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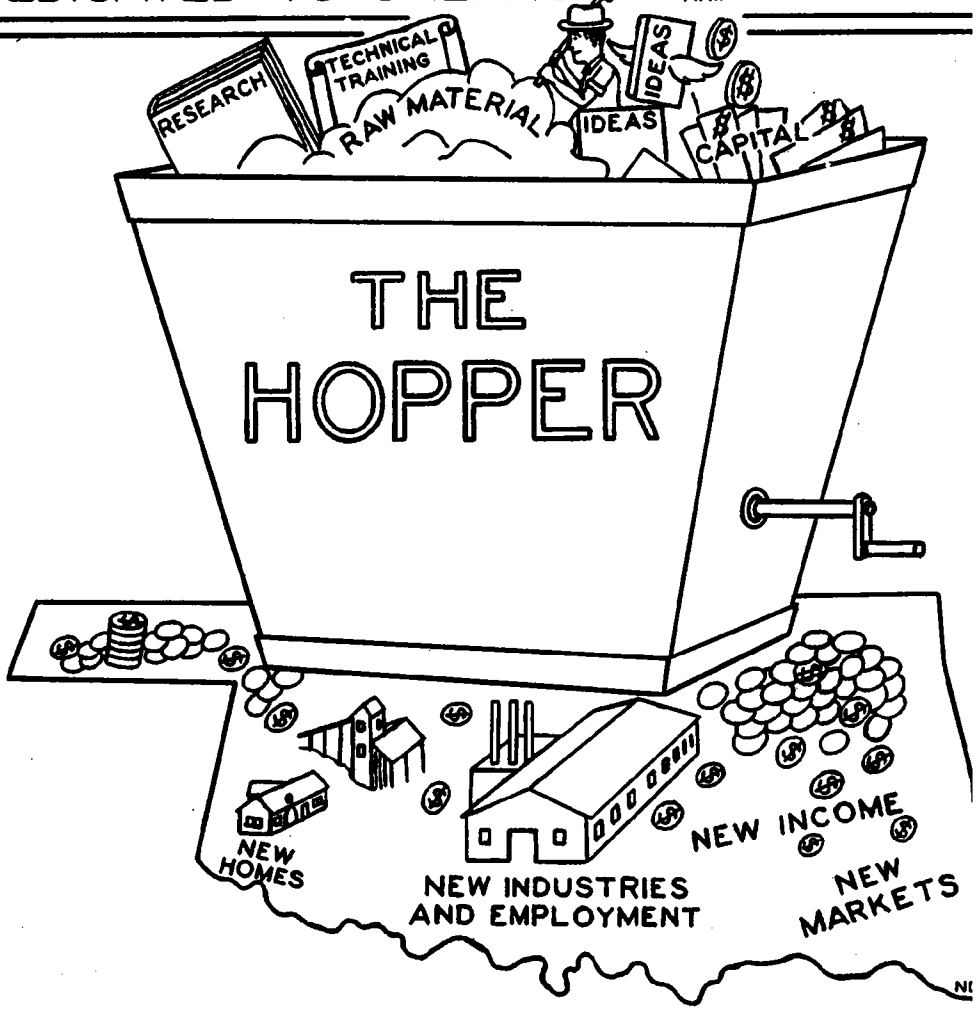

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NATIVE ROCKS AS FERTILIZER

By
Dr. W. D. Keller, Professor of Geology,
University of Missouri

ABSTRACT

(The following abstract of an article by Dr. W. D. Keller appeared in Vol. 12, No. 7, July, 1950, issue of THE ORE.-BIN, publication of the Oregon State Department of Geology and Mineral Industries, Portland, Oregon. THE ORE.-BIN abstract was made from a paper by Dr. Keller which appeared in the April, 1950, issue of the Organic Farmer.

The possible importance to agriculture of trace minerals contained in limestones and other natural rocks applied to soils has been suggested in the past, and articles dealing with the effect of minute quantities of some of these trace elements on plants have appeared in the literature. Dr. Keller's article places emphasis on natural raw rocks as soil builders, and seems to contain a novel approach and general summary of his ideas regarding the role of minerals in maintaining the productivity of soils).

"The original fertility of a soil is the result of two processes: the accumulation of humus and the weathering of the source rock. Organic farmers believe that when soil fertility has been depleted it can best be restored by duplicating these natural processes, that is, by adding organic matter and native rocks to the soil. This article focuses attention on the second process - the addition of native rock which when weathered will provide the desired nutrient elements.

Origin of primary fertility

Rocks in general contain the main nutrient elements, except for nitrogen, which plants require.

The rocks and minerals must first undergo weathering (alteration)to form soil(soil is composed mainly of sand, clay, and yellow, red, or brown iron oxides). During the weathering process, soluble forms of compounds of potassium, phosphorus, calcium, magnesium, sodium, and trace elements such as manganese, copper, cobalt, zinc, boron, and others are formed. Then, through the action of the colloidal fraction of the clay and humus, the elements listed above are taken from solid rock and are made available in a useful form to the rootlets.

Nutrient transfer via clay and humus

The rootlets withdraw much of the nutrient elements from the clay and humus and exchange hydrogen (acidity) for the calcium, potassium, etc. removed. The acid clay and humus establish chemical balance again by extracting from adjacent rock fragments more potassium, calcium, etc. This weathering action by acid soil and organic matter on rock particles breaks down the rock into more clay, more soil, and releases the desired nutrients.

A useful rock donor must have these two qualifications: it must contain the elements useful as plant nutrients and it must be relatively susceptible to weathering. Possessing these two qualifications, it becomes a long-lasting soil builder.

Natural versus processed additions

The elements liberated from native rock will be considerably more diverse than those of the more nearly pure, processed fertilizers and will normally include trace elements.

One of the many disadvantages of processed chemical fertilizer is its tendency to overstock the soil with the few elements contained in the

fertilizer. By greatly over-supplying some constituents it creates nutrient deficiencies in others.

Effective rock types

A. CALCIUM DONORS

1. Agricultural limestone (agstone) supplies calcium to the soil. Too much of a dose, however, will blot out the availability of other elements by neutralizing the acid activity. Preference is now swinging from pure calcium limestone to limestone containing a variety of elements, because the primary function of limestone is to fertilize, not neutralize.

2. Gypsum supplies calcium and sulphur to the soil. It is slightly soluble in nonacid soils such as alkali soils of dry western states.

3. Raw phosphate rock supplies calcium, phosphorous, and some trace elements.

B. MAGNESIUM-CONTAINING ROCKS

1. Dolomite supplies calcium and magnesium. Magnesium is very important to the formation of chlorophyll. The magnesium-to-calcium ratio should not be allowed to drop below 1 to 10 because an over-liming neutralizes the acidity which is necessary to liberate the magnesium.

2. Igneous and metamorphic rocks. Those that contain plagioclase feldspars release calcium through reaction with clays and humus. These silicate compounds of calcium are more resistant to weathering than are limestones, hence response of soil to them is slower.

Dunite and peridotite contain olivine, a magnesium iron silicate, and release magnesium to the soil.

C. POTASSIUM ROCK SOURCES

1. Glauconite-bearing rocks furnish potassium, calcium, and magnesium. Glauconitic dolomites in eastern states average 6 percent potassium.

2. Leucite-bearing rocks. Leucite is an aluminum magnesium silicate which weathers fairly rapidly. Known occurrences in the United States are limited to Wyoming and Montana. Wyoming leucite rock analyses are as follows: 9 percent potassium oxide, 6 percent calcium oxide, 7 percent magnesium oxide, 2 percent phosphorus pentoxide, and trace elements. The rock consequently makes a highly valuable fertilizer. Volcanic ash from Vesuvius in Italy is notably high in leucite.

3. Granite contains potassium feldspar but responds slowly to weathering.

4. Volcanic ash, the extrusive equivalent of granitic rock, is ordinarily more susceptible to weathering than its crystalline equivalent. In many respects volcanic ash is close to the ideal, naturally pulverized rock fertilizer.

D. Other materials such as slags from metallurgical furnaces, portland cement clinkers, and waste products due to improper burning of lime or dolomite may be effective as rock fertilizers.

Pulverizing of rocks essential

Silicate rocks should be pulverized finer than carbonates (limestone and dolomite), volcanic ash excepted. Some pulverized materials available in nature may be applied to the soil in their natural form. These are: silt from river bottoms, windblown dust (loess), and volcanic ash.

Agricultural stone, once considered to be the "poor relative" of fertilizers, now ranks with them as a native fertilizer. Moreover, agricultural limestone producers are now blending their products with other native rocks and minerals to meet particular soil needs. The rock-fertilizer industry is in its infancy, consequently many deposits of potential fertilizers are yet to be recognized."

Oklahoma Rocks and Agriculture

Among the classes of rocks listed in the table as effective rock types, Oklahoma has the following in abundance:

Calcium rocks: Agricultural limestone and gypsum.

Magnesium-containing rocks: Dolomite and igneous rocks.

Potassium-bearing rocks: Volcanic ash (and volcanic tuff) and granite.

In less abundance are the phosphatic limestones and some low-grade glauconitic sandstones and limestones.

Oklahoma limestone and dolomite is being quarried and crushed in considerable quantities at numerous quarries, and fines from several crushers are sold for agricultural purposes, and some operators specialize in supplying agstone. Veins of calcite, the calcium carbonate mineral, have been mined in a few instances in the Wichita and Arbuckle Mountains and used for soil treatment. In some areas of the state there are deposits of magnesian limestone (limestone in which the magnesium carbonate is too low to form a true dolomite), as well as large deposits of high grade dolomite in a few areas. So far as known, no other types of rocks have been produced especially for agricultural uses in Oklahoma.

DEEP-WELL IRRIGATION IN OKLAHOMA PANHANDLE

by
Stuart L. Schoff, Geologist
U.S. Geological Survey

Irrigation with ground water in Texas, Beaver, and Cimarron Counties, Oklahoma, which constitute most of the High Plains portion of the state, has increased markedly since World War II. A reconnaissance of the area in May, 1950, revealed that 31 wells have been drilled, most if not all of them since 1945, and that 8 wells were then under construction. As a consequence, more irrigation wells are in use in the Oklahoma Panhandle than at any previous time. Although interest in irrigation may have been heightened by the dry weather of the last 6 months, much of the development has taken place during years of plentiful precipitation.

Of the completed wells, 12 are in Texas County, and 9 in Beaver County. Of the wells being drilled, four are in Cimarron County, two in Texas County, and two in Beaver County. These wells penetrate water-bearing sand and gravel beds of Tertiary age. The deposits are geologically and hydrologically similar to the water-bearing stratum of the irrigated area of the Texas High Plains.

Although some of the wells encounter water at shallow to moderate depths, many are in areas where static water levels range from 100 to 200 feet below the land surface. Yields are as much as 1,900 gallons per minute, but most of the wells yield less than 1,000 gallons per minute.

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William J. Wilhelm of East Mauch Chunk, Pennsylvania, joined the Survey staff on July 15 as ceramic technologist. Mr. Wilhelm is a graduate of Pennsylvania State College where he majored in ceramic work.

HOBBYISTS SPEND MONEY TOO

By
Alan White

Summertime is vacation and recreation time, when millions of Americans become tourists on the nation's highways. Thousands of these tourists are and will be traveling Oklahoma's highways, either seeking recreation within the state, or passing through over the transcontinental highways that cross the state. An occasional car will be parked beside the road - possibly with a flat tire, maybe with motor trouble; or the passengers may be members of that peculiar breed of hobbyists who, armed with rock hammer and sample sacks, find pleasure in seeking rare or unusual mineral specimens to add to their collections.

Paradoxical as it may seem, there are regions that can profit indirectly by practically giving away much of what it has to offer in the way of recreation. This applies especially to those hobbyists who combine outdoor recreation with collecting items of art created by Nature's workshop in the mineral kingdom. Dollars spent at roadside mineral stands by a passing tourist seem small compared to the dollars spent for lodging, car services, and other incidental expenses by tourist-collectors and their families who can be encouraged to spend a day or so longer in the area to scour the terrain in search of the hoped-for lucky find of a near-perfect specimen of crystal or gem stone.

There are more than 100 members of the Oklahoma Mineral and Gem Society, and doubtless a much larger number of mineral collectors who are not members of the society. Oklahoma is not one of the leading states in the number of people engaged in this hobby, as there are literally thousands of citizens in the United States who follow the hobby of collecting and working with gem stones and crystals as a spare time recreation. Efforts have

been made to arrive at a fair estimate of the number of dollars spent for recreation in the United States each year. Although there is a wide range in the totals arrived at by different groups, all agree that it is a multi-billion dollar business.

The American Automobile Association in the 1949 edition of its pamphlet, "Americans on the Highway," published a table showing the approximate amounts spent by tourists each year in each of the 48 states. These statistics were compiled from every available source and, in some cases, purely from estimates. Oklahoma is shown as being in a 4-way tie for thirty-fifth place. Oklahoma, Nebraska, Nevada and South Dakota are all listed as having an annual tourist-income of $60,000,000. The extremes as shown in the statistics are 19 million dollars spent by tourists in Rhode Island and a billion dollars spent in New York.

The foregoing figures must not be taken too literally but they do show about where Oklahoma stands as compared to the other states and they furnish a rough idea as to the amount spent here annually by tourists.

It is said that with the exception of Mount Vernon, the Will Rogers Memorial at Claremore attracts more visitors than any other similar memorial in the United States. Other points of interest are Platt National Park, the Pioneer Woman statue at Ponca City and the many good lakes which are becoming more and more popular among fishermen. All of these help to pull tourists into Oklahoma and minerals play their part in attracting and holding visitors for that extra day or so that is the key to success in getting a bigger share of the tourist dollar.

Two of Oklahoma's attractions for mineral collectors have become reasonably well known. These are the "barite roses" of central Oklahoma, and the

various minerals in the Tri-State lead-zinc area, part of which is in Ottawa County. Many out-of-state collectors visit these localities each year, and local dealers ship specimens to all parts of the country. Following is a brief discussion of these and other minerals that may be of interest to collectors:

Sand-Barite Roses The peculiar rose-shaped crystal aggregates of barite in sandstone from central Oklahoma have been called "barite roses," "barite rosettes," "petrified roses," "rose rocks," "petrified walnuts," "sand barites," "sand crystals," "sand barite rosettes" and "sand barite crystals." The rose-like appearance of these aggregates has made them prized by collectors, for rock gardens and other decorative purposes, and thus they became widely known. The fact that barite roses are found in few places in the world has caused scientific interest, and several attempts to explain their origin have been made. The concept that barite roses occur only in Oklahoma is erroneous, for similar specimens have been reported from Salina County, Kansas; Caeyama Valley, California, and Egypt. They are rather abundant in certain sections of Oklahoma, and have been reported from Cleveland, Logan, Lincoln, Okfuskee, Oklahoma, Pottawatomie, McClain, Garvin, Comanche and Tillman Counties.

Five to six miles east of Norman and extending north and south is an area particularly rich in these "roses." Findings have been reported north past Edmond and south past the Canadian River into Garvin County.

Aragonite Aragonite crystals similar to barite crystals have been found just south of the Cimarron River and on the east side of the road between Harper and Beaver Counties in northwestern Oklahoma.

Smoky Quartz Smoky quartz crystals have been found in the government quarry at Lugert. Some of the

larger crystals are two feet long and 12 inches in diameter. In the area near the northwest entrance to the wildlife refuge in the Wichita Mountains both amethyst and smoky quartz crystals are found.

Zircon Zircon crystals may be found in the Wichita Mountains at the west edge of the refuge in Section 21, T. 3 N., R. 15 W. These crystals are not of gem quality as they tend to be brownish in color. The crystal forms, however, are good and are unusual in that the prism faces are absent.

Galena The Tri-State district in the northeast corner of the state probably has some of the most nearly perfect galena crystals known and the most varied modifications of crystal form.

Calcite The Tri-State district is also one of the best-known regions where calcite crystals may be found. These are highly fluorescent and range in color from white to a honey-color. Just about every crystal form which calcite is known to take is found here and some of the forms are found only here.

Materials Suitable for Cutting and Polishing Some of the collectors have invested several hundred dollars for saws and equipment to be used in cutting and polishing rocks and minerals. Among the materials that have been collected in Oklahoma for cutting and polishing are:

Prenite which is found in and adjacent to Section 36, T. 4 N., R. 14 W.
Petrified Wood from the ancient stream gravels of Oklahoma.
Quartz Pebbles also from the ancient stream gravels.
Jasper from the Arbuckle Mountains.
Alabaster suitable for carving from the Blaine Gypsum in western and northwestern Oklahoma. Many colors and hues are available.