Potential uranium deposits possibly correspond to Subclass 244 (Austin and D'Andrea, 1978). The host rocks resemble in many respects the uraniferous Salt Wash Member of the Morrison Formation, Uravan Mineral Belt.

PERMIAN WICHITA-ALBANY GROUP

The Wichita-Albany Group, equivalent to part of the Oscar and Sumner Groups in Oklahoma, is exposed in the northwestern corner of the Sherman Quadrangle. The dominant lithological units comprise lenticular sandstones (Fig. 7) separated by red siltstones and mudstones. This environment is favorable for Subclass 243 uranium deposits because of:

--the platform setting

--abundant scous, channels, and large-scale cross-bedding

--permeable coarse-grained channel fill

--interchannel siltstones and mudstones

The Sherman Quadrangle outcrops represent the southeastern limit of an extensive study by Al-Shaieb and others (1977 a and b) and Al-Shaieb (1978) in Oklahoma. These workers documented several uranium occurrences related to major structural features. Uranium is present in the vicinity of faults and also along magnetic anomalies that may reflect faulting. According to Al-Shaieb and co-workers, the faults may have provided a pathway for transporting uranium from the underlying Pennsylvanian feldspathic sandstones. Al-Shaieb (1978) further suggests that hydro-carbon seepage up the faults may have furnished the reducing conditions necessary for uranium precipitation. Bunn (1930) noted discolored radioactive sediments over anticlines in Jefferson County.

Although several significant structural features, such as the Muenster Arch and associated faults, extend southeastward into the Sherman Quadrangle, no structurally associated uranium occurrences have been detected. There are, however, five known uranium occurrences (Pl. 2, App. C). These were reinvestigated during the present study. All showed a relatively low level of radioactivity of up to 125 counts per second, which is approximately four times background, and a uranium content of up to 20 ppm. Rock samples showed enrichment of uranium relative to thorium and potassium (Pls. 14 and 15).

Three airborne radiometric anomalies are located near known uranium occurrences in Permian strata, but these show only slight equivalent uranium enrichment. In addition, two preferred anomalies showing strong equivalent uranium enrichment are present in the Permian outcrop area. Additional processing of the data (G. J. Indelicato, personal communication, 1979) delineated a weakly defined area of high equivalent uranium values (Pl. 3, anomaly III).

Values of uranium concentration greater than one standard deviation above the mean occur in ground-water samples from Permian strata, but further analysis of the data suggests that these are probably not indicative of uranium deposits (D. L. Shettel, personal communication, 1979). One stream-sediment sample showing significant uranium enrichment is located within the Permian outcrop belt (Pl. 4), but was possibly transported from the Antlers Formation. This anomaly is in the general vicinity of known uranium occurrences. Followup field investigations failed to locate any additional occurrences.

The known uranium occurrences are present in channel-fill sandstones and finer-grained interfluvial deposits. Typical channel-fill sandstones in Montague and Jefferson Counties show rare concentrations of multicolored chert pebbles, but are predominantly fine to very fine-grained, submature sandstones. Mudclasts, carbonaceous debris, pyrite, and calcite cement occur sporadically, particularly toward the base of sandstone lenses. Internal structures and the upward-fining patterns, together with the elongate, lenticular geometry of the sandstone bodies, reflect deposition by meandering streams subject to frequent avulsion. Point bar accretion surfaces are conspicuous (Fig. 7). Chute channels contain a complex and variable fill. The rivers flowed toward the northwest and west, probably draining a Ouachita source terrain. Radioactivity of more than background level is associated with some carbonaceous channel lag units, but elsewhere it occurs irregularly at higher levels in the sandstone units.

The erratic, podlike distribution of these low-grade uranium occurrences places them within the peneconcordant sandstone Subclass 243 (Austin and D'Andrea, 1978). Channel geometry, the presence of permeable ground-water conduits, and organic precipitants were important controls. Like the uranium deposits of the Monument Valley - White Canyon Districts with which the Permian occurrences are compared, the uranium source is unknown. It is conceivable that tectonic structures were an important factor (Al-Shaieb, 1978), but this cannot be demonstrated with any assurance in the Sherman Quadrangle. The dominant primary uranium minerals are probably uraninite and coffinite. Total area covered by potentially favorable environments in the Wichita-Albany Group (Pl. 1, area C) is 2388 km^2 (877 mi^2); total volume is estimated as 5.42×10^{11} m^3 (1.82×10^{13} ft^3). The land is predominantly under private ownership.

WOODBINE FORMATION

The Upper Cretaceous Woodbine Formation is a favorable environment for Subclass 243 uranium deposits because of:

--the broad, shallow basin setting

--abundant updip volcanic ash

--permeable channel-fill sandstone

--reducing interchannel deposits

The Woodbine Formation is well exposed in the Sherman Quadrangle area. There is no direct evidence of uranium deposits, but the formation is included in the favorable category because it conforms with uranium recognition criteria of Austin and D'Andrea (1978). Aerial radiometric data define an aera of high equivalent uranium values in the south-central part of the Sherman Quadrangle (Pl. 3, anomaly II), which includes outcrops of the Woodbine Formation. Field checking failed to reveal any uranium occurrences within this anomalous area.

Three major genetic divisions (Fig. 8) were recognized by Oliver (1971). The Dexter (fluvial) Member is a tabular unit of multilateral fluvial-channel deposits. The sand is mainly fine-grained with much carbonaceous debris. Complex internal structures include upper flow regime plane-beds, broad troughs, and planar cross-beds, suggesting deposition by bed-load streams of flashy discharge. Volcanic rock fragments are recognizable in cores. The Dexter Member interfingers to the southwest with coastal barrier facies of the Freestone high-destructive deltaic member (Fig. 9). Overlying the Dexter Member is the Lewisville (shelf/strandplain) Member with marine-reworked, strike-oriented sandbodies (Fig. 10), massive oyster accumulations, and shelf and lagoonal muds.

Powell (1975) established that low-intensity radiometric anomalies in the Woodbine and Eagle Ford Formations northeast of the Sherman Quadrangle area are related to acid volcaniclastics; these are updip of the Sherman Quadrangle and are ideally situated with respect to potential leaching of uranium and its incorporation into the ground-water flow system. Some of the coarser-grained units in the ash-rich updip areas show evidence of significant leaching, indicating that uranium mobilization has occurred.

Fluvial channel sands of the Dexter Member (Fig. 9) provide a direct connection between these source rocks and the Sherman Quadrangle area, where precipitation may have occurred. The Dexter Member is a well-integrated, permeable aquifer. Abundant finely divided plant material constitutes an excellent potential precipitant. Furthermore, the fluvial sands interfinger with highly carbonaceous interchannel muds, providing permeability barriers and geochemical gradients favorable for uranium precipitation.

The highest level of radioactivity in the Woodbine Formation in the Sherman Quadrangle area is encountered in dark, backswamp muds (Class 210, Jones, 1978). These are not considered favorable environments because of their limited volume and low grade. Maximum scintillometer readings were 120 counts per second, and maximum uranium content is 12.5 ppm.

Humic acids derived from these dark muds would have been capable of effecting reduction and precipitation of uranium in the associated channel sands; several examples of this process have been documented by Turner-Peterson and Peterson (1978). Precipitation may have been effected along axes of maximum through-going permeability (Austin and D'Andrea, 1978), producing peneconcordant deposits of Class 243. That these have not been encountered during the investigation may be due to (1) the relatively infrequent exposure of the Dexter member compared with the overlying marine-influenced Lewisville member and (2) the rarity of gamma-ray logs.

None of the sandstones examined displayed radioactivity significantly above background levels (15 to 25 counts per second). Although there is a possibility that uranium occurrences are present in the subsurface, and most geological aspects of the Dexter Member conform closely to the recognition criteria for favorable sandstone environments (Austin and D'Andrea, 1978), prospects for uranium occurrences in the Woodbine Formation are judged to be lower than for other favorable environments in the Sherman Quadrangle.

Nearly all of the land underlain by the Woodbine Formation is under private ownership. Within the Sherman Quadrangle, the Dexter Member, the most likely host for Class 243 uranium deposits (Austin and D'Andrea, 1978), averages 37 m (120 ft) in thickness, with a volume of 1.46×10^{11} m^3 (4.90×10^{12} ft^3), and extends from the surface to a maximum depth of 250 m (800 ft). The favorable area is indicated on Plate 1, area D.

ENVIRONMENTS UNFAVORABLE FOR URANIUM DEPOSITS

In the Sherman Quadrangle, unfavorable environments include platform and basin deposits (Classes 130 and 230, Jones, 1978) of Cambrian to Mississippian age, Pennsylvanian limestones and shales (Classes 130 and 230, Jones, 1978), Pennsylvanian sandstones of Ouachita provenance, Cretaceous shales and limestones (Classes 130 and 230, Jones, 1978), and sporadic sands and gravels of Tertiary and Quaternary age.

LIMESTONES AND SHALES OF CAMBRIAN TO PENNSYLVANIAN AGE

Units such as the Ellenburger, Simpson, Viola, and Mississippian shelf and basin deposits, and the marine facies of Pennsylvanian age, all include dark marine shales (Class 130, Jones, 1978) which probably underwent some syngenetic mineralization. However, these would be low-grade resources at best, and their predominantly subsurface occurrence eliminates them from further consideration. The same reasoning applies to associated calcareous and siliceous units, which are potentially even less favorable. Several beds of acid tuff are present near the base of the Mississippian

Ouachita facies, but are unfavorably situated with regard to uranium mobilization and transportation. Pennsylvanian marine limestone units (Class 230, Jones, 1978) represent an environment that was not conducive to either syngenetic or epigenetic enrichment of uranium. Carbonaceous shale (Class 210, Jones, 1978) of delta-plain origin occurs in thin, discontinuous units that lack evidence of significant syngenetic enrichment.

PENNSYLVANIAN SANDSTONES OF OUACHITA PROVENANCE

Pennsylvanian fluvial and deltaic sandstones (Class 240, Austin and D'Andrea, 1978) contributed by erosion of the Ouachita foldbelt are considered unfavorable because of low uranium concentrations in the Ouachita provenance area (Stanton and others, 1977). Furthermore, they were probably not good conduits for ground-water flow because of the large proportion of fine-grained units and common lack of interconnection between channel sandstone aquifers. Exposures of these rocks do not display significant radioactivity, and only one sample was enriched in uranium relative to thorium and potassium (Pls. 14 and 15).

LOWER CRETACEOUS SHALES, LIMESTONES, AND SANDSTONES

A well-defined trend of high equivalent uranium values detected by airborne radiometric reconnaissance extends along strike of the Walnut Clay marine deposits (Pl. 3, Anomaly I). There are also a number of areas of Walnut Clay outcrop that show enrichment in uranium relative to thorium and potassium in rock samples. Careful scintillometer field checking failed to detect any radioactivity significantly above background level. Maximum uranium content of rock samples was 10.0 ppm. Anomaly I of the aerial radiometric data interpretation (Pl. 3) is probably accounted for by a combination of slightly elevated radioactivity and better than average exposure on steep slopes beneath the scarp-forming Goodland Limestone. Despite the evidence of some uranium enrichment, probably by syngenetic processes in a shallow epeiric sea (Class 130, Jones, 1978), three factors -- the very low grade, thickness of only 1.5 to 3.5 m (5 to 12 ft), and the resistant Goodland Limestone overburden -- together relegate the Walnut Clay environment to the unfavorable category.

Dark, shallow marine shales of the Kiamichi Formation and the Weno, Pawpaw, Denton, and Grayson Formations of the Washita Group also correspond to Class 130 (Jones, 1978); they show minor radioactivity of up to 55 counts per second and uranium content of up to 7.0 ppm, reflecting minor syngenetic enrichment. The Kiamichi Formation is locally more than 20 m (70 ft) thick and is relatively homogenous. In places it is enriched in uranium relative to thorium and potassium (Pls. 14 and 15). It could be regarded as a marginally favorable environment, but is judged unfavorable on the basis that the required uranium tonnage could probably not be attained by strip mining. The shale formations of the Washita Group are generally thinner and show numerous barren sandstones and impure limestone intervals. None of the shale samples were enriched in uranium relative to thorium and potassium, but one Duck Creek Limestone sample was enriched relative to thorium. In view of the low uranium content of the Duck Creek Limestone, this enrichment is not significant.

UPPER CRETACEOUS MARINE DEPOSITS

The Eagle Ford Formation and the Austin, Taylor, and Navarro Groups were subjected to close scrutiny because of the presence of phosphatic beds (Fisher and Owen, 1965), statistically significant aerial radiometric anomalies (Texas Instruments Incorporated, 1977), and above average uranium concentration in ground-water and stream-sediment samples (Union Carbide Corporation, 1978). Subsequently, further processing and analysis of these data indicated that most of these anomalies are accounted for by random variation, localized areas of good exposure, and the presence of heavy or resistate minerals (D. Shettel and G. Indelicato, personal communication, 1979). High uranium values in stream-sediment samples from the Taylor Group apparently are related to the locally phosphatic limestone terrain, within which field checking did not reveal significant radioactivity.

CENOZOIC DEPOSITS

Tertiary sediments in the extreme southeast corner of the Sherman Quadrangle and Quaternary terrace gravels and sandy alluvium show low levels of radioactivity (50 counts per second) and uranium concentrations of less than 2.0 ppm. Airborne radiometric data indicate several small areas of relative uranium depletion coincident with tracts of modern alluvium. This may be due to placer concentration of thorium and leaching of uranium.

UNEVALUATED ENVIRONMENTS

Precambrian granites and metasediments of the Muenster Arch occur below a depth of 300 m (1,000 ft) on a basement fault block subjected to 1500 m (5,000 ft) of Early Pennsylvanian uplift. Little is known of these rocks, but they may have constituted a uranium source for the locally eroded sediments of Pennsylvanian fan-delta systems.

RECOMMENDATIONS TO IMPROVE EVALUATION

Evaluation of gamma-ray anomalies in the subsurface Pennsylvanian arkosic wedges could be improved considerably by acquisition of cuttings and cores from radioactive intervals such as those noted in the Strawn and Canyon Groups.

The possibility of downdip uranium occurrences in the subsurface Antlers Formation could be evaluated more effectively by drilling a test well through the overlying Washita and Fredericksburg Groups into the Antlers Formation along a major sand axis. Ideally, such a well or series of wells should be located over the axis of the Sherman or Kingston Syncline, far enough updip that the top of the Antlers Formation is relatively shallow, and where there is a possibility that mineralization has occurred; wells farther downdip might be situated beyond the limits of mineralization. A suitable site for a test well would be in the vicinity of Denison in Grayson County (lat 34°42'N., long 96°34'W.). The probability of locating a uranium occurrence is considered to be low, unless a large number of wells were to be drilled, but geochemical and mineralogical data from cores would almost certainly improve evaluation.

SELECTED REFERENCES

Al-Shaieb, Zuhair, Olmsted, R. W., Shelton, J. W., May, R. T., Owens, R. T., and Hanson, R. E., 1977a, Uranium potential of Permian and Pennsylvanian sandstones in Oklahoma: Am. Assoc. Petroleum Geologists Bull., v. 61, no. 3, p. 360-375.

Al-Shaieb, Zuhair, Shelton, J. W., Donovan, R. N., Hanson, R. E., May, R. T., Hansen, C. A., Morrison, C. M., White, S. J., and Adams, S. R., 1977b, Evaluation of uranium potential in selected Pennsylvanian and Permian units and igneous rocks in southwestern and southern Oklahoma: Final Report, U.S. Department of Energy, Open File Report GJBX-35(78), 248 p.

Al-Shaieb, Zuhair, 1978, Guidebook to uranium mineralization in sedimentary and igneous rocks of Wichita Mountains region, southwestern Oklahoma: Am. Assoc. Petroleum Geologists Convention, Oklahoma City, 1978, 73 p.

Armstrong, J. M., Giddings, H., Scott, Gayle, and others, compilers, 1930, revised 1937, Geologic map of Wise County: Univ. Texas, Bur. Econ. Geology, scale 1:48,000.

Austin, E. G., 1948, Geology of the Wylie area, Collin County, Texas: Dallas, Texas, Southern Methodist University, M.S. thesis, 29 p.

Austin, S. Ralph, and D'Andrea, R. F., Jr., 1978, Sandstone-type uranium deposits, in Mickle, D. G., and Mathews, G. W., eds., Geologic characteristics of environments favorable for uranium deposits: U.S. Department of Energy, Open-File Report GJBX-67(78), 250 p.

Barnes, V. E., project director, 1967, Sherman sheet: Univ. Texas, Bur. Econ. Geology Geologic Atlas of Texas, scale 1:250,000.

Bauchman, J. A., 1952, The geology of the Josephine Quadrangle, Collin and Hunt Counties, Texas: Dallas, Texas, Southern Methodist University, M.S. thesis, 24 p.

Bergquist, H. R., compiler, 1949, Geology of the Woodbine Formation of Cooke, Grayson and Fannin Counties: U.S. Geological Survey, Oil and Gas Prelim., Map 98, sheet 1, scale 1:62,500.

Bradfield, H. H., 1957, Petroleum geology of Grayson County, Texas, in Bradfield, H. H., ed., The geology and geophysics of Cooke and Grayson Counties, Texas: Dallas Geol. Soc. and Dallas Geophys. Soc., p. 15-69.

Brown, L. F., Jr., Cleaves, A. W., II, and Erxleben, A. W., 1973, Pennsylvanian depositional systems in north-central Texas -- a guide for interpreting terrigenous clastic facies in a cratonic basin: Univ. Texas at Austin, Bur. Econ. Geology Guidebook No. 14, 122 p.

Brown, O. C., Jr., 1949, Geology of the Verona area, Collin County, Texas: Dallas, Texas, Southern Methodist University, M.S. thesis, 21 p.

Budd, H. J., Jr., 1950, Geology of the McKinney area, Collin County, Texas: Dallas, Texas, Southern Methodist University, M.S. thesis, 20 p.

Bullard, F. M., 1931, Geology of Grayson County, Texas: Univ. Texas Bull. 3125, 175 p.

Bullard, F. M., and Cuyler, R. H., 1930, The geology of Montague County, Texas: Univ. Texas Bull. 3001, 19 p.

Bullard, F. M., and Redfield, J. S., 1930, Love and Marshall Counties, Oklahoma: Oklahoma Geological Survey Bull. no. 40, vol. III, 25 p.

Bunn, J. R., 1930, Oil and gas in Oklahoma, Jefferson County: Oklahoma Geol. Survey Bull. 40, p. 341-381.

Bybee, H. P., and Bullard, F. M., 1927, Geology of Cooke County, Texas: Univ. Texas Bull. 2710, 56 p.

Caughey, C. A., 1977, Depositional systems in the Paluxy Formation (Lower Cretaceous), northeast Texas -- oil, gas, and groundwater resources: Univ. Texas at Austin, Bur. Econ. Geology Geological Circular No. 77-8, 59 p.

Cleaves, A. W., II, 1975, Upper Desmoinesian - Lower Missourian depositional systems (Pennsylvanian), North-Central Texas: Austin, Texas, University of Texas at Austin, Ph.D. dissertation, 257 p.

Eargle, D. H., and McKay, E. J., 1955, Permian and Triassic sediments of northern Texas and southern Oklahoma, in Geological investigations of radioactive deposits, semiannual progress report, June 1 to November 30, 1955: U.S. Geol. Survey TEI-590, p. 257-262, issued by U.S. Atomic Energy Commission Technical Information Service, Oak Ridge, Tenn.

Eargle, D. H., and McKay, E. J., 1956, Stratigraphic distribution of uranium in northern Texas and southern Oklahoma, in Geological investigations of radioactive deposits, semiannual progress report, December 1, 1955, to May 31, 1956: U.S. Geol. Survey TEI-620, p. 261-264, issued by U.S. Atomic Energy Commission Technical Information Service, Oak Ridge, Tenn.

Edwards, A. R., 1959, Facies changes in Pennsylvanian rocks along north flank of Wichita Mountains, in Petroleum geology of southern Oklahoma, a symposium: Tulsa, Oklahoma, Am. Assoc. Petroleum Geologists, v. 2, p. 142-155.

Erxleben, A. W., 1975, Depositional systems in Canyon Group (Pennsylvanian System), North-Central Texas: Univ. Texas at Austin, Bur. Econ. Geology Report of Investigations 82, 67 p.

Fisher, W. L., and Owen, D. E., 1965, Phosphorite, in Fisher, W. L., ed., Rock and mineral resources of East Texas: Univ. Texas, Austin, Bur. Econ. Geology Report of Investigations No. 54, p. 299-304.

Fisher, W. L., and Rodda, P. V., 1966, Nomenclature revision of basal Cretaceous rocks between the Colorado and Red Rivers, Texas: Univ. Texas, Austin, Bur. Econ. Geology Report of Investigations 58, 16 p.

Flawn, Peter T., Goldstein, August, Jr., King, Philip B., and Weaver, C. E., 1961, The Ouachita System: Univ. Texas, Austin, Bur. Econ. Geology Publication No. 6120, 401 p.

Frederickson, E. A., and Redman, R. H., 1965, Geology of Love County, Oklahoma: Oklahoma Geological Survey, Circular 63, 37 p.

Galloway, W. E., Kreitler, C. W., and McGowen, J. H., 1979, Depositional and ground-water flow systems in the exploration for uranium: Univ. Texas at Austin, Bur. Econ. Geology Research Colloquium Notes, 267 p.

Gallup, M. R., 1975, Lower Cretaceous dinosaurs and associated vertebrates from north-central Texas in the Field Museum of Natural History: Austin, Texas, University of Texas at Austin, M.S. thesis, 159 p.

Goldberg, J. M., 1949, Geology of the Copeville area, Collin County, Texas: Dallas, Texas, Southern Methodist University, M.S. thesis, 36 p.

Johnson, W. B., 1948, The geology of the Lucas area, Collin County, Texas: Dallas, Texas, Southern Methodist University, M.S. thesis, 41 p.

Jones, C. A., 1978, Uranium occurrences in sedimentary rocks exclusive of sandstone, in Mickle, D. G., and Mathews, G. W., eds., Geologic characteristics of environments favorable for uranium deposits: U.S. Department of Energy, Open-File Report GJBX-67(78), 250 p.

McKay, E. J., 1957, Permian of north Texas and southern Oklahoma, in Geologic investigations of radioactive deposits, semiannual progress report, December 1, 1956, to May 31, 1957: U.S. Geol. Survey TEI-690, p. 425-427, issued by U.S. Atomic Energy Commission Technical Information Service, Oak Ridge, Tenn.

Mickle, D. G., and Mathews, G. W., eds., 1978, Geologic characteristics of environments favorable for uranium deposits: U.S. Department of Energy, Open-File Report GJBX-67(78), 250 p.

Miser, H. D., compiler, 1954, Geologic map of Oklahoma: U.S. Geological Survey, scale 1:500,000.

Mitchell, J. G., 1973, Geology of the Argyle Quadrangle, Denton County, Texas: Arlington, Texas, Univ. Texas at Arlington, M.S. thesis, 124 p.

Moor, A. L., 1973, Geology of the Denton East Quadrangle, Denton County, Texas: Arlington, Texas, Univ. Texas at Arlington, M.S. thesis, 69 p.

Oliver, W. B., 1971, Depositional systems in the Woodbine Formation (Upper Cretaceous), northeast Texas: Univ. Texas at Austin, Bur. Econ. Geology Report of Investigations No. 73, 28 p.

Olson, L. J., compiler, 1965, Geologic map of Bryan County, Oklahoma: University of Oklahoma, scale 1:42,240.

Powell, D. J., 1975, Results of preliminary reconnaissance of uranium potential in Woodbine and Tokio Formations (Cretaceous) in southwest Arkansas and adjacent areas of Texas: U.S. Geol. Survey Open-File Rept. 75-645, 27 p.

Southern Interstate Nuclear Board, 1969, Uranium in the southern United States: U.S. Atomic Energy Commission, WASH-1128, 230 p.

Stanton, G. D., Brogdon, L. D., Quick, J. V., Thomas, N. G., and Martin, T. S., 1977, Uranium favorability of southwestern Oklahoma and north-central Texas: U.S. Department of Energy, Open-File Report GJBX-75(77), 104 p.

Steinhoff, R. O., 1964, Geology of the Lavon area, Collin County, Texas: Tulane studies in geology, vol. 2, no. 2, 9 p.

Stricklin, F. L., Smith, C. I., and Lozo, F. E., 1971, Stratigraphy of Lower Cretaceous Trinity deposits of Central Texas: Univ. Texas at Austin, Bur. Econ. Geology Report of Investigations No. 71, 34 p.

Texas Instruments Incorporated, 1977, Aerial gamma-ray and magnetic survey of the Red River area -- Block C, Texas and Oklahoma: U.S. Energy Research and Development Administration, Open-File Report GJBX-17(77), 85 p.

Tirey, H. L., Jr., 1950, The geology of the southeastern quarter of the Frisco Quadrangle, Texas: Dallas, Texas, Southern Methodist University, M.S. thesis.

Tomlinson, C. W., and McBee, W., Jr., 1962, Pennsylvanian sediments and orogenies of Ardmore district, Oklahoma, in Branson, C., ed., Pennsylvanian Systems in the United States: Tulsa, Oklahoma, Am. Assoc. Petroleum Geologists, p. 461-500.

Turner, G. L., 1958, Paleozoic stratigraphy of the Fort Worth Basin: Abilene and Fort Worth Geol. Socs., Field Trip Guidebook, p. 57-77.

Turner-Peterson, C., and Peterson, F., 1978, Uranium in sedimentary rocks, with emphasis on facies control in sandstone-type deposits: U.S. Geol. Survey Open-File Report No. 78-359.

Union Carbide Corporation, 1978, Hydrogeochemical and stream-sediment reconnaissance basic data for Sherman NTMS Quadrangle, Texas; Oklahoma: U.S. Department of Energy, Open-File Report GJBX-134(78), 34 p.

Vaughan, M. J., 1973, Geology of Lewisville West Quadrangle, Denton County, Texas: Arlington, Texas, Univ. Texas at Arlington, M.S. thesis, 63 p.

White, F. R., 1948, Areal geology and possible structural relationships of the Muenster Arch, northwestern Cooke County, Texas: Fort Worth, Texas, Texas Christian University, M.S. thesis, 33 p.

Winton, W. M., 1925, Geology of Denton County, Texas: Univ. Texas Bull. 2544, 84 p.

[redacted]

APPENDIX A. URANIUM OCCURRENCES IN THE SHERMAN QUADRANGLE

Table A1. Visited Uranium Occurrences in the Sherman Quadrangle

Occurrence no.	Name	County	Location ¼ Sec.	Sec. (S)	Twp. (S)	Rng. (W)	Lat. (N)	Long. (W)	Host rock formation/member	Deposit class or sub-class (no.)	Production#	Reference**
1	L.R. Blevins Ranch	Montague (Texas)					33 49 24	97 56 06	Wichita Fm.	Sandstone(240)*	a	PRR DEB P-S-2458
2	Brooks Estate	Montague (Texas)					33 45 50	97 48 30	Wichita Fm.	Sandstone(240)*	a	PRR DEB P-5-2436
3	Jewel Castleberry Farm	Montague (Texas)					33 52 48	97 57 48	Wichita Fm.	Sandstone(240)*	a	PRR DEB P-5-2459
4	Howard Estate	Montague (Texas)					33 53 31	97 35 24	Wichita Fm.	Sandstone(240)*	a	PRR DEB P-5-2439
7	Rocky Point Occurrence	Grayson (Texas)					33 51 45	96 38 12	Antlers Fm.	Carbonaceous Shale (210)	a	This Report

*Austin and D'Andrea, 1978.

#Production categories: a. 0 to 20,000 lb. U_3O_8 (no uranium production reported from these occurrences).

**PRR: U.S. Atomic Energy Commission Preliminary Reconnaissance Report, open filed.

URANIUM OCCURRENCE

REPORT

Quad Name A90 Sherman

Quad Scale A100 | 1,2,5,0,0,0,0

Deposit No. B40 1

Deposit Name A10 < Blevins Ranch occurrence >

Synonym Name(s) A11 < >

District or Area A30 < Ringgold >

Country A40 <U S> U S State Texas

State Code A50 <4 8> 4 8 County A60 < Montague >
(Enter code twice from List D)

Position from Prominent Locality A82 < One-half mile north of Ringgold

Field Checked G1 <7 9 0 6> By G2< Rose , Floyd G. >
Yr Mo Last name First Initial

Latitude A70 <3 3 - 4 9 - 2 4 N> Longitude A80 < 9 7 - 5 6 - 0 6 W>
Deg Min Sec Deg Min Sec

Township A77 < > Range A78 < > Section A79 < >
N/S E/W

FT/M

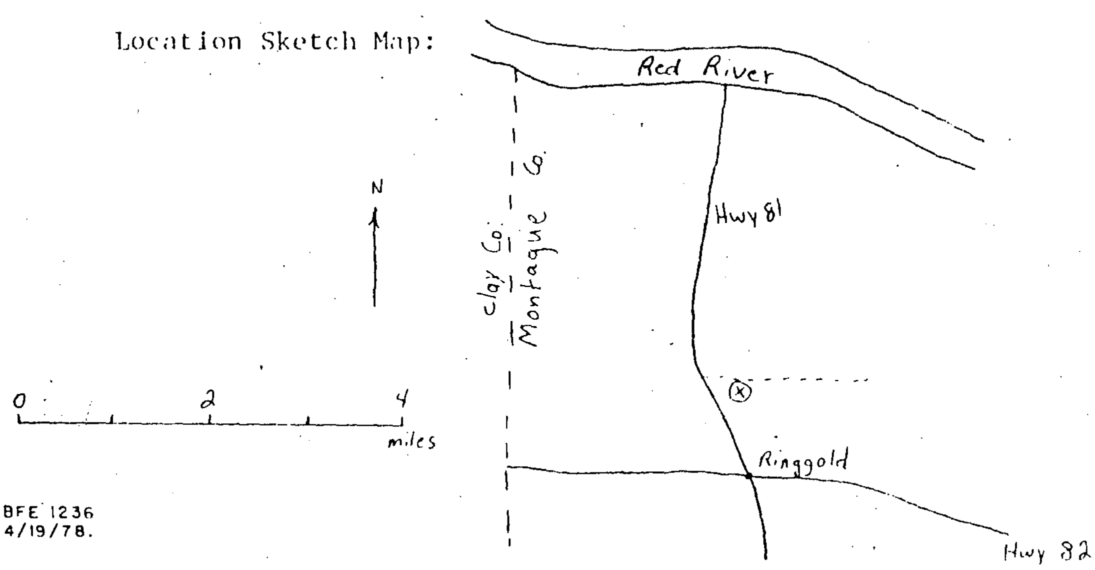
Meridian A81 < > Altitude A107 < 890 ft >

Quad Scale A91 <2 4 0 0 0 > Quad Name A92 < Ringgold >
(7½' or 15' quad)

Physiographic Province A63 <0 6> Interior Lowlands >
(List K)

Location Comments A83 < 0.6 miles north of Ringgold and intersection of Hwy's 81 and 82, turn east on dirt road 0.2 miles >

Location Sketch Map:



BFE 1236
4/19/78.

URANIUM OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 1

Commodities Present:

C10 < U >

Commodities Produced:

MAJOR < > COPROD < >

MINOR < > BYPROD < >

Potential Commodities:

POTEN < > OCCUR < U >

Commodity Comments C50 < 20.0 ppm U_3O_8 >

Status of Exploration and Development A20 < 1 >
(1 = occurrence, 2 = raw prospect, 3 = developed prospect, 4 = producer)

Comments on Exploration and Development L110 < >

Property is A21 (Active) A22 (Inactive) (Circle appropriate labels)

Workings are M120 (Surface) M130 (Underground) M140 (Both)

Description of Workings M220< >

Cumulative Uranium Production PROD YES NO SML MED LGE (circle)

DH2 accuracy thousands of lb. years grade

G7< U > G7A< > G7B<LB> G7C< > G7D< % U308>

Source of Information D9 < >

Production Comments D10 < >

Reserves and Potential Resources

EH accuracy thousands of lb. year of est. grade

E1< U > E1A< > E1B<LB> E1C< > E1D< % U308>

Source of Information E7 < >

Comments E8 < >

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URANIUM-OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 1

Deposit Form/Shape M10 < circular area of anomalous radioactivities >

FT/M

Length M40 < 40 > M41< M >

Width M50 < 15 > M51< M >

Thickness M60 < 5 > M61< M >

Strike M70 < >

Dip M80 < >

Size M15 (circle letter):

lb U308

A 0 - 20,000
B 20,000 - 200,000
C 200,000 - 2 million
D 2 million - 20 million
E More than 20 million

Tectonic Setting N15 < Platform >

Major Regional Structures N5 < >

Local Structures N70 < >

Host-FM. Name U1 < Wichita > Member U2 < >

Host Rock K1 < PERMIAN | | | ~~b~~ | Fine endurated gray sandstone with carbonaceous material, underlain by reddish brown clay shale
(Age) (Rock type, texture, composition, color, alteration, attitude, geometry, structure, etc.) >

Host-Rock Environment U3 < Fluvial channel >
(Sed. dep. environ., metamorphic facies, ign. environ.)

Comments on Associated Rocks U4 < >

Ore Minerals C30 < none >

Gangue Minerals K4 < none >

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URANIUM-OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 1

Alteration N75 < None >

Reductants U5 < humic debris >

Analytical Data (General) C43 < >

Radiometric Data (General) U6 < 3 times BG (150 x 50 ft)
(No. times background and dimensions) >

Ore Controls K5 < >

Deposit Class C40 < Sandstone > Class No. U7 < 2 4 0 >

Comments on Geology N85 <

Low hills in the area are capped by similar sandstone channels; each channel sand overlies a light brown fine to silt sized shale; most uranium concentration is in the very well endurated cap rock, which contains abundant humic debris >

URANIUM-OCCURRENCE REPORT

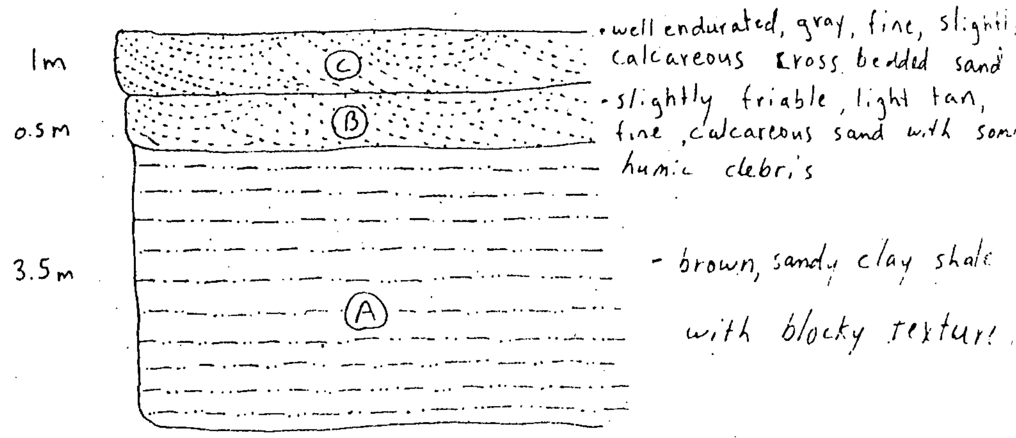
Quad Name Sherman

Deposit No. 1

Uranium Analyses:

Sample No.	Sample Description	Uranium Analysis
MGX 001	Grab sample of mudstone below channel sand	5.7 ppm U_3O_8
MGX 002	Grab sample of sandstone channel (endurated)	7.7 ppm U_3O_8
MGX 003	Grab sample of sandstone channel (slightly friable)	4.9 ppm U_3O_8
MGX 004	Grab sample of sandstone channel (slightly friable)	3.2 ppm U_3O_8
MGX 005	Grab sample of sandstone channel (slightly friable)	2.0 ppm U_3O_8
MGX 006	Grab sample of mudstone below channel sand	4.5 ppm U_3O_8

Geologic Sketch Map and/or Section, with Sample Locations:



C 002, 006

B 003, 004, 005, 849, 850, 853, 854

A 001, 851, 852, 855, 856

References:

F1 < AEC Preliminary Reconnaissance Report DEB P-5-2458, open filed

F2 < >

F3 < >

F4 <

RFE 1235

URANIUM OCCURRENCE REPORT

County: Sherman

Quadrangle: 1

Continuation from p. 1-5

Label

Uranium Analyses cont.

MGX 849	Grab sample of siltstone just under channel sand	7.8 ppm U_3O_8
MGX 850	Grab sample of siltstone under channel sand	10.5 ppm U_3O_8
MGX 851	Grab sample of sandstone channel (endurated)	5.3 ppm U_3O_8
MGX 852	Grab sample of sandstone channel (endurated)	4.5 ppm U_3O_8
MGX 853	Grab sample of sandstone channel (slightly friable)	3.0 ppm U_3O_8
MGX 854	Grab sample of sandstone channel (slightly friable)	2.5 ppm U_3O_8
MGX 855	Grab sample of siltstone under channel sand	8.8 ppm U_3O_8
MGX 856	Grab sample of siltstone under channel sand	20.0 ppm U_3O_8

URANIUM OCCURRENCE

REPORT

Quad Name A90 Sherman

Quad Scale A100 |2,5,0,0,0,0|

Deposit No. B40 2

Deposit Name A10 < Brooks Estate Occurrence

Synonym Name(s) A11 <

District or Area A30 < Belcherville

Country A40 <|U,S|> |U,S| State Texas

State Code A50 <|4,8|> |4,8| County A60 < Montague
(Enter code twice from List D)

Position from Prominent Locality A82 < East of Nocona

Field Checked G1 <|7,8|1,1|> By G2< Rose, Floyd G. >
Yr Mo Last name First Initial

Latitude A70 <|3,3|-|4,5|-|5,0, N|> Longitude A80 <|9,7|-|4,8|-|3,0, W|>
Deg Min Sec Deg Min Sec

Township A77 <| | | | |> Range A78 <| | | | |> Section A79 <| | |>
N/S E/W

FT/M

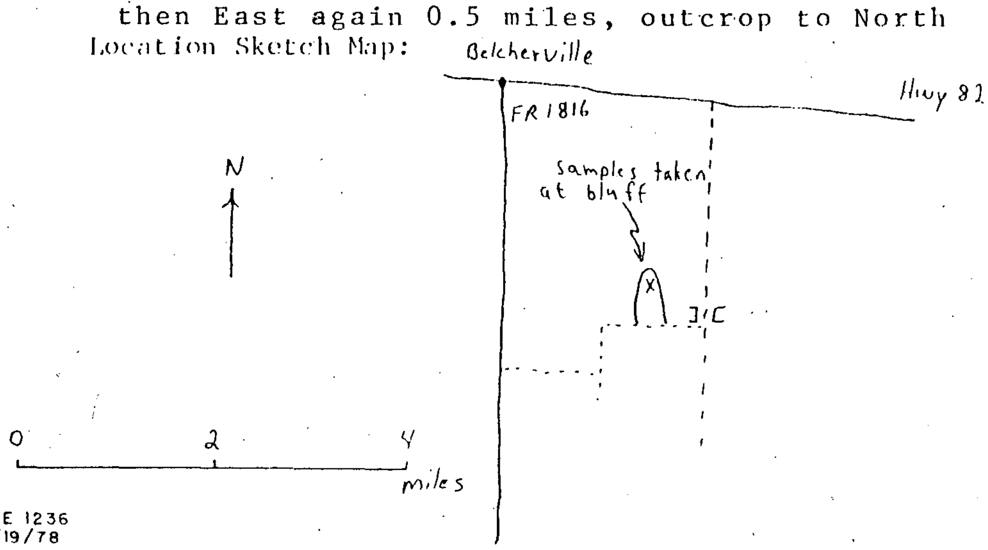
Meridian A81 < > Altitude A107 < 900 ft >

Quad Scale A91 <| | |2,4,0,0,0|> Quad Name A92 < Belcherville >
(7½' or 15' quad)

Physiographic Province A63 <|0,S| | Interior Lowlands >
(List K)

Location Comments A83 < 3 miles south of intersection of Hwy 92 and FR 1816 at Belcherville, go East on dirt road, then turn North, and then East again 0.5 miles, outcrop to North

Location Sketch Map:



BFE 1236
4/19/78

URANIUM-OCCURRENCE

REPORT

Quad Name Sherman

Deposit No. 2

Commodities Present:
C10 < U >

Commodities Produced:
MAJOR < > COPROD < >

MINOR < > BYPROD < >

Potential Commodities:
POTEN < > OCCUR < U >

Commodity Comments C50 < 5.7 ppm U_3O_8 >

Status of Exploration and Development A20 < 1 >
(1 = occurrence, 2 = raw prospect, 3 = developed prospect, 4 = producer)

Comments on Exploration and Development L110 < >

Property is A21 (Active) A22 (Inactive) (Circle appropriate labels)

Workings are M120 (Surface) M130 (Underground) M140 (Both)

Description of Workings M220< >

Cumulative Uranium Production PROD YES NO SML MED LGE (circle)

DH2 accuracy thousands of lb. years grade
G7< U > G7A< > G7B<LB> G7C< > G7D< % U308>

Source of Information D9 < >

Production Comments D10 < >

Reserves and Potential Resources

EH accuracy thousands of lb. year of est. grade
E1< U > E1A< > E1B<LB> E1C< > E1D< % U308>

Source of Information E7 < >

Comments E8 < >

BFE 1236
4/19/78

URANIUM-OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 2

Deposit Form/Shape M10 < elongate, parallel to channel >

Length	M40 < 60 >	M41 < M > (FT/M)	
Width	M50 < 20 >	M51 < M >	
Thickness	M60 < 5 >	M61 < M >	
Strike	M70 < >		
Dip	M80 < >		

Size M15 (circle letter):

lb U308

A 0 - 20,000
B 20,000 - 200,000
C 200,000 - 2 million
D 2 million - 20 million
E More than 20 million

Tectonic Setting N15 < Platform >

Major Regional Structures N5 < >

Local Structures N70 < >

Host-FM. Name U1 < Wichita > Member U2 < >

Host Rock K1 < PERMIAN (Age) > Light greenish gray fine sandstone channel which overlays a gray silty sandstone (Rock type, texture, composition, color, alteration, attitude, geometry, structure, etc.) >

Host-Rock Environment U3 < Fluvial > (Sed. dep. environ., metamorphic facies, ign. environ.)

Comments on Associated Rocks U4 < >

Ore Minerals C30 < None >

Gangue Minerals K4 < None >

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URANIUM-OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 2

Alteration N75 < None >

Reductants U5 < humic debris >

Analytical Data (General) C43 < 3 x BG (50 x 200) >

Radiometric Data (General) U6 < >
(No. times background and dimensions)

Ore Controls K5 < >

Deposit Class C40 < sandstone > Class No. U7 < 24 10 >

Comments on Geology N85 < >

URANIUM-OCCURRENCE REPORT

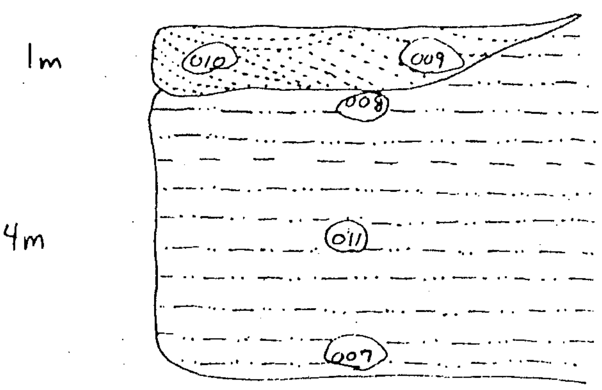
Quad Name: Sherman

Deposit No. 2

Uranium Analyses:

Sample No.	Sample Description	Uranium Analysis
MGX 007	Grab sample of siltstone under channel sand	4.4 ppm U_3O_8
MGX 008	Grab sample of sandstone channel	1.0 ppm U_3O_8
MGX 009	Grab sample of sandstone channel	1.2 ppm U_3O_8
MGX 010	Grab sample of sandstone channel	5.7 ppm U_3O_8
MGX 011	Grab sample of siltstone under channel sand	3.7 ppm U_3O_8

Geologic Sketch Map and/or Section, with Sample Locations:



light greenish gray, cross bedded, fine sand, slightly calcareous with some humic debris

dark gray sandy siltstone

References:

F1 < AEC Preliminary Reconnaissance Report, DEB P-5-2436, Open filed

F2 <

F3 <

F4 <

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[illegible] OCCURRENCE REPORT — [illegible] Sherman

REPORT — [illegible] 2

Continuation from p. 1-[illegible]

Label

URANIUM-OCCURRENCE

REPORT

Quad Name A90< Sherman

Quad Scale A100< 1:250,000 >

Deposit No. B40< 3

Deposit Name A10 < Jewel Castleberry occurrence >

Synonym Name(s) A11 < >

District or Area A30 < Ringgold >

Country A40 <U S> U S

State Texas

State Code A50 <4 8> 4 8
(Enter code twice from List D)

County A60 < Montague >

Position from Prominent Locality A82 < 5 miles North of Ringgold

Field Checked G1 <7 9 0 6> By G2< Rose, Floyd G. >
Yr Mo — Last name, First, Initial

Latitude A70 <33-52-48 N> (Deg Min Sec)
Longitude A80 <97-57-48 W> (Deg Min Sec)

Township A77 < > N/S
Range A78 < > E/W
Section A79 < >

Meridian A81 < > Altitude A107 < 800 ft. > FT/M

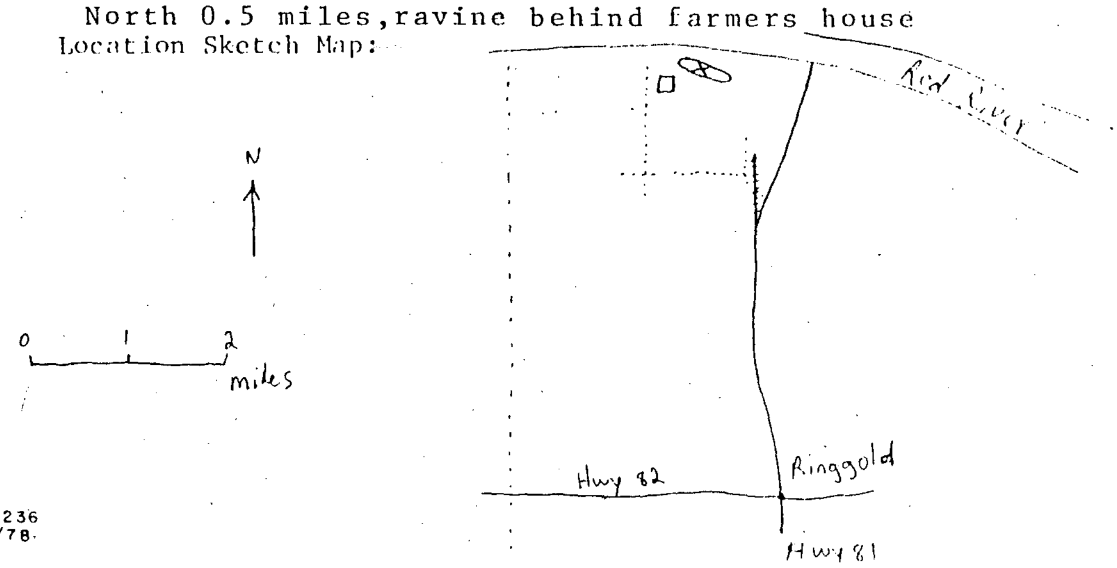
Quad Scale A91 <1:24,000> (7½' or 15' quad)

Quad Name A92 < Terrel >

Physiographic Province A63 <0 5> Interior Lowlands >
(List K)

Location Comments A83 < North of Ringgold 3.1 miles turn west across railroad bridge, then go North 0.3 miles and west 1.2 miles, turn North 0.5 miles, ravine behind farmers house >

Location Sketch Map:



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URANIUM-OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 3

Commodities Present:
C10 < U >

Commodities Produced:
MAJOR < > COPROD < >

MINOR < > BYPROD < >

Potential Commodities:
POTEN < > OCCUR < U >

Commodity Comments C50 < 3.5 ppm U_3O_8 >

Status of Exploration and Development A20 < 1 >
(1 = occurrence, 2 = raw prospect, 3 = developed prospect, 4 = producer)

Comments on Exploration and Development L110 < >

Property is A21 (Active) A22 (Inactive) (Circle appropriate labels)

Workings are M120 (Surface) M130 (Underground) M140 (Both)

Description of Workings M220< >

Cumulative Uranium Production PROD YES NO SML MED LGE (circle)

DH2 accuracy thousands of lb. years grade
G7< U > G7A< > G7B<LB> G7C< > G7D< % U308>

Source of Information D9 < >

Production Comments D10 < >

Reserves and Potential Resources

E11 accuracy thousands of lb. year of est. grade
E1< U > E1A< > E1B<LB> E1C< > E1D< % U308 >

Source of Information E7 < >

Comments E8 < >

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URANIUM-OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 3

Deposit Form/Shape M10 <elongate parallel to ravine >

FT/M

Length M40 < 500 > M41< M >

Width M50 < 200 > M51< M >

Thickness M60 < 10 > M61< M >

Strike M70 < >

Dip M80 < >

Size M15 (circle letter):

lb U308

A 0 - 20,000
B 20,000 - 200,000
C 200,000 - 2 million
D 2 million - 20 million
E More than 20 million

Tectonic Setting N15 < >

Major Regional Structures N5 < >

Local Structures N70 < >

Host-FM. Name U1 < Wichita > Member U2 < >

Host Rock K1 <|P|E|R|M|I|A|N| | | |M| Fine light gray fairly well endurated
(Age) (Rock type, texture, composition, color,

sand which caps a brown siltstone
alteration, attitude, geometry, structure, etc.) >

Host-Rock Environment U3 < fluvial sand covers silt layer >
(Sed. dep. environ., metamorphic facies, ign. environ.)

Comments on
Associated Rocks U4 < >

Ore Minerals C30 < None >

Gangue Minerals K4 < None >

URANIUM-OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 3

Alteration N75 < None >

Reductants U5 < None observed >

Analytical Data (General) C43 < 2 x BG (1000 x 3000 ft) >

Radiometric Data (General) U6 < >
(No. times background and dimensions)

Ore Controls K5 < >

Deposit Class C40 < sandstone > Class No. U7 <[2 4 0]>

Comments on Geology N85 < >

URANIUM-OCCURRENCE REPORT

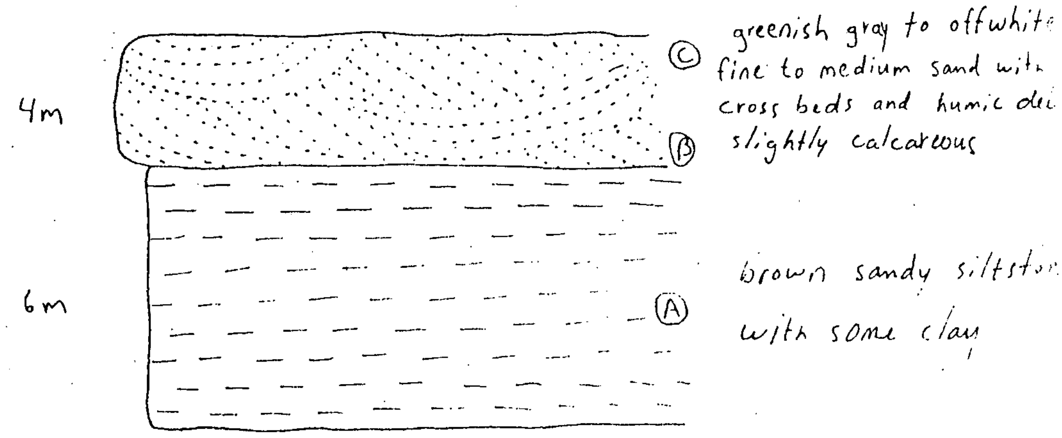
Quad Name: Sherman

Deposit No. 3

Uranium Analyses:

Sample No.	Sample Description	Uranium Analysis
MGX 896	Grab sample of siltstone under channel sand	1.8 ppm U_3O_8
MGX 897	Grab sample of sandstone with dark grains	0.2 ppm U_3O_8
MGX 898	Grab sample of sandstone	0.8 ppm U_3O_8
MGX 899	Grab sample of siltstone under channel sand	2.0 ppm U_3O_8
MGX 900	Grab sample of siltstone under channel sand	3.0 ppm U_3O_8
MGX 901	Grab sample of siltstone under channel sand	2.8 ppm U_3O_8

Geologic Sketch Map and/or Section, with Sample Locations:



C 904, 905

B 896, 899, 900, 901, 902, 903

A 897, 898, 906, 907

References:

F1 < AEC Preliminary Reconnaissance Report DEB P-5-2459 >

F2 <

F3 < >

F4 <

URANIUM-OCCURRENCE REPORT

County Sherman

Deposit No. 3

Continuation from p. 1-5

Label

Uranium Analyses

MGX 902	Grab sample of siltstone under channel sand	1.5 ppm U_3O_8
MGX 903	Grab sample of siltstone under channel sand	1.0 ppm U_3O_8
MGX 904	Grab sample of claystone associated with siltstone	2.5 ppm U_3O_8
MGX 905	Grab sample of claystone associated with siltstone	3.5 ppm U_3O_8
MGX 906	Grab sample of sandstone channel	1.5 ppm U_3O_8
MGX 907	Grab sample of sandstone channel	1.0 ppm U_3O_8

URANIUM-OCCURRENCE

REPORT

Quad Name A90< Sherman
Quad Scale A100< 2,5,0,0,0,0 >
Deposit No. B40< 4 >

Deposit Name A10 < Howard Estate Occurrence >

Synonym Name(s) A11 < >

District or Area A30 < Bonita >

Country A40 <U S> U S State Texas

State Code A50 <4 8> 4 8 County A60 < Montague >
(Enter code twice from List D)

Position from Prominent Locality A82 < North of Nocona

>

Field Checked G1 <7 9 0 6> By G2< Rose, Floyd G. >
Yr Mo Last name First Initial

Latitude A70 <3 3 5 3 3 1 N> Longitude A80 <9 7 3 5 2 4 W>
Deg Min Sec Deg Min Sec

Township A77 < > Range A78 < > Section A79 < >
N/S E/W

FT/M

Meridian A81 < > Altitude A107 < 780 ft. >

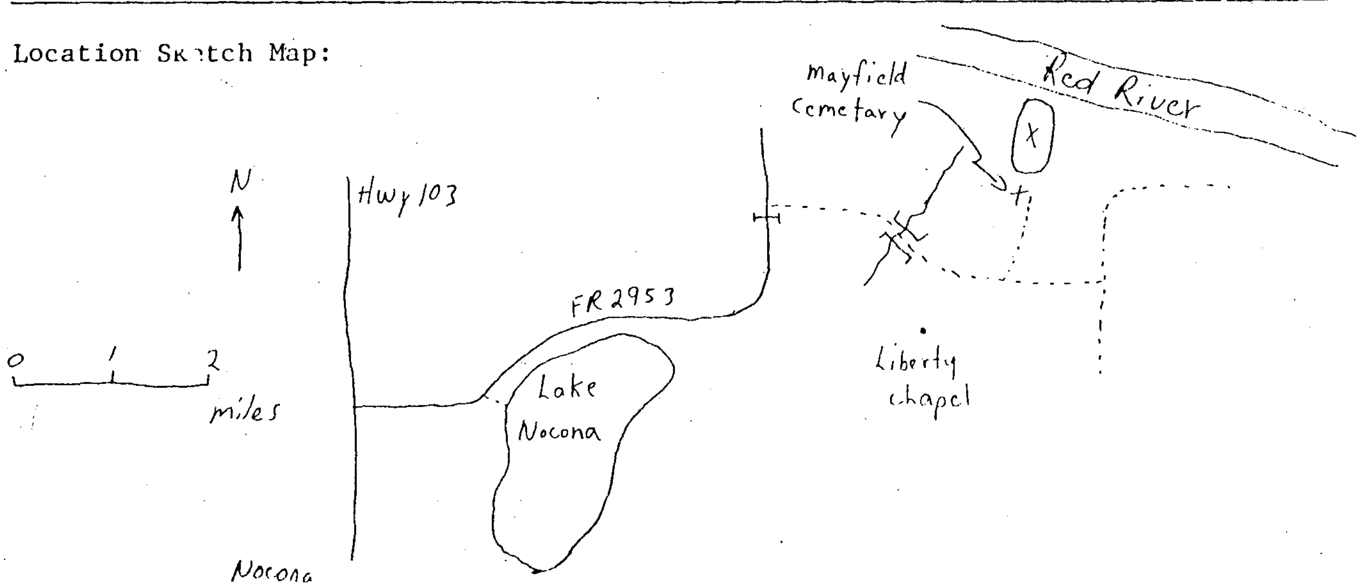
Quad Scale A91 < 2 4 0 0 0 > Quad Name A92 < Spanish Fort >
(7½' or 15' quad)

Physiographic Province A63 <0 5 Interior Lowlands >
(List K)

Location Comments A83 < Ravine located behind old Mayfield Cemetery

>

Location Sketch Map:



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URANIUM-OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 4

Commodities Present:
C10 < U >

Commodities Produced:
MAJOR < > COPROD < >

MINOR < > BYPROD < >

Potential Commodities:
POTEN < > OCCUR < U >

Commodity Comments C50 < 2.5 ppm U_3O_8 >

Status of Exploration and Development A20 < 1 >
(1 = occurrence, 2 = raw prospect, 3 = developed prospect, 4 - producer)

Comments on Exploration and Development L110 < >

Property is A21 (Active) A22 (Inactive) (Circle appropriate labels)

Workings are M120 (Surface) M130 (Underground) M140 (Both)

Description of Workings M220< >

Cumulative Uranium Production PROD YES NO SML MED LGE (circle)

DH2
accuracy thousands of lb. years grade
G7< U > G7A< > G7B<LB> G7C< > G7D< % U308>

Source of Information D9 < >

Production Comments D10 < >

Reserves and Potential Resources

EH
accuracy thousands of lb. year of est. grade
E1< U > E1A< > E1B<LB> E1C< > E1D< % U308>

Source of Information E7 < >

Comments E8 < >

URANIUM OCCURRENCE

REPORT

Quad Name Sherman

Deposit No. 4

Deposit Form/Shape M10 < elongate parallel to ravine >

FT/M

Length M40 < 75 > M41< M >

Width M50 < 30 > M51< M >

Thickness M60 < 7 > M61< M >

Strike M70 < >

Dip M80 < >

Size M15 (circle letter):

lb U308

A 0 - 20,000
B 20,000 - 200,000
C 200,000 - 2 million
D 2 million - 20 million
E More than 20 million

Tectonic Setting N15 < Platform >

Major Regional Structures N5 < >

Local Structures N70 < >

Host-FM. Name U1 < Wichita > Member U2 < >

Host Rock K1 <|P|E|R|M|I|A|N| | | |M| Gray endurated fine sand which overlays
(Age) (Rock type, texture, composition, color,

a dark gray to brown slightly radioactive shale
alteration, attitude, geometry, structure, etc.)

>

Host-Rock Environment U3 < Fluvial channel sands >
(Sed. dep. environ., metamorphic facies, ign. environ.)

Comments on
Associated Rocks U4 < >

Ore Minerals C30 < None >

Gangue Minerals K4 < None >

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URANIUM-OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 4

Alteration N75 < None >

Reductants U5 < humic debris >

Analytical Data (General) C43 < >

Radiometric Data (General) U6 < 2 x BG (100 x 200 ft) >
(No. times background and dimensions)

Ore Controls K5 < >

Deposit Class C40 < sandstone > Class No. U7 < 2 4 0 >

Comments on Geology N85 <

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URANIUM-OCCURRENCE REPORT

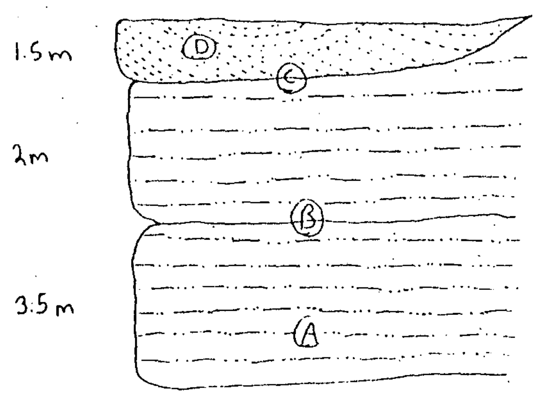
Quad Name: Sherman

Deposit No. 4

Uranium Analyses:

Sample No.	Sample Description	Uranium Analysis
MGX 908	Grab sample of sandstone channel	1.0 ppm U_3O_8
MGX 909	Grab sample of sandstone channel	1.5 ppm U_3O_8
MGX 910	Grab sample of siltstone under sandstone	2.5 ppm U_3O_8
MGX 911	Grab sample of siltstone under sandstone	2.3 ppm U_3O_8
MGX 912	Grab sample of sandstone(coarse-congl.)	1.0 ppm U_3O_8
MGX 913	Grab sample of siltstone under sandstone	2.8 ppm U_3O_8

Geologic Sketch Map and/or Section, with Sample Locations:



well indurated, light gray, fine grain cross bedded, slightly calcareous sand with some organics

medium gray, sandy, silty shale

brown sandy shale

D 908, 909, 912

C 914, 915

B 913, 916, 919

A 910, 911, 917, 918

References:

F1 < AEC Preliminary Reconnaissance Report DEB P-5-2439 >

F2 < >

F3 < >

F4 < >

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URANIUM OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 4

Continuation from p. 1-5:

Label

< Uranium Analyses

MGX 914	Grab sample of siltstone under sandstone	1.5 ppm U_3O_8
MGX 915	Grab sample of siltstone under sandstone	2.0 ppm U_3O_8
MGX 916	Grab sample of siltstone under sandstone	2.0 ppm U_3O_8
MGX 917	Grab sample of siltstone under sandstone	2.5 ppm U_3O_8
MGX 918	Grab sample of siltstone under sandstone	1.0 ppm U_3O_8
MGX 919	Grab sample of siltstone under sandstone	0.5 ppm U_3O_8

URANIUM-OCCURRENCE

REPORT

Quad Name A90 Sherman

Quad Scale A100 < 2 5 0 0 0 0 >

Deposit No. B40 < 7

Deposit Name A10 < Rocky Point Occurrence >

Synonym Name(s) A11 < >

District or Area A30 < Denison Dam >

Country A40 < U S > U S

State Texas

State Code A50 < 4 8 > 4 8
(Enter code twice from List D)

County A60 < Grayson >

Position from Prominent Locality A82 < Northwest of Denison

Field Checked G1 < 7 8 | 1 2 > By G2 < Rose , Floyd C. >
Yr Mo Last name First Initial

Latitude A70 < 3 3 | 5 1 | 4 5 N > Longitude A80 < 9 6 | 3 8 | 1 2 W >
Deg Min Sec Deg Min Sec

Township A77 < > Range A78 < > Section A79 < >
N/S E/W

FT/M

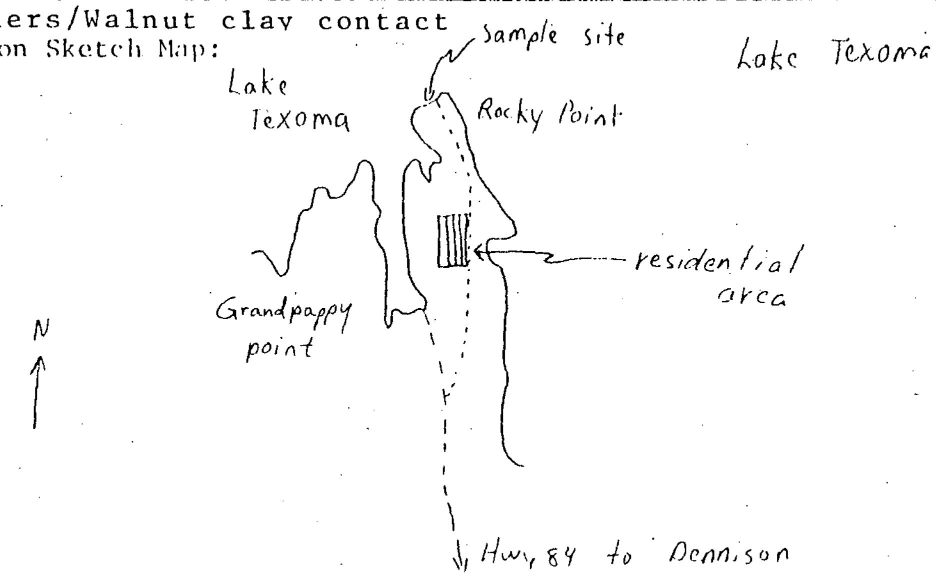
Meridian A81 < > Altitude A107 < 650 ft >

Quad Scale A91 < 6 2 5 0 0 > Quad Name A92 < Denison Dam >
($7\frac{1}{2}$' or 15' quad)

Physiographic Province A63 < 0 3 | Coastal Plain >
(List K)

Location Comments A83 < take Hwy 84 from Denison to Grandpappy point, go to end of road on map below, then follow shoreline to East to Antlers/Walnut clay contact

Location Sketch Map:



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URANIUM-OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 7

Commodities Present:
C10 < U >

Commodities Produced:
MAJOR < > COPROD < >

MINOR < > BYPROD < >

Potential Commodities:
POTEN < > OCCUR < U >

Commodity Comments C50 < 112.5 ppm U_3O_8 >

Status of Exploration and Development A20 < 1 >
(1 = occurrence, 2 = raw prospect, 3 = developed prospect, 4 = producer)

Comments on Exploration and Development L110 < >

Property is A21 (Active) A22 (Inactive) (Circle appropriate labels)

Workings are M120 (Surface) M130 (Underground) M140 (Both)

Description of Workings M220< >

Cumulative Uranium Production PROD YES NO SML MED LGE (circle)

DH2 accuracy thousands of lb. years grade
G7< U > G7A< > G7B<LB> G7C< > G7D< % U308>

Source of Information D9 < >

Production Comments D10 < >

Reserves and Potential Resources

EH accuracy thousands of lb. year of est. grade
E1< U > E1A< > E1B<LB> E1C< > E1D< % U308>

Source of Information E7 < >

Comments E8 < >

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URANIUM-OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 7

Deposit Form/Shape M10 < elongate parallel to Lake Texoma shoreline >

Length M40 < 30 > M41 < M > (FT/M)

Width M50 < UK > M51 < >

Thickness M60 < 3 > M61 < M >

Strike M70 < >

Dip M80 < >

Size M15 (circle letter):

lb U308

A 0 - 20,000
B 20,000 - 200,000
C 200,000 - 2 million
D 2 million - 20 million
E More than 20 million

Tectonic Setting N15 < coastal plain >

Major Regional Structures N5 < >

Local Structures N70 < >

Host-FM. Name U1 < Antlers > Member U2 < >

Host Rock K1 < CRETACEOUS Dark gray to black lignitic clay derived from organic debris. Material is associated with calcite which seems to encircle the organics >

(Age) (Rock type, texture, composition, color, alteration, attitude, geometry, structure, etc.)

Host-Rock Environment U3 < fluvial channel sands >
(Sed. dep. environ., metamorphic facies, ign. environ.)

Comments on Associated Rocks U4 < >

Ore Minerals C30 < none >

Gangue Minerals K4 < none >

URANIUM-OCCURRENCE REPORT

Quad Name Sherman

Deposit No. 7

Alteration N75 < none >

Reductants U5 < plant debris >

Analytical Data (General) C43 < >

Radiometric Data (General) U6 < 8 x BG (200 x UK)
(No. times background and dimensions) >

Ore Controls K5 < calcite >

Deposit Class C40 < carbonaceous shale > Class No. U7 <2 1 0>

Comments on Geology N85 < >

URANIUM-OCCURRENCE REPORT

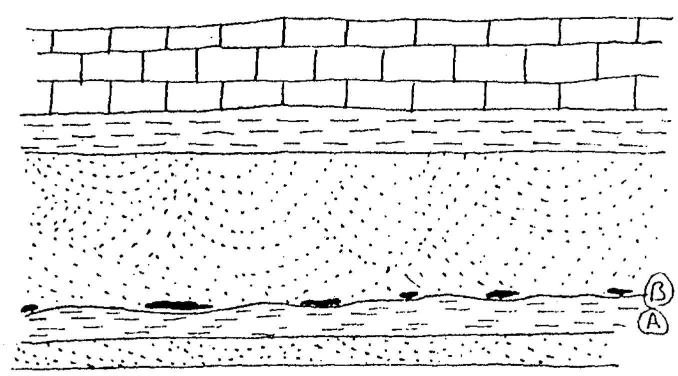
Quad Name: Sherman

Deposit No. 7

Uranium Analyses:

Sample No.	Sample Description	Uranium Analysis
MGX 058	Greenish mudstone grab sample	2.8 ppm U_3O_8
MGX 059	Gray mudstone grab sample	1.4 ppm U_3O_8
MGX 060	Carbonaceous clay grab sample	19.2 ppm U_3O_8
MGX 061	Greenish clay grab sample	4.9 ppm U_3O_8
MGX 062	Carbonaceous clay grab sample	112.5 ppm U_3O_8
MGX 063	Carbonaceous clay grab sample	23.3 ppm U_3O_8

Geologic Sketch Map and/or Section, with Sample Locations:



Goodland Fm.

walnut Clay Fm

cross bedded sand (Antlers Fm)

lignitic plant debris

clay

cross bedded sand

References:

F1 < this report >

F2 < >

F3 < >

F4 < >

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URANIUM-OCCURRENCE REPORT

Quad. Sherman

Deposit No. 7

Continuation from p. 1-5:

Label

< Uranium Analyses

MGX 064 Carbonaceous (lignitic) clay 200 ppm U_3O_8

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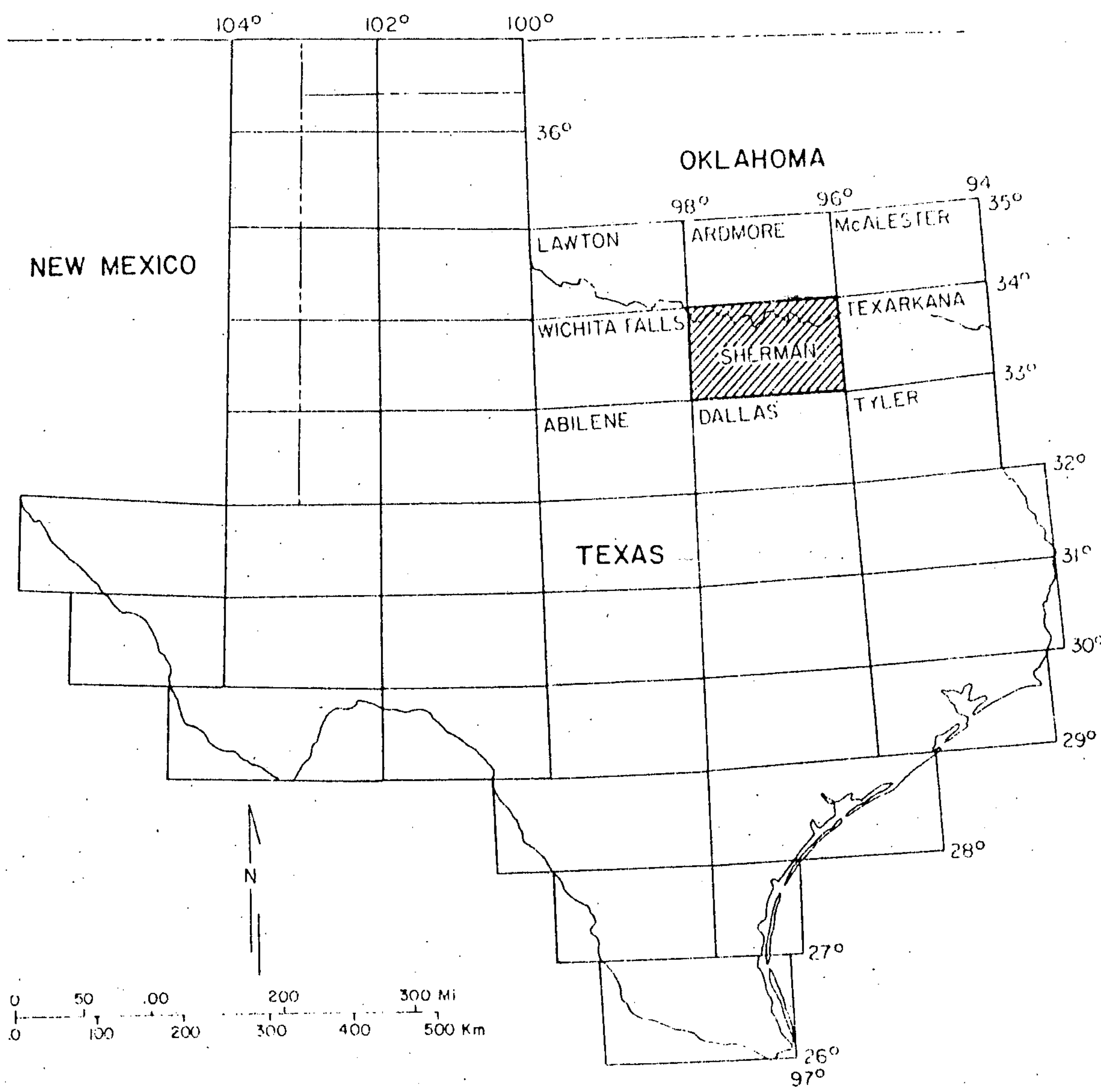
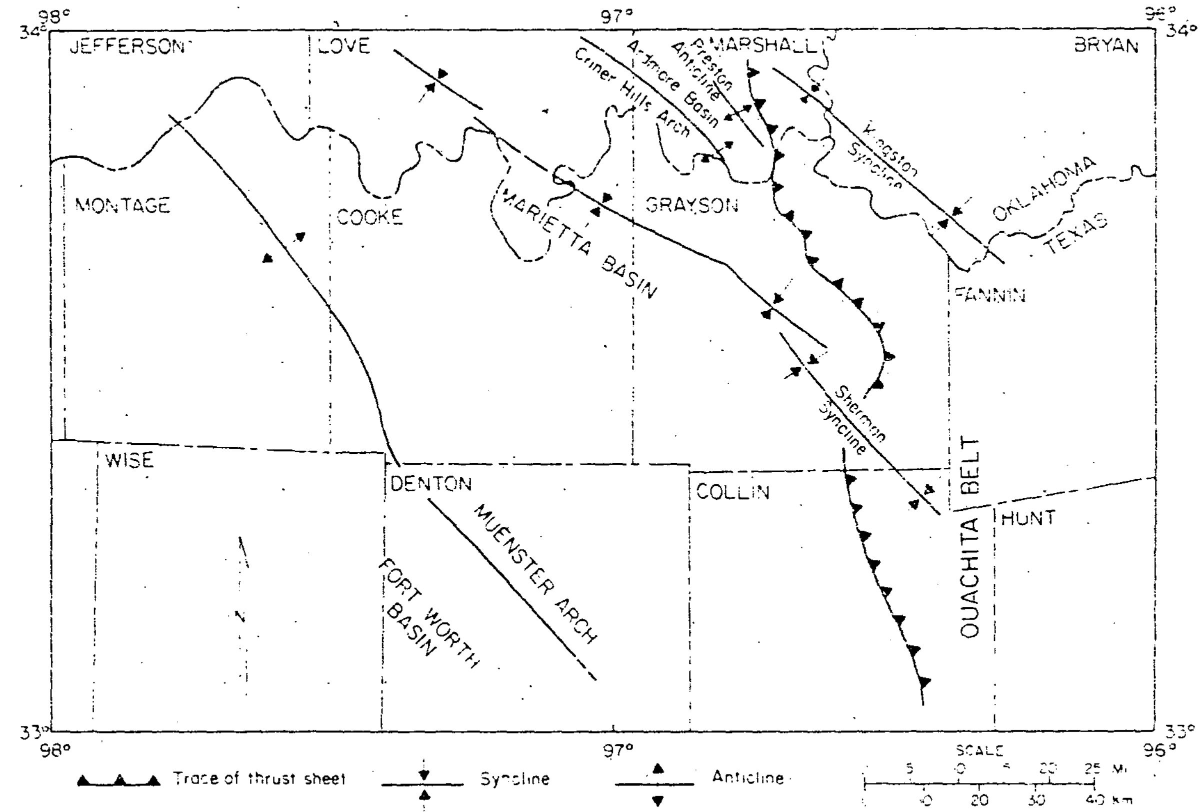
APPENDIX D. ANOMALIES ON GAMMA-RAY LOGS FROM PETROLEUM TEST WELLS

Operator	Well	County	State	Location	Anomalous Interval(s)
Kewanee O.C.	#B-16 Lanier	Cooke	Texas	33° 47' 12" N 97° 27' 00" W	Canyon Formation
M.P. Springer	#2 Marshall	Cooke	Texas	33° 46' 48" N 97° 03' 48" W	Strawn Formation
Sinclair	#21 D.A. Cox "B"	Cooke	Texas	33° 45' 06" N 97° 01' 18" W	Strawn Formation
Mobil O.C.	#8 Morney Est.	Cooke	Texas	33° 36' 06" N 97° 03' 48" W	Strawn Formation



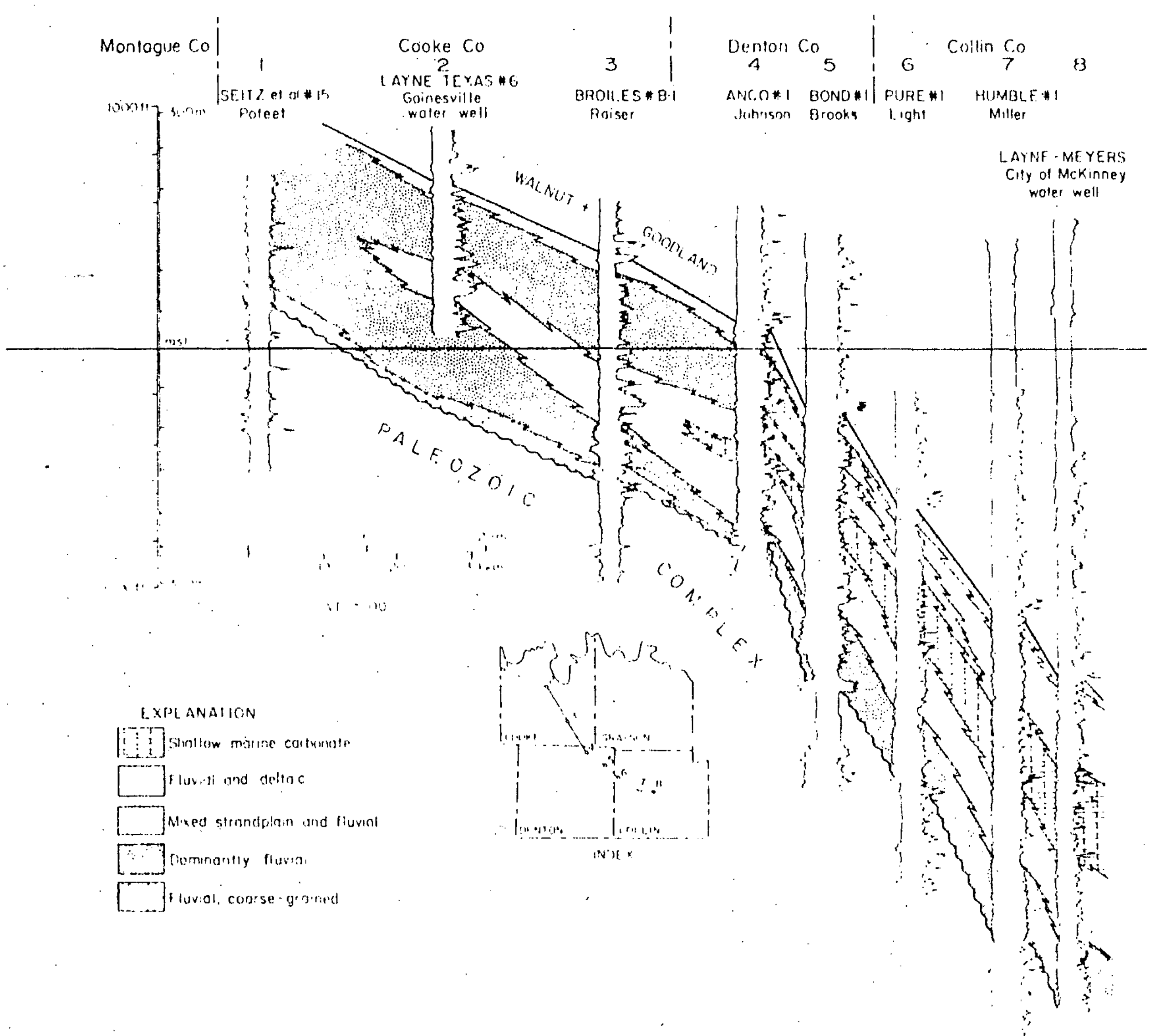
104°
102°
100°
36°
OKLAHOMA
98°
96°
94
35°
NEW MEXICO
LAWTON
ARDMORE
McALESTER
34°
WICHITA FALLS
SHERMAN
TEXARKANA
33°
ABILENE
DALLAS
TYLER
32°
TEXAS
31°
30°
29°
28°
27°
26°
97°
N
0 50 100 200 300 Mi
0 100 200 300 400 500 Km



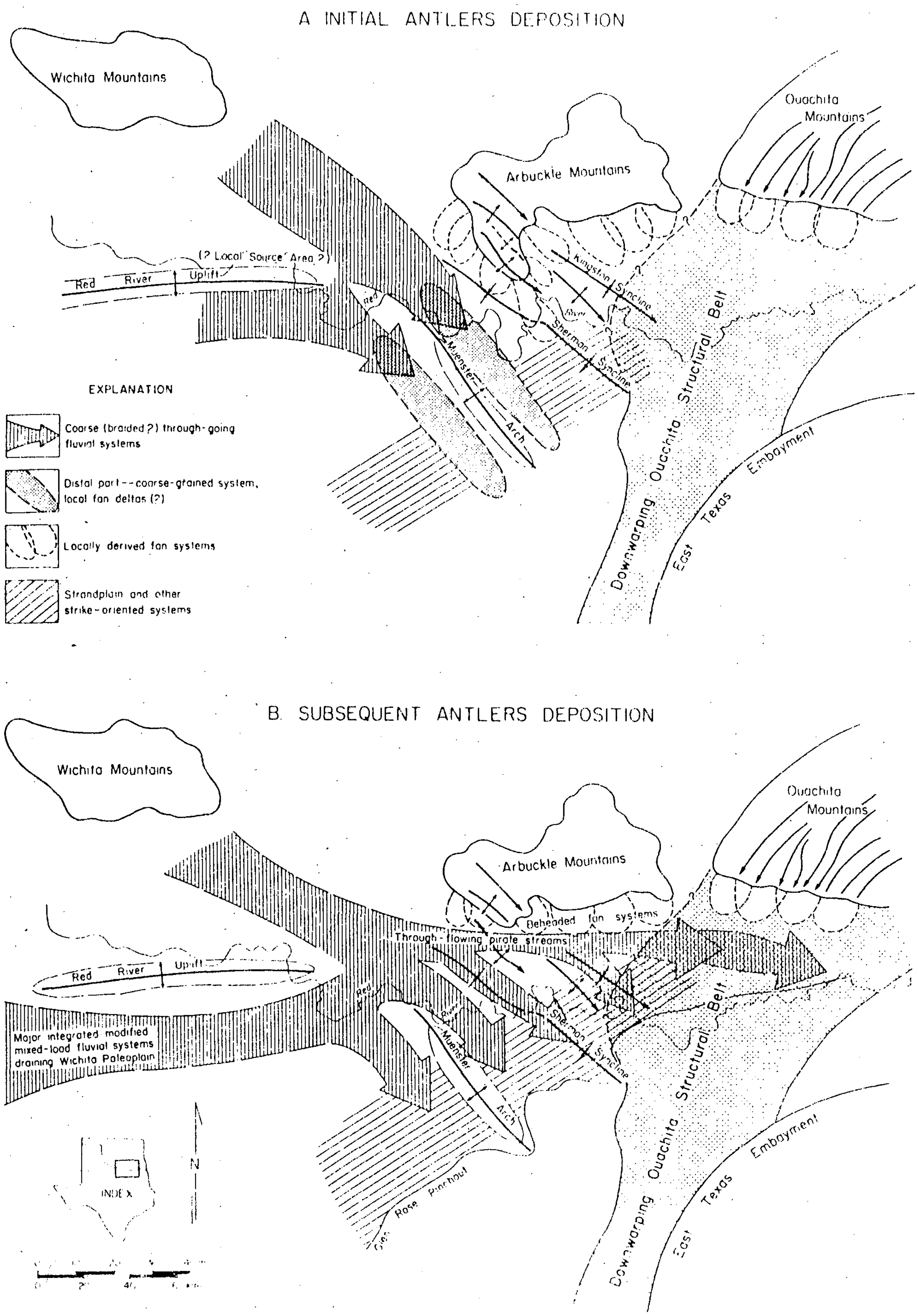
98°
34°
97°
96°
34°
JEFFERSON
LOVE
MARSHALL
BRYAN
Preston Anticline
Ardmore Basin
Criner Hills Arch
Kingston Syncline
OKLAHOMA
TEXAS
MONTAGE
COOKE
GRAYSON
MARIETTA BASIN
FANNIN
Sherman Syncline
WISE
DENTON
COLLIN
MUENSTER ARCH
FORT WORTH BASIN
OUACHITA BELT
HUNT
33°
98°
97°
33°
96°
Trace of thrust sheet
Syncline
Anticline
SCALE
5 0 5 10 15 20 25 Mi
0 10 20 30 40 km

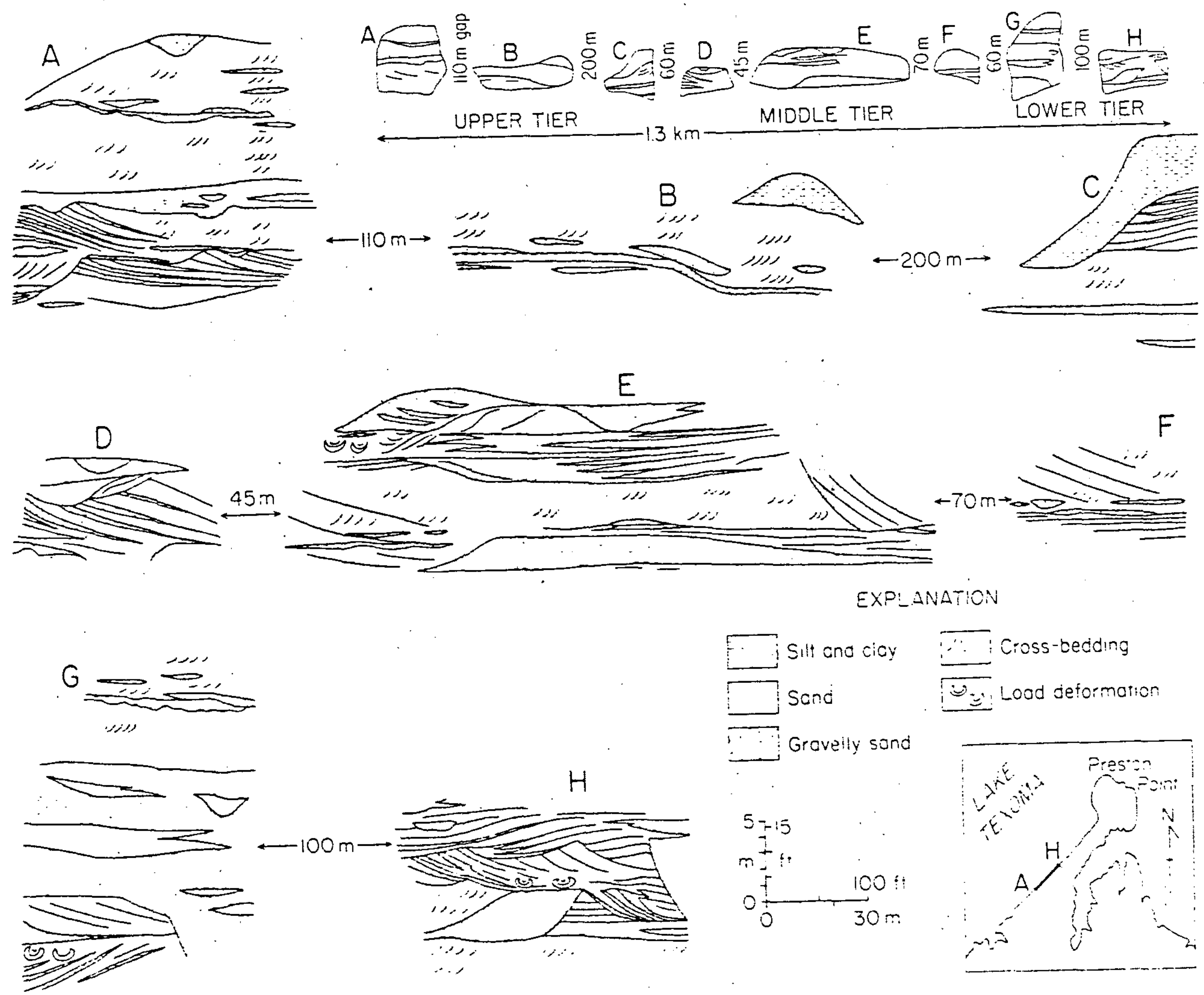
ERA	SYSTEM	SERIES	GROUP	FORMATION	LITHOLOGY	DESCRIPTION
[illegible]	QUATERNARY	[illegible] / PLEISTOCENE				[illegible]
	TERTIARY					[illegible]
			NAVARRO	Kincaid		[illegible]
				Kemp Clay		[illegible]
				[illegible]		[illegible]
				[illegible]		[illegible]
				[illegible]		[illegible]
			[illegible]	[illegible]		[illegible]
				Wolfe City		[illegible]
				Ozan		[illegible]
				[illegible]		[illegible]
				Brownstown Marl		[illegible]
			[illegible]	[illegible]		[illegible]
				[illegible] Marl		[illegible]
				[illegible]		[illegible]
				Eagle Ford		[illegible]
				Woodbine *		[illegible]
				[illegible]		[illegible]
				Pawpaw		[illegible]
				Weno		[illegible]
			[illegible]	Denton Clay		[illegible]
				Fort Worth		[illegible]
				Duck Creek		[illegible]
				Caddo Limestone		[illegible]
				Kiamichi		[illegible]
			[illegible]	Goodland		[illegible]
				Walnut Clay		[illegible]
			[illegible]	[illegible] Paluxy		[illegible]
				Glen Rose		[illegible]
				Twin Mts *		[illegible]
			[illegible] Albany	*		[illegible]
	PERMIAN	LEONARDIAN / WOLFCAMPIAN				[illegible]
			[illegible]			
		VIRGILIAN		Graham		[illegible]
				Caddo Creek *		[illegible]
			CANYON	Brad *		[illegible]
		MISSOURIAN		Graford *		[illegible]
				[illegible]		[illegible]
		[illegible]	[illegible]	*		
		[illegible] / MORROWAN	[illegible]	Atoka / Marble Falls		[illegible]
		CHESTERIAN		Jackfork		[illegible]
	[illegible]			[illegible] / Woodford		[illegible]
	DEVONIAN			Arkansas Novaculite		[illegible]
	SILURIAN					
	ORDOVICIAN		[illegible]	[illegible]		[illegible]
	CAMBRIAN		[illegible]	[illegible]		[illegible]
[illegible]						[illegible]

* Favorable for uranium deposition



Montague Co
Cooke Co
Denton Co
Collin Co
1
2
3
4
5
6
7
8
SEITZ et al #15
Poteet
LAYNE TEXAS #6
Gainesville
water well
BROILES # B-1
Raiser
ANCO # 1
Johnson
BOND #1
Brooks
PURE #1
Light
HUMBLE #1
Miller
LAYNE-MEYERS
City of McKinney
water well
1000 ft
msl
WALNUT + GOODLAND
PALEOZOIC COMPLEX
EXPLANATION
Shallow marine carbonate
Fluvial and deltaic
Mixed strandplain and fluvial
Dominantly fluvial
Fluvial, coarse-grained
INDEX


A INITIAL ANTLERS DEPOSITION
Wichita Mountains
Arbuckle Mountains
Ouachita Mountains
(? Local Source Area ?)
Red River Uplift
Kingston Syncline
Sherman Syncline
Muenster Arch
Ouachita Structural Belt
Downwarping
East Texas Embayment
EXPLANATION
Coarse (braided ?) through-going fluvial systems
Distal part--coarse-grained system, local fan deltas (?)
Locally derived fan systems
Strandplain and other strike-oriented systems
B. SUBSEQUENT ANTLERS DEPOSITION
Wichita Mountains
Arbuckle Mountains
Ouachita Mountains
Beheaded fan systems
Through-flowing pirate streams
Red River Uplift
Major integrated modified mixed-load fluvial systems draining Wichita Paleoplain
Sherman Syncline
Muenster Arch
Rose Pinchout
Downwarping Ouachita Structural Belt
East Texas Embayment
INDEX
N


A
110 m gap
B
200 m
C
60 m
D
45 m
E
70 m
F
60 m
G
100 m
H
UPPER TIER
1.3 km
MIDDLE TIER
LOWER TIER
110 m
200 m
45 m
70 m
100 m
EXPLANATION
Silt and clay
Sand
Gravelly sand
Cross-bedding
Load deformation
5 m
15 ft
0
100 ft
30 m
LAKE TEXOMA
Preston Point
N

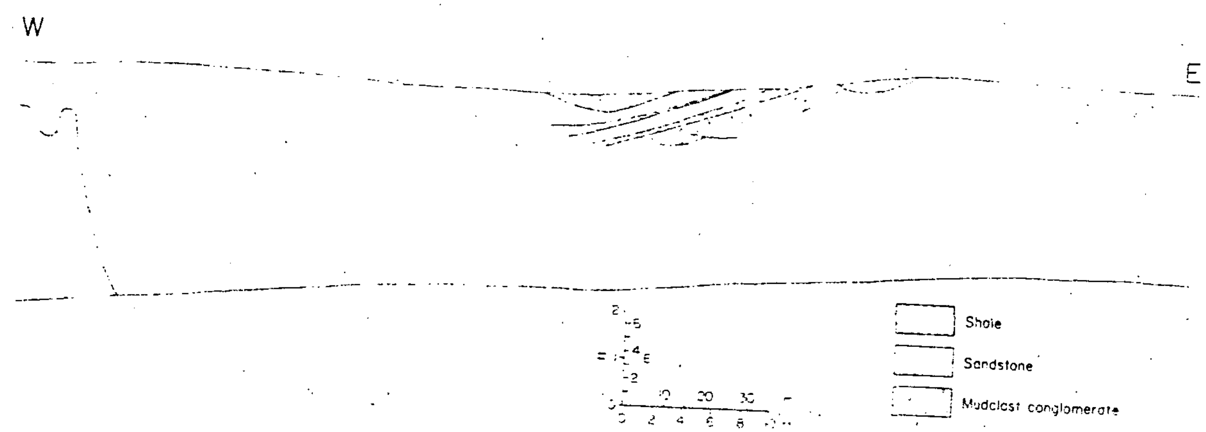

W
E
Shale
Sandstone
Mudclast conglomerate

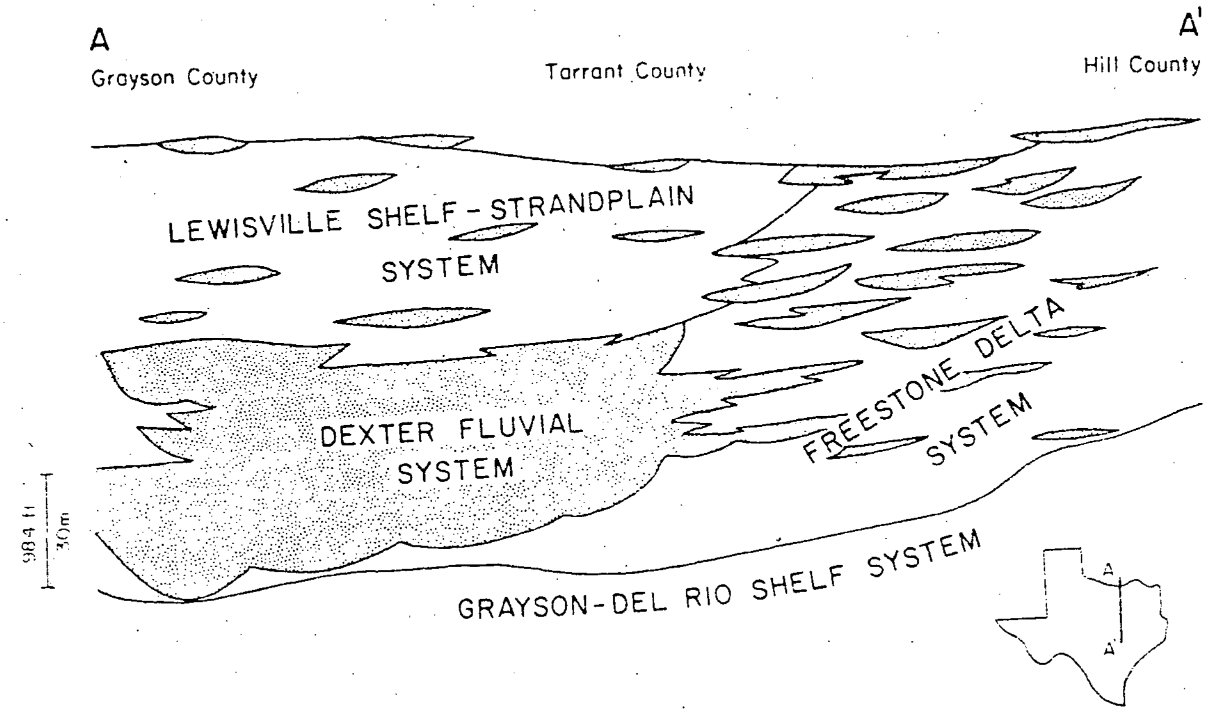
Table A2. Uranium Occurrences Searched For But Not Found, Sherman Quadrangle

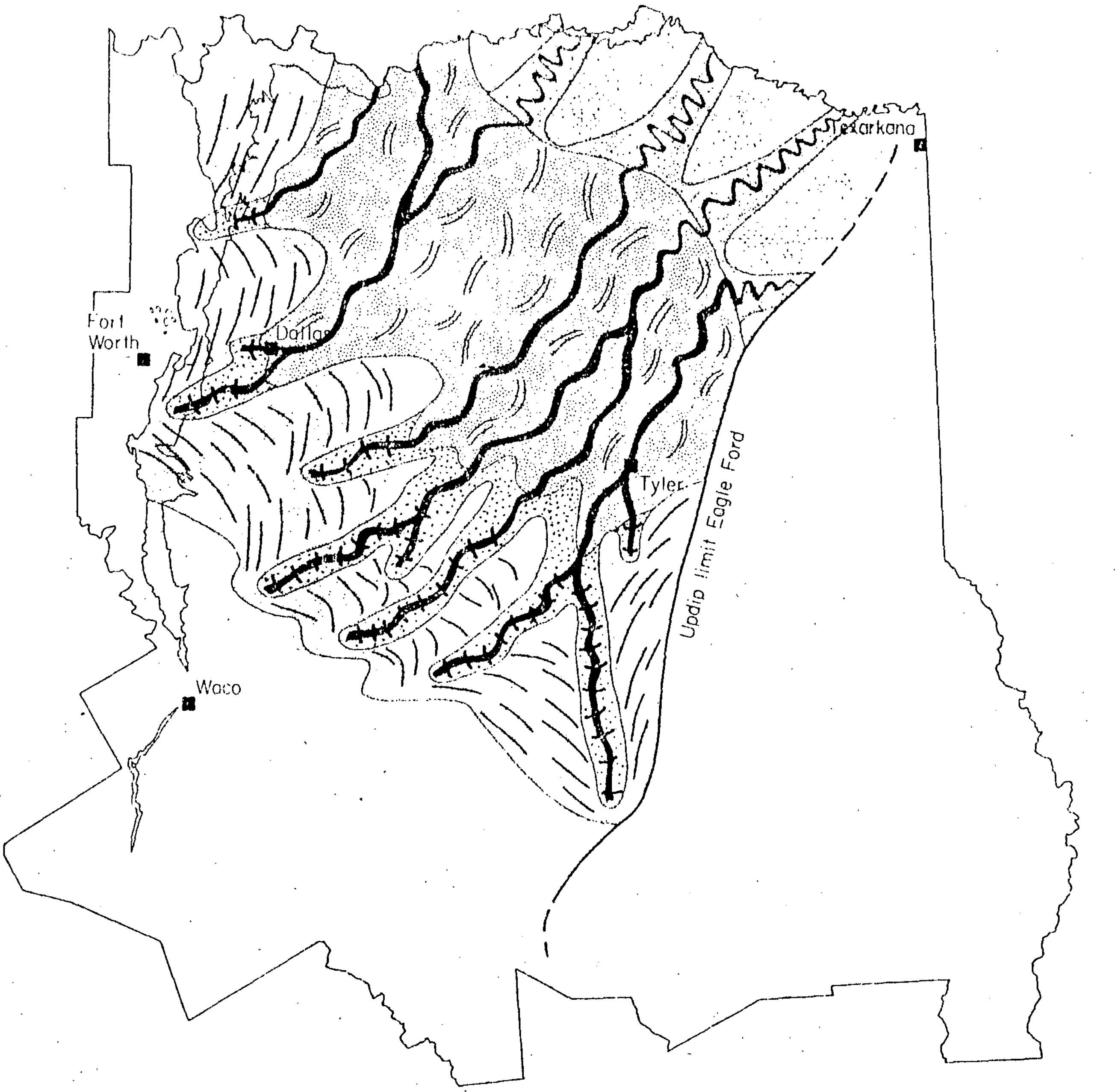
Occurrence no.	Name	County	Location: ¼ Sec.	Location: Sec. (S)	Location: Twp. (S)	Location: Rng. (W)	Location: Lat. (N)	Location: Long. (W)	Host rock formation/member	Deposit class or subclass (no.)	Production#	Reference**
X5	Smart Ranch (existence doubtful)	Jefferson (Oklahoma)	SESE	6	7	6	33 58 22	97 51 27	Wichita Fm.	Sandstone(240)*	a	PRR TM 190-2805
X6	O'Neal Occurrence (existence doubtful)	Jefferson (Oklahoma)	SESE	16	7	6	33 56 25	97 49 21	Wichita Fm.	Sandstone(240)*	a	PRR TM 190-F-39266

*Austin and D'Andrea, 1978.

#Production categories: a. 0 to 20,000 lb. U_3O_8 (no uranium production reported from these occurrences).

**PRR: U.S. Atomic Energy Commission Preliminary Reconnaissance Report, open filed.


A
Grayson County
Tarrant County
A'
Hill County
LEWISVILLE SHELF - STRANDPLAIN SYSTEM
DEXTER FLUVIAL SYSTEM
FREESTONE DELTA SYSTEM
GRAYSON-DEL RIO SHELF SYSTEM
98.4 ft
30m
A
A'



FREESTONE DELTA SYSTEM

Coastal barrier facies

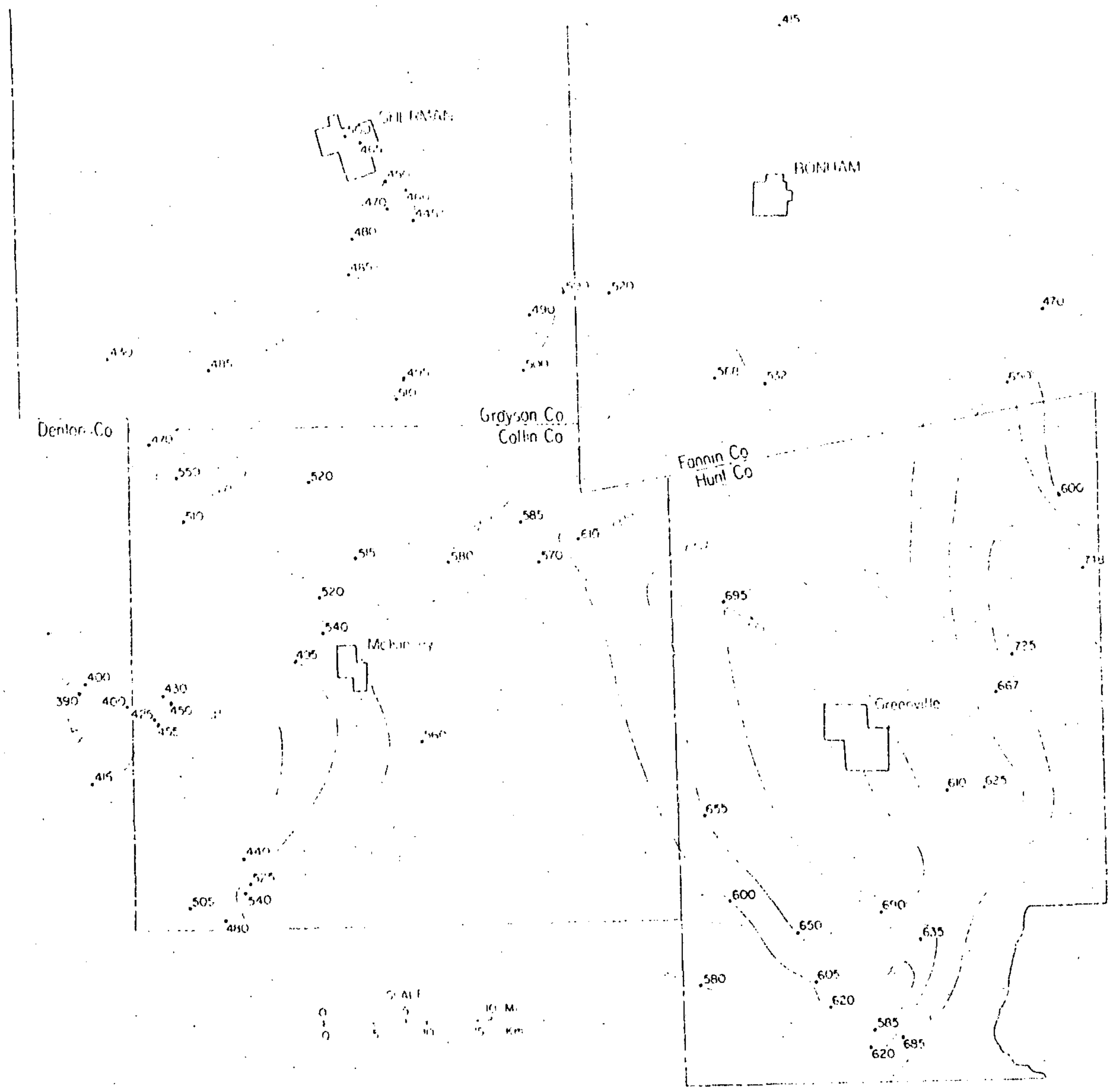
Channel mouth bar facies

Prodelta-shelf facies (Pepper Formation)

DEXTER FLUVIAL SYSTEM

Tributary facies, channel/overbank

Meander belt facies


SHERMAN
BONHAM
Denton Co
Grayson Co
Collin Co
Fannin Co
Hunt Co
McKinney
Greenville
SCALE