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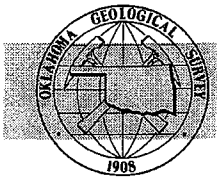

OKLAHOMA GEOLOGICAL SURVEY
A State Agency for research and public service

INDUSTRIAL-MINERAL RESOURCES OF OKLAHOMA[1]

Kenneth S. Johnson[2]

INTRODUCTION

Industrial minerals (which are the nonfuel, nonmetallic minerals that have potential for economic use) are widely distributed in Oklahoma (Fig. 1), and many of them are being mined for local, regional, and national markets. Numerous and varied industrial-mineral industries are active in 69 of Oklahoma's 77 counties. Although such activity is widespread in the State, some of the most important regions are the Wichita, Arbuckle, and Ouachita Mountain uplifts in the south, and the Ozark uplift in the northeast (Fig. 2); it is in these areas where some of the State's unique rock and mineral deposits have been uplifted and are now exposed at the land surface.

Crushed-stone and building-stone resources include limestone, dolomite, granite, and rhyolite; other major construction resources are cement (made from limestone and shale) and the extensive sand and gravel deposits along modern and ancient riverways. Glass sand (a high-purity silica sand) is used for glass making, foundry sands, ceramics, and abrasives. Enormous resources of gypsum in the western part of the State are mined for wallboard, for plaster, as retarder in portland cement, and as soil conditioner. Thick layers of rock salt underlie most of western Oklahoma, and natural springs emit high-salinity brine to the several salt plains. Oklahoma iodine, produced from deep brines in the northwest, is the Nation's sole domestic supply. Other important industrial minerals in Oklahoma include clays and shales (to make brick and tile), and tripoli and volcanic ash (abrasive and/or absorbent materials). Gem-stone production includes fresh-water mussel shells and fresh-water pearls.

The total estimated value of industrial-mineral production in Oklahoma during 1997 was $411 million (Table 1), and the State ranked 34th in the Nation. Leading nonfuel commodities during 1997 were crushed stone ($134 million), portland and masonry cement ($131 million), sand and gravel ($33 million), glass sand ($27 million), iodine ($24 million), and gypsum ($18 million) (Table 1).

This report, modified from Johnson (1993), is a description of the State's industrial minerals, arranged alphabetically. Many of the data are based upon reports by Johnson (1969a, 1977), Morris (1982), and the Oklahoma Department of Mines (1991); the reader is referred to these reports, as well as other reports that are referenced separately for several of the commodities. The many companies that mine Oklahoma's mineral resources are listed in a "Directory of Oklahoma Mining Industry" (Arndt and Springer, 1993), and maps from that report are reproduced here (Figs. 3–6) to show the number of current mining operations for specified commodities in each county.

ASPHALT

Asphalt is an oil-based commodity, but, because it has been used mainly as a road-surfacing and tar material in Oklahoma, it is herein considered as a nonfuel-mineral resource. Asphalt forms where crude oil migrates upward near the land surface: the lighter hydrocarbons evaporate, leaving a thicker, heavy residue that impregnates the rocks as rock asphalt, or that fills voids as a tar-like substance called asphaltite.

The major sources of rock asphalt and asphaltite are in sedimentary rocks in and around the Arbuckle and Ouachita Mountains of southern Oklahoma (Jordan, 1964). Additional smaller deposits occur in sedimentary rocks surrounding the Wichita Mountains and in northeast Oklahoma. From the State's large resources, about 3 million tons of asphalt were produced between 1891 and 1960, chiefly from asphaltic sandstones and limestones

[1]Johnson, K. S., 1993, Industrial-mineral resources of Oklahoma, *in* Johnson, K. S. (ed.), Industrial-minerals development in Oklahoma—a symposium: Oklahoma Geological Survey Special Publication 93-2, p. 1–10.

[2]Associate Director, Oklahoma Geological Survey.

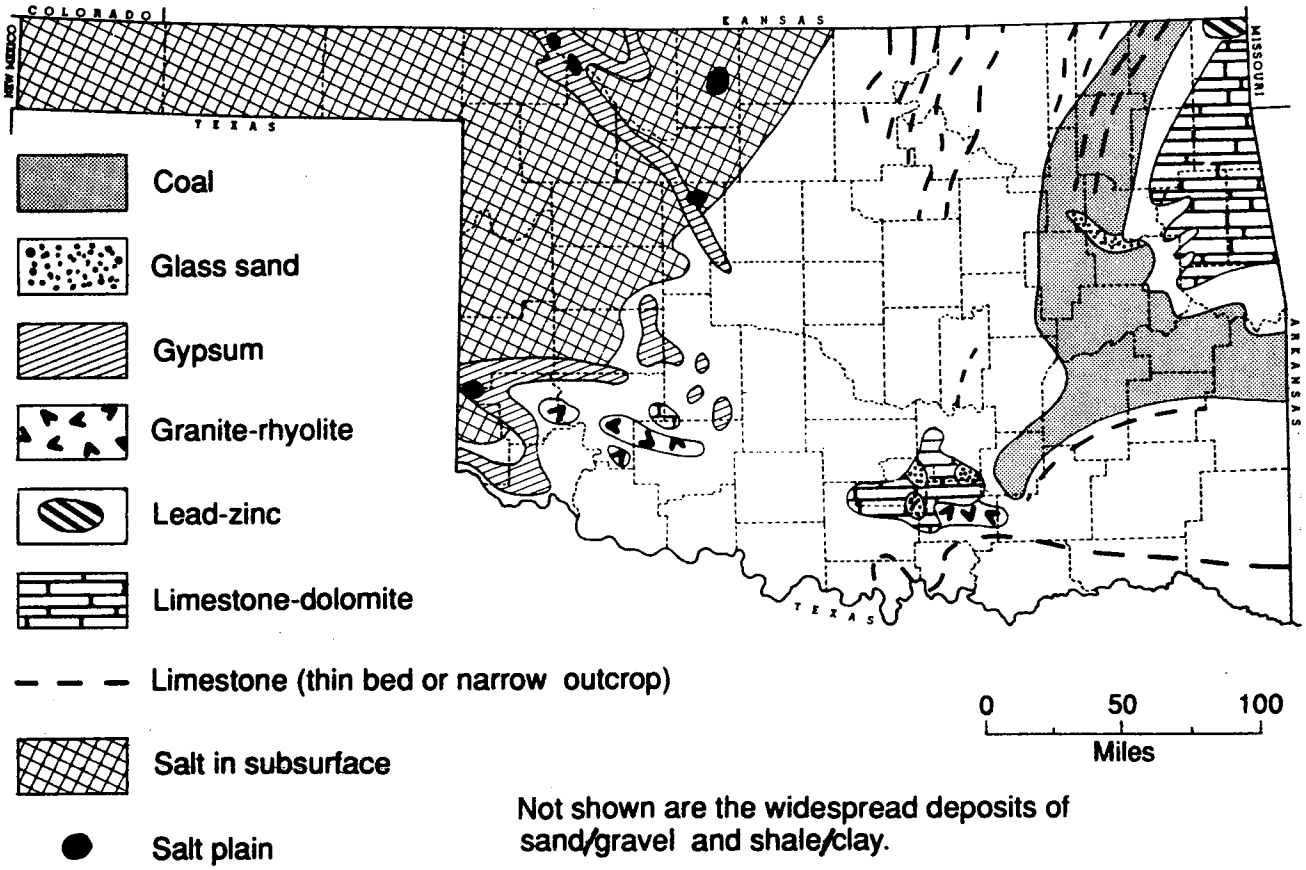

Figure 1. Selected nonpetroleum-mineral resources of Oklahoma.

in the Sulphur and Dougherty districts of the Arbuckle Mountains. Principal mines for asphaltite were operated near Page, Sardis, and Jumbo in the Ouachita Mountains; these shaft mines and surface mines operated between 1890 and 1916.

Most of the rock asphalt mined in Oklahoma was used as paving material for roads in Oklahoma and adjacent states. Petroleum refineries now produce the large quantities of asphaltic material needed for road construction and maintenance, and all natural-rock-asphalt quarries are currently inactive. Asphaltite was used mainly in making roofing pitch, paints, varnishes, rubber substitutes, and electrical-wire insulation. Future demands for asphaltic materials and/or heavy oils can readily be satisfied by the vast resources that remain in the State.

CEMENT

Raw materials for the manufacture of portland cement and masonry cement are limestone and clay or shale. Oklahoma has an abundance of both these resources, and they are discussed separately elsewhere in this report. Three cement plants currently are operating in Mayes, Pontotoc, and Rogers Counties: production in 1997 was estimated at 1.9 million metric tons, with a value of $131 million (Table 1).

CHAT

Chat, which consists of crushed limestone, dolomite, and chert, was produced as a waste byproduct of mining and milling of lead/zinc ores in the Tri-State district of northeast Oklahoma. The material, which now exists in large piles in the Miami-Picher area of Ottawa County, has been used as road metal, railroad ballast, concrete aggregate, and rock fill.

CHEMICAL RAW MATERIALS

Oklahoma has vast resources of certain high-purity minerals suitable as raw materials for various chemical industries (Johnson, 1969b). Major deposits of limestone, dolomite, and glass sand are in the south-central and eastern parts of the State, whereas gypsum and salt are widespread in the west; these individual resources are discussed elsewhere in this report. The abundance and purity of these minerals should enable manufacture of caustic soda, soda ash, chlorine, sulfur, sulfuric acid, lime, sodium silicate, and other chemical products. Oil, natural gas, and water, needed in the manufacture of these chemi-

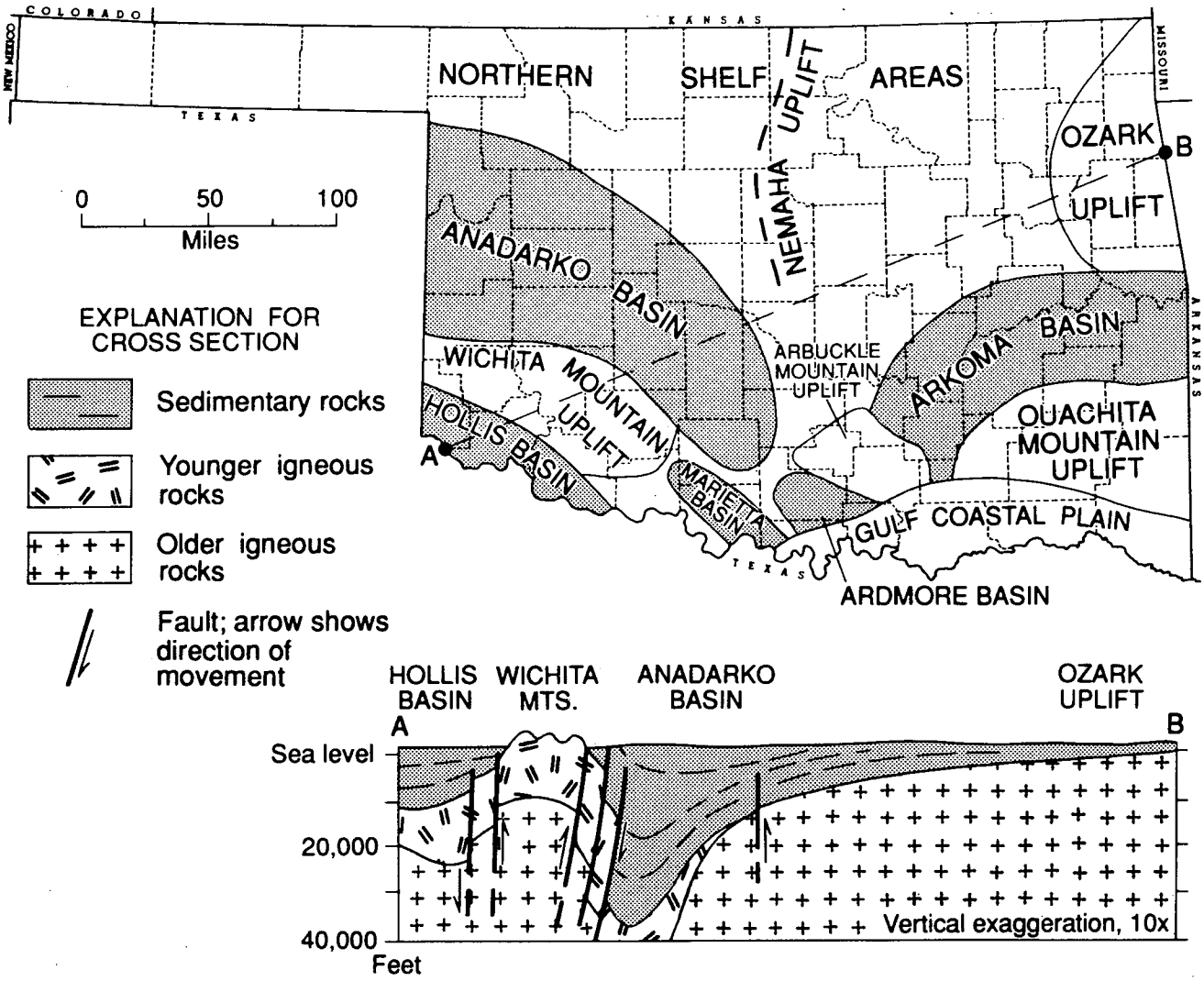

Figure 2. Major geologic provinces of Oklahoma.

cal products, are plentiful in most parts of the State, and bituminous coal is abundant in eastern Oklahoma.

CLAY AND SHALE

Clay and shale are present in almost every county in Oklahoma, and deposits suitable for manufacture of red brick and tile products are widely distributed (Fig. 3). Light-firing clays, low-grade refractory clays, and clays suitable for making pottery are present at a few localities, and clay suitable for making lightweight aggregate is common in the eastern portion of the State.

Most of the shale deposits in Oklahoma contain illite as the dominant clay mineral, and the illite is associated with varying mixtures of clay-sized quartz and other clay minerals. Chlorite, kaolinite, montmorillonite, and mixed-layer clays generally are of lesser importance, although each of these clays is predominant in certain localities. In addition to these common shales, there are several types of specialty clays in parts of Oklahoma: small- to moderate-sized deposits of bentonitic clay (montmorillonite) are associated with, and altered from, volcanic ash, mainly in northwestern Oklahoma. Recent reports on clays and shales in Oklahoma are by Bellis (1972) and Johnson and others (1980).

Shale has been an important part of the construction industry in Oklahoma since before Statehood. More than 120 brick plants have operated since 1888, with most of them being in the central part of the State (Morris, 1982). Also, shale is one of the major ingredients at the three cement factories now operating in the State. In 1993, 21 companies were producing clay and shale in many different parts of Oklahoma (Oklahoma Department of Mines, 1994), and in 1997 the State produced an estimated 772,000 metric tons of clay and shale valued at about $3.6 million (Table 1).

DIMENSION STONE

Oklahoma has a variety of sandstones, limestones, dolomites, and granites suitable for building and ornamental purposes, and native stone has been used extensively in residence and building construction. The quality of some sandstones in eastern Oklahoma and of oolitic limestone in southern Oklahoma compares favorably with any in the nation, and several of the limestones and dolomites

have unusual beauty and texture. The various types of dimension stone are discussed further in this report under the rock names. In 1997, Oklahoma produced about 9,761 metric tons of dimension stone, valued at an estimated $2.2 million (Table 1).

DOLOMITE

Large resources of high-purity Cambrian dolomite are present in the Arbuckle Mountains (Ham, 1949); the stone is quarried for high-purity material at one site and is quarried for crushed stone at two other sites in the Arbuckle Mountain region (Fig. 6). The high-purity Royer Dolomite is about 500 ft thick in the area, and other dolomite units are also 400–500 ft thick. Smaller deposits or thinner beds, generally of lower purity, are known in the Wichita Mountains, in Delaware and Osage Counties, and in widely scattered Permian outcrops of western Oklahoma; several of these deposits are worked for dimension stone and/or for crushed stone.

Current and potential uses of dolomite are for fluxing stone, glass manufacture, refractories, dolomitic lime,

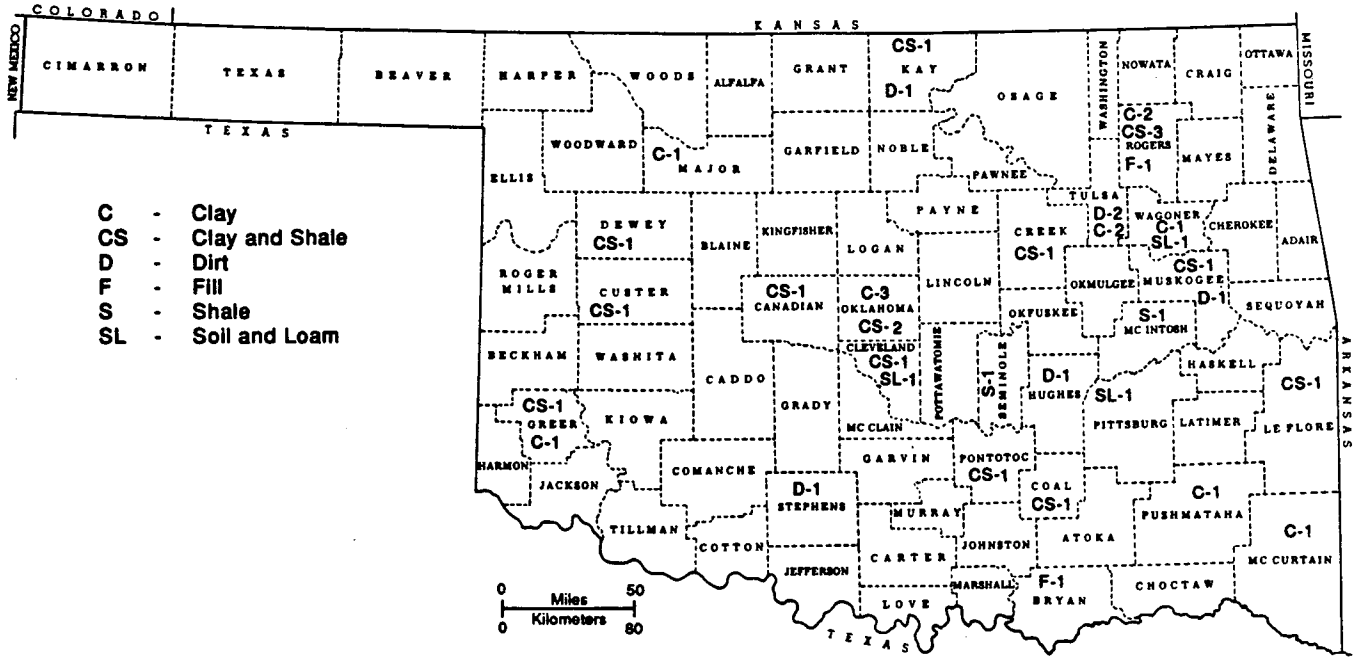

Figure 3. Number of clay, shale, and soil pits in each of Oklahoma's counties (from Arndt and Springer, 1993).

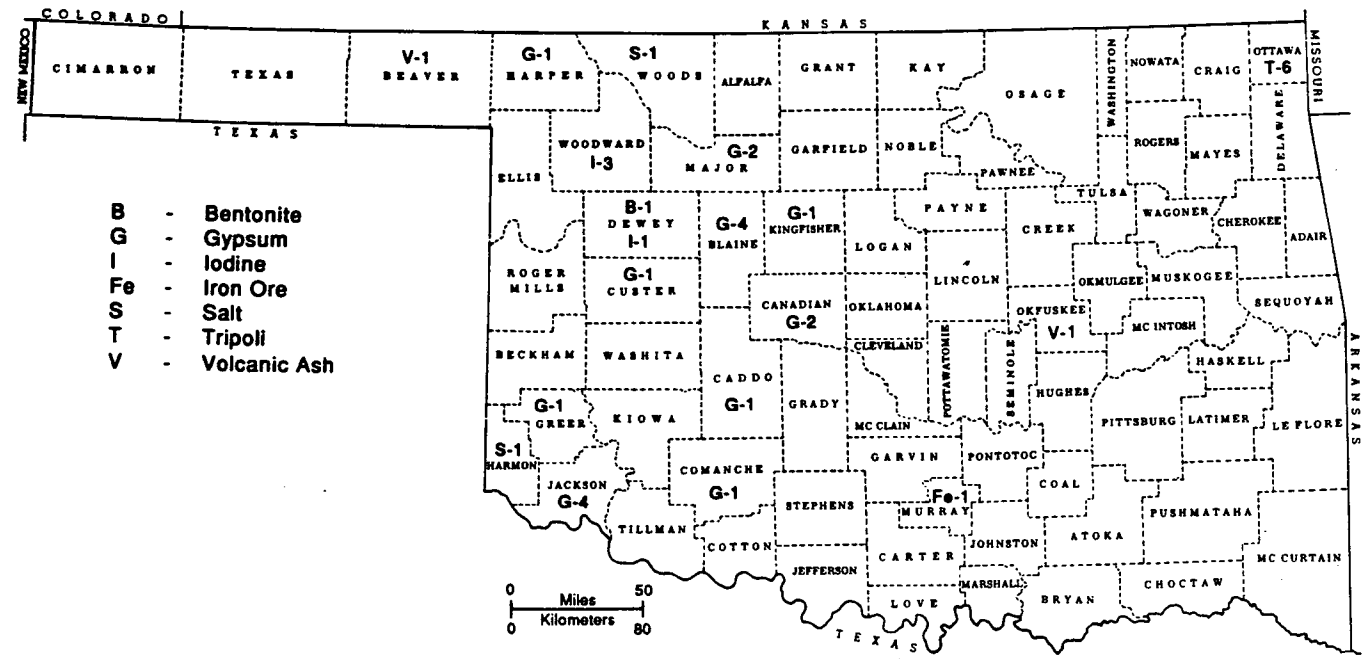

Figure 4. Number of bentonite, gypsum, iodine, iron ore, salt, tripoli, and volcanic-ash operations in each of Oklahoma's counties (from Arndt and Springer, 1993).

magnesium metal, fertilizers, feeds, and as a soil conditioner. Quantity and value of current production are included within the estimates for crushed and dimension stone (Table 1).

GEM STONES

Gem-stone production consists of the harvesting of fresh-water mussel shells from lakes and rivers, chiefly in eastern Oklahoma. The shells then are cut up and rounded, and the shell pellets are implanted in oysters for creating cultured pearls. Small quantities of fresh-water pearls are also recovered from the mussels, but these are only a minor byproduct of the shell production. Three firms are currently buying fresh-water mussels from independent divers in Oklahoma, and almost all the shell material is being exported to Japan. The value of fresh-water mussel shells and pearls harvested in 1997 was estimated at nearly $1 million (Table 1).

Although there are about 300 species of fresh-water mussels, only about 15–20 are suitable for use as shell pellets for implanting. Also, about 100 species are already

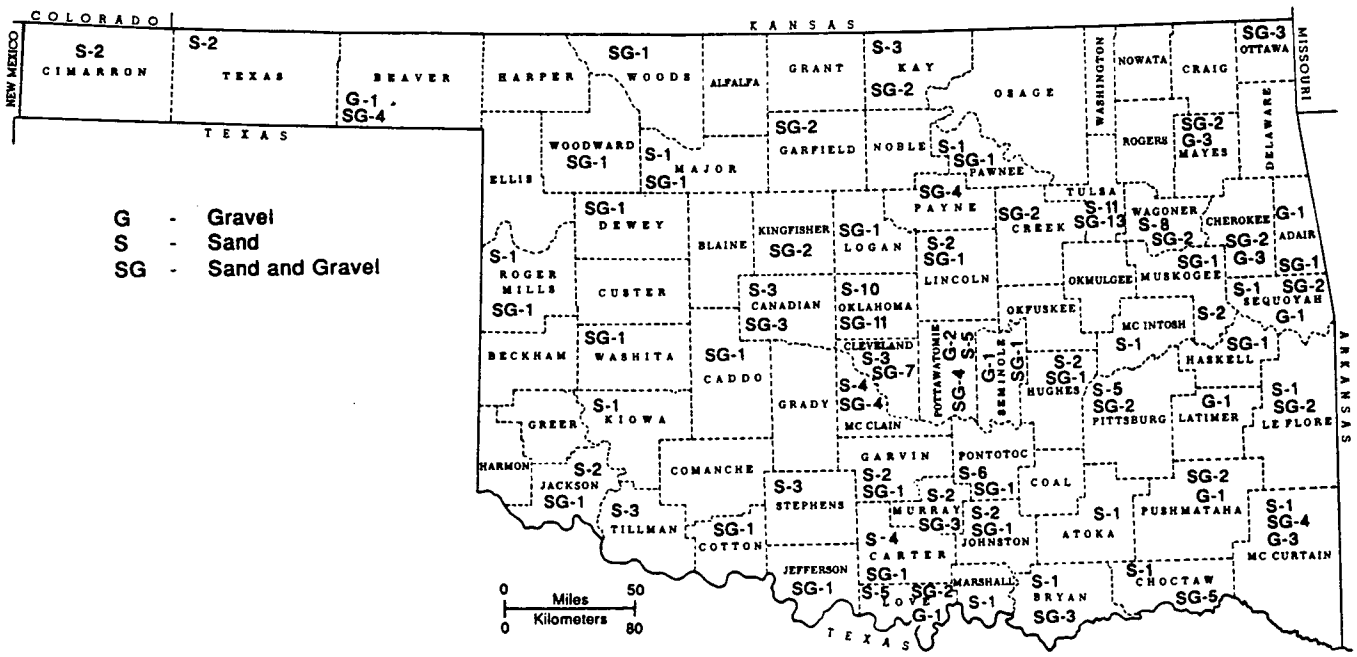

Figure 5. Number of sand and gravel operations in each of Oklahoma's counties (from Arndt and Springer, 1993).

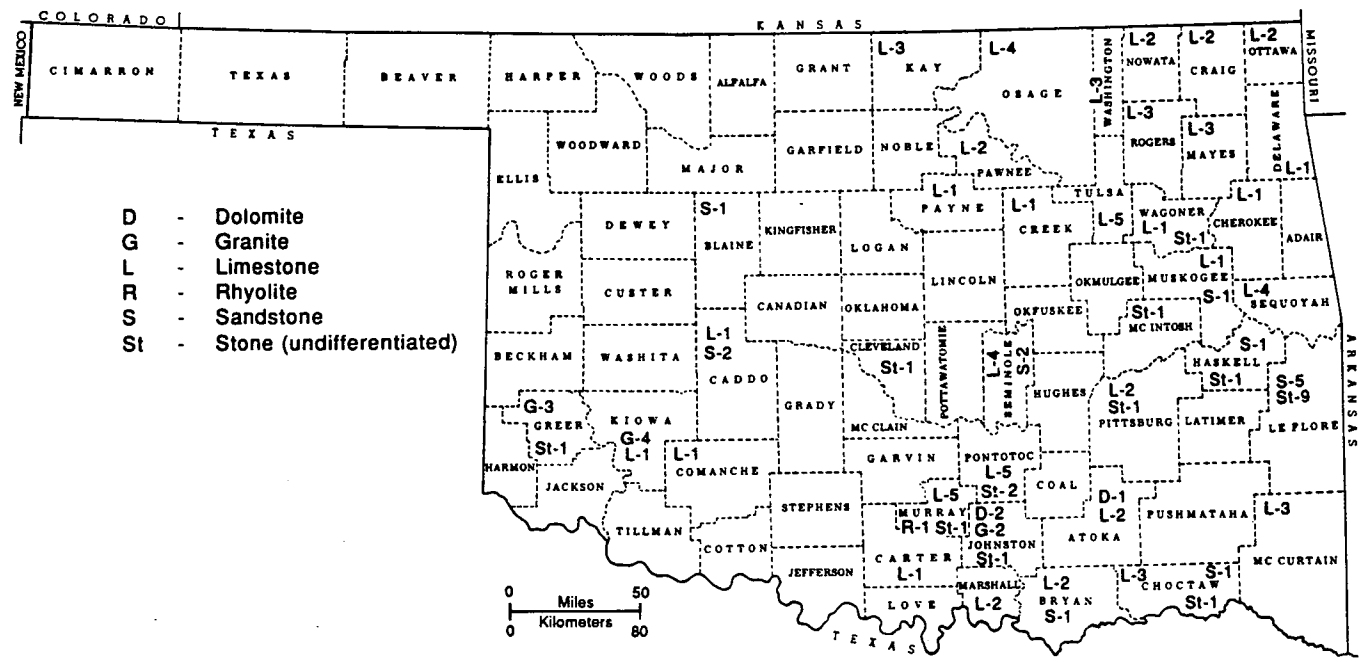

Figure 6. Number of stone quarries in each of Oklahoma's counties (from Arndt and Springer, 1993).