

ILLINOIS STATE GEOLOGICAL SURVEY



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State of Illinois  
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STATE GEOLOGICAL SURVEY  
M. M. Leighton, Chief

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FOURTH ANNUAL MINERAL INDUSTRIES CONFERENCE OF ILLINOIS

"Research on the State's Mineral Resources  
and Their Utilization"

Urbana, Illinois  
April 24-25, 1936

C L A Y   A N D   C L A Y   P R O D U C T S   S E S S I O N S


ABSTRACT REPORTS OF  
GENERAL SESSION, FORUM ON RESEARCHES IN PROGRESS,  
AND SYMPOSIUM ON NEEDED RESEARCHES

Sponsored by:

The Illinois State Geological Survey Division of the Department  
of Registration and Education  
The Engineering Experiment Station of the University of Illinois  
Illinois Mineral Industries Committee

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Abstract reports of the addresses presented at the Fourth Annual Mineral Industries Conference of Illinois are available as follows:

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The State Geological Survey does not assume responsibility for the statements herein presented.



Many of these papers are being published in full by technical or trade journals.

Friday Forenoon, April 24, 1936

GENERAL SESSION

The general session was under the chairmanship of Dean M. L. Enger of the Engineering Experiment Station of the University of Illinois. After welcoming the guests he introduced Dr. M. M. Leighton, Chief of the State Geological Survey, who outlined the objectives of the conference.

Dr. Leighton pointed out that prosperity in our early history rested upon the exploration and development of the country's untouched resources, whereas now it rests upon scientific discoveries and technologic developments of new and improved uses of these same basic resources. The new viewpoint given us by science is that we should make a complete inventory of our many types of resources by thoroughgoing investigations and then show that their constitution, composition, and properties are such that they can be transformed in various ways into ever increasingly useful products. The commonwealth that will make available this kind of information will make more profitable use of its resources, will be better able to meet competitive conditions, will create more industrial opportunities, will provide more widespread employment and will lay the soundest of foundations for prosperity and happiness of its people.

He stated that this conference was thus planned to discuss the importance of research as applied to the State's mineral resources and their utilization, to acquaint the industries with the research now in progress and the value of the results, to permit us all to catch a larger vision of the possibilities of well planned comprehensive research, to receive suggestions of additional researches needed from the standpoint of industrial experience, and to develop a joint interest in pursuing a research program with proper facilities and qualified personnel that will make for greater industrial activity and greater public welfare within our commonwealth.

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The main address was given by Mr. Fred Wesley Sargent, President of the Chicago and North Western Railway Company, who was introduced by Dr. A. C. Willard, President of the University of Illinois. Mr. Sargent's subject was

"Research and the Immediate Future"

Mr. Sargent set forth the thesis that economic conditions will be improved by the production of new forms of wealth. Intensive research is producing new and improved means of production, and

is creating new industries and enormous demand for changes and improvement in old industries. The chemical industry illustrates the tremendous and rapid advances of scientific research. Many things are being done with chemistry that it was thought, heretofore, could only be done with machinery and muscle. Changes are coming so rapidly that frequently plants become obsolete long before they are worn out.

The intensive developments in science make it imperative that producers of raw materials ever be alert to scientific research. Pure research working in cooperation with honest business are forces that will move us into an era of unprecedented prosperity.

By enlarging the wants of men and women in diverse directions and by the consequent new demands arising for new additional services, scientific discoveries enlarge the field of human activity thereby creating new types of employment.

The Illinois coal industry, which in quantity and total value of product, is Illinois' largest mineral industry, ought also to be one of the greatest in concentrated value. Coal must not be looked upon only as a fuel to be destroyed by burning. Coal as coal only to burn may not long be able to hold its modern place of power, but through the aid of research it has limitless possibilities not only as a source of power but as a basis for vast new industries. Railroads are now burning dyes, medicines, perfumes and innumerable valuable chemicals along with their coal, all of which are wasted, and all of which ought to be captured for the service of mankind. New forms of competition are forcing the railroads to herculean efforts to hold their place in the field of transportation. Since some of these efforts are directed to producing power at lower cost, the coal industry must avail itself of research and more research to meet the competition of other fuels.

The possibilities of coal as a chemical raw material are illustrated by analogy to the rapid modern development in the products obtained from corn. In recent weeks the daily press has reported the discovery whereby a powerful explosive can be extracted from corn.

The railroads stand indicted because of their failure to take full advantage of scientific research possibilities. None of the major contributions to railroad development during the nineteenth century came from the railroads themselves. The telegraph was invented by Wheatstone; an English professor of philosophy, and Morse, an American artist; the Pullman sleeping car by a street contractor; the automatic coupler by Janney, a dry goods clerk; the automatic block signal system by Hall, a retired textile manufacturer; etc.

The railroads recently created the Association of American Railroads, and this organization created a Department of Research. This is a most important branch of this organization for



it should lead to things of permanent value - safety, greater efficiency and lower costs in producing and delivery transportation service.

It is no longer possible to stand by, trusting to luck, that some school teacher, artist, street contractor, or dry goods clerk will save the transportation industry in the future as they have in the past. The tempo of the times will not tolerate it. Progress through research is the order of the day. It is ridiculous to haul a ton and a half of dead weight per ton of freight and several tons of Pullman per passenger; to haul two to three thousand pounds of engine tender with load in order to have coal and water next to the power plant; and to use steam only once and then allow it to escape into the air.

New scientific achievements are eagerly recorded in the daily press. The most promising field of achievement is in the full use of all the riches wrapped up in our mineral resources, the development of transportation to the end that goods and persons will move freely and within the purchasing power of all. The true idols of the future will be the "Microbe Hunters," the "Hunger Fighters," the engineers, and the great students in pure scientific research.

"We are in the midst of a real, practical, scientific revolution that holds promise of a marvelous future for the raw products of our State, providing we have the vision and the courage to organize for research and thereby convert to useful purposes the riches now wasted, and through new and better processes make our minerals more valuable in all uses to which they may be applied to the end of a greater abundance for men and women everywhere."

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Friday Afternoon, April 24

FORUM ON CLAY AND CLAY PRODUCTS

RESEARCHES IN PROGRESS

Following are abstracts of the papers presented at this forum which was one of four on Researches in Progress by the State Geological Survey and the Engineering Experiment Station of the University of Illinois, on the mineral resources of the State and their utilization. These forums covered four major field - Coal, Oil and Gas, Clay and Clay Products, and Rock and Rock Products - and were held separately and concurrently on Friday afternoon.

Inventorizing the Clay and Shale Resources of Illinois, by J. E. Lamar, Geologist, and H. B. Willman, Associate Geologist, Illinois State Geological Survey. The inventorizing of the clay and shale resources of Illinois involves studies of distribution, mode of occurrence, availability and character. Such knowledge of what and where the State's resources are, when systematically catalogued, is absolutely essential to industry seeking new sources and kinds of raw materials and is the first step in researches on improved and new utilization. Only on this basis can research be directed into the most useful and productive channel.

In addition to a general program of accumulating data regarding Illinois clays and shales, special inventory studies in progress and in various stages of completion, are studies of the clay and shale resources (1) along the navigable waterways of Illinois, i.e., Mississippi, Illinois, and Ohio rivers; (2) along the new Illinois Waterway; and (3) in extreme southern Illinois.

A fourth study deals with the clay resources of the Chicago area, concerning which generally very little has been known in detail despite the existence of a large brick industry in the area. The project is intended to provide data regarding the types of clays available, their ceramic properties, and chemical, physical, and mineralogical composition. The field work on this project is completed and the systematically collected samples are being studied in the laboratory. The progress of the study to date is such that there are indications of results which will make possible a better and possibly increased utilization of the Chicago clays.

Constitution of the Clay and Shale Materials in Relation to Their Use, by Ralph E. Grim, Petrographer, State Geological Survey. The uses of clays in the rubber, paper, cement, steel, oil, and other industries are less well known than their ceramic uses. The utility of a given clay for one of these specific uses is dependent upon four interrelated factors: (1) Texture, (2) ultimate chemical composition, (3) mineral composition, and (4) base-exchange. The importance of the two latter factors has only recently been recognized, and it is with these that the Geological Survey's clay research program is especially concerned.

The combined use of chemical, optical, and X-ray data have led to the recognition of such clay minerals as kaolinite, anauxite, halloysite, beidellite, nontronite, montmorillonite, and a sericite-like mineral. All of these belong to the group of hydrated aluminum silicates, and are micro-crystalline in nature. The physical properties of a given clay depend largely on which of these clay minerals are the prime constituents. For example, large amounts of beidellite yield high bond strength and plasticity, and large amounts of kaolinite tend to yield high refractoriness. Kaolinite and the sericite-like mineral are the important major constituents of many Illinois clays and shales, and beidellite the important minor constituent. The first two have little or no base-exchange capacity, but the latter exhibits high exchangeability. The green properties of clays vary with the magnitude of the exchange capacity, and with the character of the exchangeable bases. Calcium clays exhibit good plasticity characteristics; sodium clays exhibit high drying shrinkage. Research will be continued on the green characteristics of specific clay minerals with various exchangeable bases.

A Progress Report on the Use of Peat with Clay in the Production of Porous Brick, by C. W. Parmelee, Head of the Department of Ceramic Engineering, and Frank J. Fallon, Research Assistant, Department of Ceramic Engineering, University of Illinois. Previous work had demonstrated that the addition of peat from northern Illinois to till from Cook County and fireclay from LaSalle County could be employed for the preparation of porous brick by the plastic process. An attempt to use the dry-press process with the same materials gave porous wares, which, however, were more dense.

Progress Report on the Investigation of Illinois Face Brick, by C. W. Parmelee, Head of the Department of Ceramic Engineering, and W. B. Silverman, Research Assistant, Department of Ceramic Engineering, University of Illinois. This report presents engineering data on a total of 22 brands of Illinois brick and 26 brands of out-of-state brick sold in Illinois, with reference to measurements of absorption, rate of absorption, compressive strength, flexural strength, density, warpage, and uniformity of dimensions. The data show the superiority in these tests of Illinois brick as a group in nearly all physical properties. The limited amount of data

available for direct comparison shows an apparent inferiority of southern and western brick compared to mid-western brick.

Probable Trends in the Use of Brick in the Near Future, by W. H. Voskuil, Mineral Economist, Illinois State Geological Survey. This paper presents an evaluation of the present status of building construction, beginning with a review of the building curve since 1921. The period ending in 1921 saw a curtailment in war-type construction and increase in much needed peace-time construction, i. e., homes, apartment houses, office buildings, and factories. Over confidence in the future, increased profits, and inflation brought about over-building, which reached its high peak in 1926. The result was a rapid downward curve of construction activity in 1928, increased burden of stocks, unemployment, shut-down of many brick plants. The depression was a transitional period of discussion and experimentation on new methods of building, prefabrication, etc. that probably retarded construction to some extent while awaiting the new house around the corner. We are entering a period of increasing building activity with the usual building materials. Today's outlook is one of declining inventories with increasing construction, soon to make safe a return to areal deficiencies on account of shifting populations, increase in suburban movement, and new industries. The F.H.A. predicts a need of 250,000 new homes in 1936. The problem of industry is being shifted from one of production to one of distribution so that more accurate and detailed measurement of potential markets is needed. The clay products industry manufactures a product largely local in its distribution, the market for which will be determined largely by local economic conditions.

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Saturday Forenoon, April 25

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SYMPOSIUM ON

CLAY AND CLAY PRODUCTS RESEARCHES NEEDED

On Saturday forenoon symposia on Needed Researches from the industrial viewpoint were held separately and concurrently for Coal, Oil and Gas, Clay and Clay Products, and Rock and Rock Products. These meetings were planned in order to provide industries with a special opportunity to offer their suggestions of needed researches. Following are abstracts of the papers presented at the Clay and Clay Products symposium.

The Field of Research on the Non-Ceramic Uses of Clay, by W. M. Weigel, Mineral Technologist, Missouri Pacific Railway Company. Needed fundamental research on clays for non-ceramic uses includes comprehensive petrographic and chemical studies to determine the kind and amount of clay constituents and of impurities in the clay, supplemented by field work on the geology and origin of the various clay deposits. Numerous fields need the benefits of such technical research as may result in the development of a method of controlling color in filler clays; the better removal of grit; the higher retention of clay in paper pulp; discovery of the cause of darkening of clay filler in paint mix when turpentine or linseed oil is added; an understanding of the adsorptive properties of clay as it affects the quality of rubber; a way of processing non-suspending clays so that they will remain in suspension in water, important in oil-well drilling; why heat and acid treatment improve the usefulness of some clays for oil refining and destroys that of others; what properties make a clay suitable as an admix for concrete, and whether an unsuitable clay can be so treated as to be made suitable; and further research into the pH value of a clay for certain uses. The problem of commercial recovery of aluminum from clay is still unsolved, and several additional lines of research were suggested concerning the use of clay in chemistry and possible uses of dehydrated clays and of blended clays.

A Detailed Mineralogic, Chemical, and Ceramic Study of Illinois Clay and Shale Resources, by J. E. Lamar, Geologist, Illinois State Geological Survey. An integrated program of research on Illinois clays and shales, especially those under exploitation, conducted by the Illinois Geological Survey, the Department of Ceramic Engineering of the University of Illinois, and other cooperating agencies, in which would be employed the services of geologists, chemists, and ceramists, and the most recent tools for research, would be of much value to the Illinois clay and clay products industry. Such a study should be conducted along four major lines. First, a study of Illinois raw materials including both detailed field examination and sampling and careful laboratory study to determine ceramic properties, mineral and chemical composition, texture, base exchange capacity and other properties. Second, a study of clays imported into Illinois to be conducted along the same lines outlined for Illinois clays.

From these two investigations will result complete data regarding the nature of Illinois clays and shales and of the clays imported into Illinois. On the basis of such data the possibilities can be determined for substituting Illinois clays and shales or blends of Illinois clays and shales for the imported clays. As Illinois contains ample deposits of the four principal clay minerals, the most important raw materials to be used in the process of blending are at hand.

The third line of study is an investigation of the uses, both ceramic and non-ceramic, of clays and shales to yield information regarding potential new uses and products. These are then to

be considered from the viewpoint of their possibilities of economic success in the Illinois market area, the fourth line of study, from which will result a list of economically favored new uses and products for Illinois clays and shales.

The results of such an integrated program of research should not only make possible the development of new or improved uses for Illinois clays and shales but should provide the Illinois industry with needed information on the full possibilities of their raw materials.

Possible Changes in the Dimensions of Standard Clay Products Units, by D. P. Ogden, Engineer, Ogden Engineering Company, Ottawa, Illinois. Ease of application and facility of manufacture have more important bearing on the size of the clay products units for building purposes than has its use or service. One-hand blocks may weigh as much as 10 pounds if carefully designed and balanced; 2-hand blocks may weigh 40-50 pounds but must offer a large wall area to offset loss of time in handling; mechanically-placed units have been made that weigh 1200 pounds.

Manufacturing limitations govern the sizes and shapes of burned clay units, best results being given by the stiff mud-auger machines. Larger units, such as brick panels, are most economically made up of pre-cast assemblies of clay units held together with cement and reinforced with steel. The possibilities in the design and use of such units are not yet appreciated.

The paper describes seven burned clay units now on the market in sizes other than standard, and discusses their advantages and disadvantages. The present trend is toward structural clay units of greater overall dimension and lighter weight per cubic foot of included volume.

Needed Researches on Illinois Refractory Clays, by C. C. Whittier, President, The Standard Chemical and Mineral Corporation, Chicago. Mineral refractories are required regularly by all the key manufacturers of metals, cement, and power production in the Illinois market area, yet most of the refractories used are manufactured outside of Illinois.

Illinois surface clays and shales are extensively used in the manufacture of non-refractory clay products, such as common and face brick. Prospecting to depths of 200-400 feet might reveal deposits of refractory clays suitable for use in high-temperature units. A geological inventory should be made of clay conditions at depth in each county, and the most promising areas should be thoroughly tested by drilling, sampling, and laboratory study.

Refractory clay products industries for the whole country increased the value of their output from a half million dollars to 70 million dollars in 60 years, reaching the peak in 1920. Illinois

already has a large output of pottery with a national distribution. A new product is a light-weight insulating refractory unit for either high-temperature or low-temperature uses and able to compete with insulating cork and other structural insulation. An Illinois refractory industry would have transportation advantages over shipped-in products and would doubtless attain a national market.

Laboratory research on refractory minerals in clays may result in the development of new chemical compounds or of synthetic minerals to be blended with natural minerals to give the right compounds. Additional research for new and improved refractory products should employ all the facts that can be used by the ceramic engineer in the design, construction, and operation of new needed refractories units that will make use of our own mineral reserves of clay, coal and oil, and use more of our Illinois labor.

Properties of Clays and their Relation to Manufactured Clay Products, by Robert Stevens, Acme Brick Company, Danville, Illinois. The present period of adjustment has been utilized by many industries in intensive research in preparation for offering new or improved products to the markets now opening. The clay products industry must meet the developments in building and architecture by commercial development of a general purpose, larger size, light-weight brick unit, if possible combined with desirable features of insulation properties and an installed low cost. Research is also needed in methods of processing the raw clay, particularly a study of the causes of defects that accompany present de-airing treatment; best methods of pugging the clay with regard to fineness of grain, quantity of water, method of mixing, and the design and spacing of knives in the pug mill. A study should also be made of possible improvements in the auger machine and in the dies, and the vitrification behavior of de-aired clays should be investigated.







