ILLINOIS STATE GEOLOGICAL SURVEY
Urbana, Illinois
John C. Frye, Chief

ILLINOIS INDUSTRIAL MINERALS NOTES

Number 2, July 1, 1955

Prepared by the Industrial Minerals Division
J. E. Lamar, Head

Considerable publicity has been given in recent months to the reported occurrence of radioactive materials on Hicks dome and at other places in Hardin County in extreme southern Illinois. To provide Illinois citizens and other interested persons with the basic facts, the Survey recently undertook and completed a preliminary investigation of the uranium possibilities in Hardin County. The results of this study, issued in June as "Preprint of Circular 200," indicate that "Hicks dome is an eroded structural dome whose specific mode of formation is not clear. Associated with it are explosion breccias and peridotite dikes. The central part of the dome is an area of about 1 1/2 square miles underlain by rocks of Devonian-New Albany age, principally limestone and chert bordered by black shale. The bedrock in the central areas of the dome, as well as in other adjacent areas, is covered by red and yellow clays believed to be a residuum resulting from the leaching of cherty Devonian limestone. Chert breccias, cemented by secondary silica, also are present.

"Tests of about 200 samples taken from the dome and throughout the county suggest that the residual clays and breccias within the Devonian-New Albany area of the dome are generally more radioactive than samples elsewhere, though there are some exceptions. Samples of fluorspar, zinc and lead ores, and concentrates from these ores have little or no radioactivity as measured by a laboratory Geiger counter. Uranium oxide (U_3O_8) determinations made by chemical procedures on 25 samples having some of the higher uranium equivalent values were all lower than the uranium equivalent values. All the samples analyzed for U_3O_8 contained less of this compound than the minimum of 0.1 percent for which prices are quoted by the Atomic Energy Commission."

A technique known as differential thermal analysis is coming into considerable use in the determination of some properties of minerals and rocks and as a means of identifying them. Basically this analysis produces a curve or chart that records the difference between the temperature of a sample being heated in an electric furnace and the tem-

perature of the interior of the furnace. When limestone is heated in the furnace, the curve or chart shows an abrupt V-shaped depression at the temperature at which the stone breaks down to lime and carbon dioxide. This is because heat was used up in the process of breaking down the limestone, causing the sample to become cooler than the furnace.

In contrast with this, the differential thermal analysis curve of coal heated in air may show one or more inverted V-shaped "peaks" which indicate when the various components of the coal sample burned, increasing the temperature of the sample above the temperature of the furnace. Many minerals have characteristic differential thermal analysis curves by which they can be identified. Also, impurities often may be detected.

J. S. Machin, of the Survey's Geochemical Section, is beginning an investigation of the chemical reactions by which pulverized Illinois fluorspar affects vanadium-staining on structural clay products and of the most suitable procedures for using the spar. Any Illinois clay-products producer troubled by severe vanadium staining is invited to submit clay samples to be included in this investigation.

Limestone is largely made up of crystalline particles of the mineral calcite, whose chemical composition is calcium carbonate. Dolomite, the common variety of limestone found in northern Illinois, is principally the mineral dolomite, which has the chemical composition calcium magnesium carbonate. Crystals of calcite and dolomite are "harder" in one direction than another and transmit light better in one direction. One surface of a crystal dissolves more rapidly than others. The crystalline particles in Illinois limestones and dolomites are not known to be "lined up," or oriented, so that these directional properties of calcite and dolomite have a major effect on the properties of the rocks. However, they may be significant in some marbles, making them easier to saw, more translucent, and more weather resistant in some directions than others.

The Porters Creek clay, which crops out at several places in extreme southern Illinois near Olmsted, Mounds, and Unity, is unusual because it is comparatively light weight and is brittle when dry, so that it crushes somewhat like limestone. Three samples of the Olmsted clay after heating to 1950 to 2100° F. had an average weight of 75 to 80 pounds per cubic foot. The samples were buff in color and retained their original shape and appearance. The pores in the sample were small and inconspicous, and the surfaces were relatively smooth. It is possible that a burned product of this sort may have merit as a lightweight or semilightweight aggregate for concrete products.

A report on the building stones of Illinois, Report of Investigations 184, has been issued recently. It describes the various types of limestones, dolo-

mites, and sandstones found in the State and gives data on those that seem to have promise as commercial limestone, marble, and travertine. Copies have been sent to Illinois stone producers. Illinois residents can receive a copy upon request without charge until September 15.

CAPSULE REPORT

Lightweight brick from clay and peat or shredded corncobs

J. E. Lamar

A number of years ago the Survey undertook a preliminary investigation of the possibility of making lightweight brick from mixtures of clay and Illinois peat or clay and shredded corncobs. Peat occurs in places in the northeastern part of the State and locally elsewhere. Corncobs are available in many parts of Illinois.

The peat and corncobs were dried and shredded into particles smaller than about one-fourth inch. No tests were made with wet peat as it might come from a peat deposit. If wet peat could be used, this would be advantageous, as it would eliminate the cost of preliminary drying.

A number of test brick of standard brick size were prepared from mixtures of various proportions of peat and Illinois clay (shale) and cobs and clay. The bricks were hand-molded; the mixtures used had roughly a "soft mud" consistency. The brick were air-dried for one week and then oven-dried. A considerable growth of white mold developed on the cob-clay bricks but disappeared as the bricks dried. Through the courtesy of an Illinois brick manufacturer, the brick were burned in a beehive kiln along with commercial brick.

After burning, both types of brick had an interesting pitted texture. In the peat-clay brick, a small residue of ash from the peat was left in the pores, which may not be desirable. The cobs left no significant ash.

Data on the bricks are given in tables 1 and 2. In assessing these data it should be borne in mind that the burning conditions and the schedule employed in firing the brick were not necessarily those most desirable for brick containing a relatively high percentage of combustible material. Other matters that may affect the strength or other properties of the brick, or that could be involved in their manufacture, are: size of the shredded cob or peat particles, ash content of the peat, use of moistened cobs or wet peat, plasticity of the clay employed, use of stiff mud molding, and determination of an optimum drying-and-firing schedule.

The possibility that a lightweight cob-clay brick or peat-clay brick might be developed that would be suitable for use in walls not exposed to the weather appears to merit further investigation. The porous character of the brick may give them heat-insulating properties.

Table 1. - Brick Made with Peat

Brick No.	Composition wt. percent Clay	Composition wt. percent Peat	Linear shrinkage - % Drying	Linear shrinkage - % Burning	Linear shrinkage - % Total	Wt. of burned brick lbs. per cu. ft.	24 hr. water absorption wt. percent	Compressive strength lbs. per ~~cu. ft.~~ sq. in.
1	95	5	3	5.5	8.5	100	7	3460+
2	91	9	4	4.9	8.9	89	11	3400+
3	83	17	4	6.7	10.7	80	12	1765
4	71	29	4	5.8	9.8	65	28	1640
5	63	37	5	4.3	9.3	46	45	365
6	50	50	6	5.6	11.6	40	50	220

Table 2. - Brick Made with Shredded Corncobs

Brick No.	Composition wt. percent Clay	Composition wt. percent Cobs	Linear shrinkage - % Drying	Linear shrinkage - % Burning	Linear shrinkage - % Total	Wt. of burned brick lbs. per cu. ft.	24 hr. water absorption wt. percent	Compressive strength lbs. per ~~cu. ft.~~ sq. in.
1	90	10	1.6	6.2	7.8	95	11	1840
2	83	17	1.6	5.8	7.4	78	22	815
3	76	24	1.6	5.0	6.6	60	34	525
4	70	30	1.6	6.2	7.8	55	48	235