1986

# Data Base for Mineral Resources Exploration in the Walnut, Mississippi -- Tennessee Quadrangle

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Open-File Report 86-12

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# DATA BASE FOR MINERAL RESOURCES EXPLORATION IN THE WALNUT, MISSISSIPPI - TENNESSEE, 7.5' QUADRANGLE

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March 26 , 1986

ACKNOWLEDGEMENTS

The authors would like to acknowledge the suggestions and assistance of the numerous people who have contributed to this project. The following, however, have made special contributions to the project and deserve special acknowledgement.

Mr. Tracy Lusk, Mississippi Mineral Resources Institute, has provided useful guidance and has freely contributed his knowledge of the geology of north Mississippi.

Ms. Renee Whiteaker, Mississippi Mineral Resources Institute, has provided the word processing expertise needed to produce this report in a timely fashion.

Mr. Paul Mitchell, Mississippi Mineral Resources Institute, constructed the geologic illustrations contained within this report.

A portion of the Walnut Quadrangle was mapped as partial requirements for a Master of Science degree by the senior author. Sigma Xi, The Scientific Research Society, and the Gulf Coast Association of Geological Societies have made monetary grants which made this earlier project possible.

# DATA BASE FOR MINERAL RESOURCES EXPLORATION IN THE WALNUT, MISSISSIPPI - TENNESSEE, 7.5'QUADRANGLE

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## Abstract

The Walnut 7.5 minute quadrangle is in Tippah County, Mississippi, and Hardeman County, Tennessee. The oldest unit cropping out in the quadrangle is the Owl Creek Formation of Cretaceous age, very limited outcrops of which can be found along the eastern edge of the map. The Midway, Wilcox, and Claiborne Groups, all of Tertiary age, are also present at the surface within the map area. Subsurface control points, in the form of well logs, are sparee. There are three oil test wells, seven water wells, and 16 wells drilled for lignite or bauxite exploration. Mineral resources within the quadrangle include ball clays, heavy minerals, bauxite, limestone, glauconite, and sand useful for road construction and/or topping.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

# DATA BASE FOR MINERAL RESOURCES EXPLORATION IN THE WALNUT, MISSISSIPPI - TENNESSEE, 7.5' QUADRANGLE

## Introduction

This data base is the first of what will hopefully be a series covering selected areas of Mississippi. The purpose is to provide useful information not only to the exploration geologist, but to city planners, engineers, water well drillers, or anyone in need of basic geologic data. A broad interpretation of mineral resources is used herein. Industrial minerals as well as ground water resources have been included.

The data base represents a compilation of new as well as previously existing data. For example, the geologic map represents field work completed in 1985 and 1986. Yet this map was built upon previous work by Connant and McCutcheon in 1941. So in many respects this map is a refinement of their earlier work. A number of the localities containing mineral resources were also discussed by Connant and McCutcheon (1941). These locations were re-examined and more accurately plotted on the data base. The availability of topographic maps is probably the most important contribution not available to earlier workers. Topographic maps have allowed the construction of a more accurate geologic map and more accurate plotting of mineral

resources. The map included in this report is a reduction of the 7.5 minute base map which is available for inspection at the Mississippi Mineral Resources Institute. It should also be noted that the data base is not intended to represent an exhaustive treatise on the geology of the quadrangle, but only an outline on which one can build.

## Geologic Map

The geologic map (Figure 1) was constructed from surface exposures, using the 7.5 minute Walnut, Mississippi - Tennessee, topographic quadrangle as a base. The units mapped included the Owl Creek Formation, Clayton Formation, Porters Creek Formation, Wilcox Group, and the Meridian Sand. Quaternary alluvium, associated with the major fluvial systems, was also mapped as a separate unit. Figure 2 is an idealized stratigraphic column for the quadrangle.

The Owl Creek Formation is the youngest Cretaceous-aged unit in north Mississippi. The Owl Creek is present within the map area only in a limited strip along the eastern extremity. The typical Owl Creek lithology consists of glauconitic, sandy, fossiliferous silts. The unit is relatively thin, varying between approximately 20 and 50 feet in thickness. Both upper and lower contacts are sharp and often burrowed. The Owl Creek's upper contact is considered the Cretaceous - Tertiary boundary, although there is no great change in grain size across the boundary

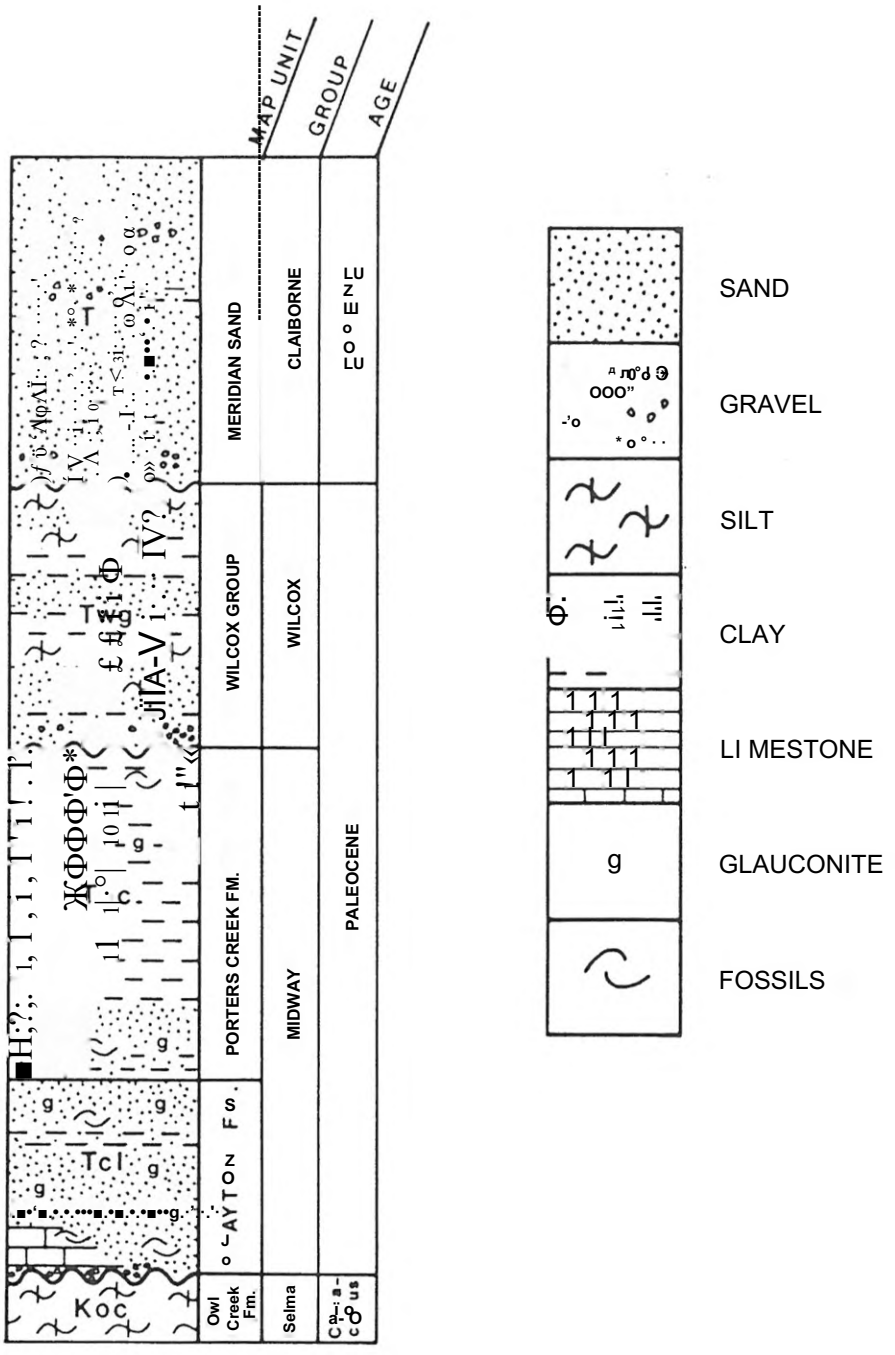


Figure 2. Generalized stratigraphic column of units exposed at the surface *

and formational boundaries between some of the Tertiary aged units are much more impressive.

The oldest Tertiary unit is the Clayton Formation. The Clayton lies unconformably above the Owl Creek Formation. The unit is composed of silts, limestones, and fine-grained glauconitic sand. A discontinuous, thin bed of medium- to coarse-grained, gravelly sand is included in the Clayton at the base of the formation. The predominant lithology is fine-grained, glauconitic, fossiliferous sand. The Clayton varies between 35 and 75 feet in thickness in the Walnut Quadrangle.

The Porters Creek Formation conformably overlies the Clayton Formation and is unconformably overlain by either the Wilcox Group or the Meridian Sand. The Porters Creek can be divided into a lower unit of interbedded sand and clay and an upper unit consisting of a thick section of grayish montmorillonitic clays. The Tippah Sand Lentil is a fine-grained sand facies within the lower section of the Porters Creek. The Porters Creek varies considerably in thickness. The entire formation is approximately 80 feet thick at Walnut on the eastern edge of the outcrop belt. In road exposures (T.2S, R3E., Sec. 13, NW 1/4) along Hurricane Creek the upper clay unit alone was measured as 120 feet in thickness. The Hurricane Creek section is located southwest of Walnut and well into the outcrop belt.

The Wilcox Group was mapped as one unit due to the complex internal facies relationships. The Wilcox is

unconformably overlain by the Meridian Sand, which, in the northern half of the quadrangle, completely overlaps the Wilcox. As a result of erosion associated with the deposition of the Wilcox, it is present as (1) a major outcrop belt in the southwest region of the quadrangle, and (2) outliers east of the major outcrop belt. Because of the relief of the Wilcox-Meridian contact, this formational boundary was one of the most difficult to map accurately.

The Wilcox lithologies consist of a lower unit of massive, sandy, light-gray clay, a middle unit of massive to bedded medium-gray clay, and an upper unit of sandy, silty clay beds interbedded with sandy silt beds. Kaolinitic beds are found at all stratigraphic intervals and apparently represent a local facies. The base of the Wilcox has an especially complex set of lithologies varying from crossbedded sands to reworked bauxite. All of the basal lithologies are local, discontinous, and are developed in the more common massive, sandy, light-gray clay unit. Many of these lithologies change facies just south of the Walnut Quadrangle near Faulkner, Mississippi.

The Meridian Sand, the basal unit of the Claiborne Group, unconformably overlies the Wilcox Group. In outliers the Meridian lithology is present in contact with the Porters Creek Formation, suggesting an overlap extending eastward beyond the Wilcox Group outcrop belt. The Meridian typically consists of fine- to very coarse-grained sands. The sands are often cross bedded and may contain well-

rounded quartz pebbles or clay clasts. Discontinuous kaolinitic beds are present in the middle section of the unit.

Quaternary alluvium has also been mapped along major streams. The unit typically consists of light-gray clays and sands and is exposed only in stream banks. The unit was mapped using the edge of the present floodplains as the boundaries because of lack of exposures where the alluvium was in contact with older units.

## Mineral Resources

The mineral resources indicated on Figure 1 represent surface exposures where the resources are present. No economic evaluation of any of these prospects was conducted. Anyone interested in a given resource should examine the entire unit in which the resource occurs.

Ball Clay - Ball clays are defined as clays with high plasticity and dry strength, long vitrification range, light color when fired, and commonly have some organic material present (Lefond, 1983). Several exposures contained clays that have potential as ball clays. These exposures are found within the Wilcox Group and Meridian Sand. The middle section of the Wilcox Group has the best potential of producing ball clay in economic amounts. The Meridian Sand also contains lenses of clay in the northern half of the map

which may be usable ball clays. All of these clays contain organic matter and may contain varying amounts of silt and sand.

Bauxite - Bauxite is used as an ore of aluminum and in high temperature refractories. Only one small exposure of bauxite was located during field operations. The ore is sandy and a very light-gray to light-red in color. The bauxite is located in the lower section of the Meridian Sand and may be reworked from older units.

Heavy Minerals - Heavy minerals are of value primarily for their content of titanium. Although only one location is indicated on the map, the Meridian Sand commonly contains small amounts of very fine-grained heavy minerals. The location on the map is exceptional in that a bed approximately four inches in thickness contained in excess of 30 percent dark heavy minerals in the sand-sized fraction. This bed probably represents a Meridian channel where the heavy minerals were concentrated by winnowing. The significance of this prospect is the fact that the Meridian contains heavy minerals and depositional environments existed that concentrated them. Therefore, this unit may contain facies that would produce heavy minerals in economic quantities.

Sand - The argillaceous to clean quartz sands within the quadrangle have been extensively used for road topping and construction. These sands are almost exclusively within

the Meridian outcrop belt. During field operations no glass or masonry sands were noted.

Limestone - Limestone may be used as building stone, road metal, for agricultural purposes, and many other uses. In the Walnut Quadrangle only one exposure of limestone was noted. This argillaceous limestone is part of the lower section of the Clayton Formation. The limestone facies is not a continous bed but has a "patchy" distribution.

Glauconite - Glauconite has limited use as a water softener and a soil conditioner. The glauconite beds noted on the map are within the upper section of the Clayton Formation. The glauconite in these "greensands" comprise an estimated 30 per of the total sediment. These glauconite-rich beds are common in the Clayton and there should be a large resource base.

Oil and Gas - The presence of hydrocarbons in the subsurface are difficult to predict from surface investigations. The study area contains only 3 oil and gas tests, and logs are not available for the #1 E.J. Martindale well. The #1 Melton and #1 Blackwell both have a good suite of geophysical logs. The #1 Melton well, which has a total depth of 5302 feet, is especially useful in that it penetrates much of the Paleozoic section which lies beneath the Coastal Plain sediments. Mississippian age sediments are located at the top of the Paleozoic section and the well bottomed in the Cambrian age Knox Dolomite.

Surface investigations have revealed evidence of structure in the Walnut Quadrangle. For example, the Porters Creek section in the town of Walnut is lower than the equivalent section across Big Creek, only approximately one mile west. These exposures indicate an eastward dip instead of the usual westward dip. Examination of the outcrop patterns of the Clayton and Porters Creek formations indicate the presence of structure associated with the present drainage of Muddy Creek. The geologic map suggests that the section on the west side of Muddy Creek is anomalously high relative to the section on the east side of Muddy Creek. Small scale faulting with displacements of a few feet are common in the-western half of the quadrangle. The presence of structure and potential source beds in the Paleozoic section improves the probability of hydrocarbon accumulations.

## Groundwater Resources

The town of Walnut, the Three Forks Water Association, and the town of Tipiersville are the largest consumers of groundwater within the quadrangle. The Coffee Sand aquifer is the source of supply for Walnut and the Three Forks Water Association. Tiplersville derives its groundwater from the McNairy Sand. Gandi (1982) includes the McNairy in the Ripley aquifer. No water supply or water quality problems

are associated with either the Coffee Sand or Ripley aquifers within the Walnut Quadrangle.

There are other potential aquifers in the study area that could be used. The top of the Paleozoic section produces water in adjoining Alcorn County and should be considered a possible source of groundwater in the Walnut Quadrangle. The Eutaw aquifer should also be considered a possible source of groundwater, although in Alcorn County the aquifer produces water with high concentrations of iron. The McNairy Sand should be considered a aquifer that could be more extensively used. The unit crops out in the adjoining Chalybeate Quadrangle to the east. Therefore, the unit would be reasonably shallow. The sand lithology and thickness should produce groundwater in amounts suitable for most uses.

In the Tertiary section the aquifers are suited best for domestic use or for livestock. The upper, sand section of the Clayton should produce water in the eastern one-third of the quadrangle, though iron content may be high. These sands thicken and thin rapidly so it would be difficult to predict where there would be an adequate thickness of sand to produce usable amounts of water. The Tippah Sand Lentil, a facies of the Porters Creek Formation, should also produce water. Because the Tippah Sand is a facies developed in an argillaceous section, recharge of the unit may present problems. Where the unit is well developed it should produce water sufficient for domestic use. The Meridian

Sand should also produce water under water table conditions in the western one-third of the quadrangle. As with most aquifers under water table conditions the water table may fluctuate significantly. This fluctuation may be especially problematic on some of the narrow ridges that are capped by Meridian sands.

## Well Data

Most of the readily accessable well data for the Walnut Quadrangle are summarized in Table 1. These data, by no means, represent all of the wells present. The source of the well data is given in Table 1. Well logs for the oil test wells can be examined at the Mississippi State Oil and Gas Board, the Mississippi Bureau of Geology, or the Mississippi Mineral Resources Institute. The water well logs are available for inspection at the Mississippi Bureau of Geology. The logs for exploration wells are available only in the referenced publication. An exception is well number one, a lignite test well, which has logs available at the Mississippi Bureau of Geology and at the Mississippi Mineral Resources Institute. Boswell (1963) presents a listing of water wells for Tippah County. Several of these wells could not be located during field work as they have been abandoned; but nonetheless this reference is useful for information on the earlier wells.

Table 1

Referenced VfelIs

| Map # | Well name | Reference | Comments |
|---|---|---|---|
| E-1 | Ls-70-1, Lignite Test well | Easom and others, 1979 | |
| W-2 | Three Forks Water Assoc. # 1 | Easom and others, 1979 | |
| 0-3 | # 1 E.J. Martindale | — | oil test - no well logs |
| W-4 | City of Walnut # 2 | Sims, 1985 | |
| W-5 | City of Walnut # 1 | Easom and others, 1979 | |
| 0-6 | # 1 Melton | Mississippi Oil and Gas Board | oil test |
| 0-7 | # 1 Blackwell | Mississippi Oil and Gas Board | oil test |
| W-8 | Tipiersville # 1 | — | no logs available |
| W-9 | Tipiersville # 2 | Sims, 1985 | |
| W-10 | Old Walnut Supply | — | well abandoned - no logs |
| E-11 | National Forest, Test Hole 2X121 | Conant and McCutcheon, 1941 | bauxite test well |
| E-12 | H.A. Hopper, Test Hole A 2X111 | Conant and McCutcheon, 1941 | bauxite test well |
| E-13 | National Forest, Test Hole 2X113 | Conant and McCutcheon, 1941 | bauxite test well |
| E—14 | H.A. Hopper, Test Hole ZX117 | Conant and McCutcheon, 1941 | bauxite test well |
| E-15 | H.A. Hopper, Test Hole 2X101 | COnant and McCutcheon, 1941 | bauxite test well |
| E-16 | H.L. Miskelly, Test Hole 2X102 | Conant and McCutcheon, 1941 | bauxite test well |
| B-17 | National Forest, Test Hole 2X107 | Conant and McCutcheon, 1941 | bauxite test well |
| E-18 | National Forest, Test Hole 2X125 | Conant and McCutcheon, 1941 | bauxite test well |
| E-19 | H.A. Hopper, Test Hole 2X129 | Conant and McCutcheon, 1941 | bauxite test well |
| E-20 | H.A. Hopper, Test Hole 2X129 A | Conant and McCutcheon, 1941 | bauxite test well |
| E-21 | H.A. Hopper, Test Hole 2X131 | COnant and McCutcheon, 1941 | bauxite test well |
| E-22 | H.A. Hopper, Test Hole 2X136 | Conant and McCutcheon, 1941 | bauxite test well |
| E-23 | National Forest, Test Hole 2X150 | Conant and McCutcheon, 1941 | bauxite test well |
| E-24 | National Forest, Test Hole 2X196 | Conant and McCutcheon, 1941 | bauxite test well |
| E-25 | National Forest, Test Hole 2X173 | Conant and McCutcheon, 1941 | bauxite test well |
| W-2 6 | Gary Burrow | Easom and others, 1979 | |

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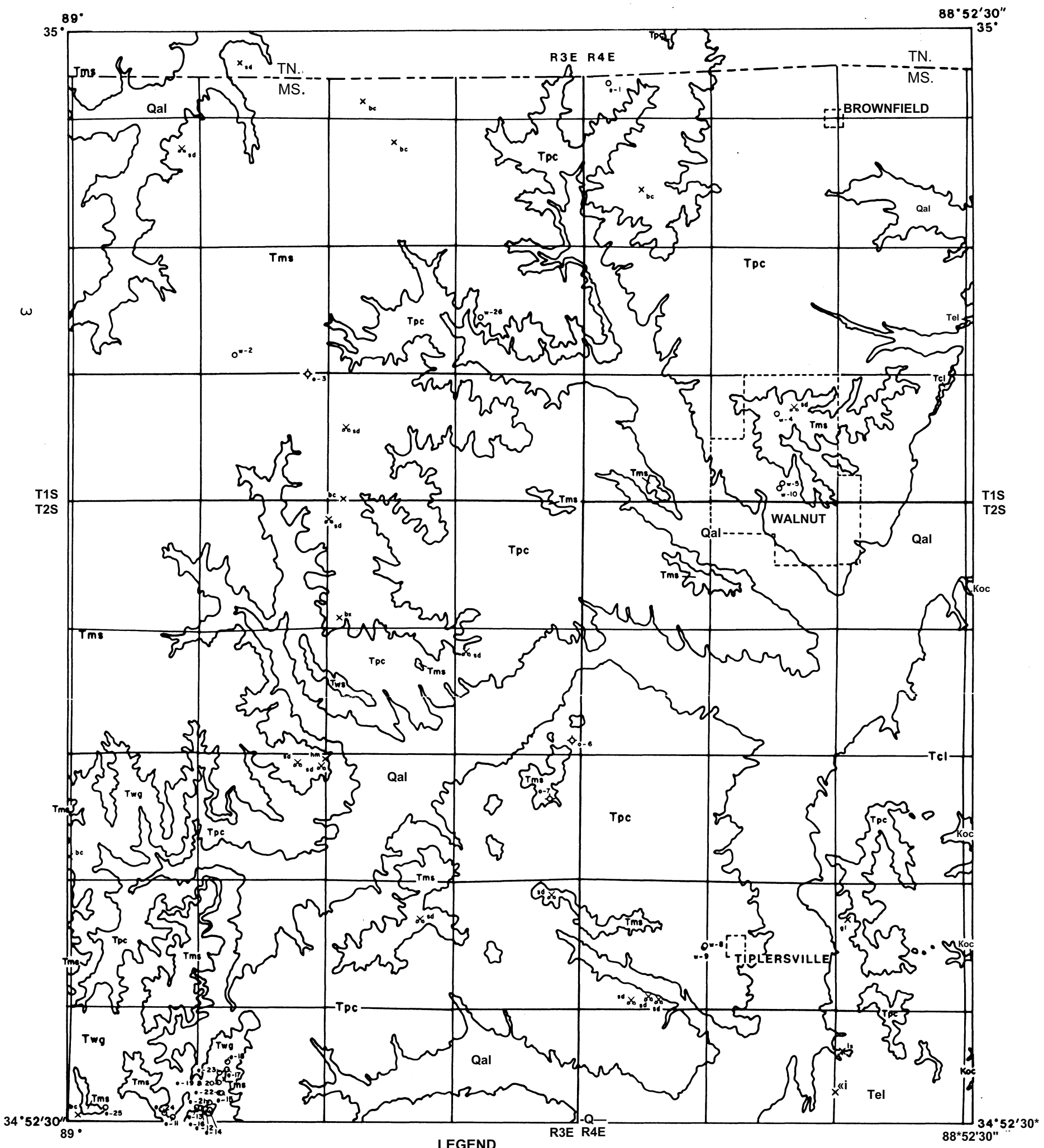


LEGEND

GEOLOGY

Ooi - Quotornory alluvium
Tm· - Meridion Sond
Twg - Wilcox Group
Tpc - Porters Crook Formotion
Tel - Cloyton Formotion
Koc - Owl Crook Formotion

MINERALS

sd - •and
bx - bauxite
be - ball cloy
hm - heavy mineral·
gl — giouconite
l· - limestone
X - prospect
pit
O ·-# " mineral exploration well a number
O w-# - water well & number
oil tost woli a number

N

0 1 2 Mi.
0 4000 8000 Ft.
0 1 2 Km

MS

# GEOLOGIC MAP OF WALNUT QUADRANGLE

FIGURE 1