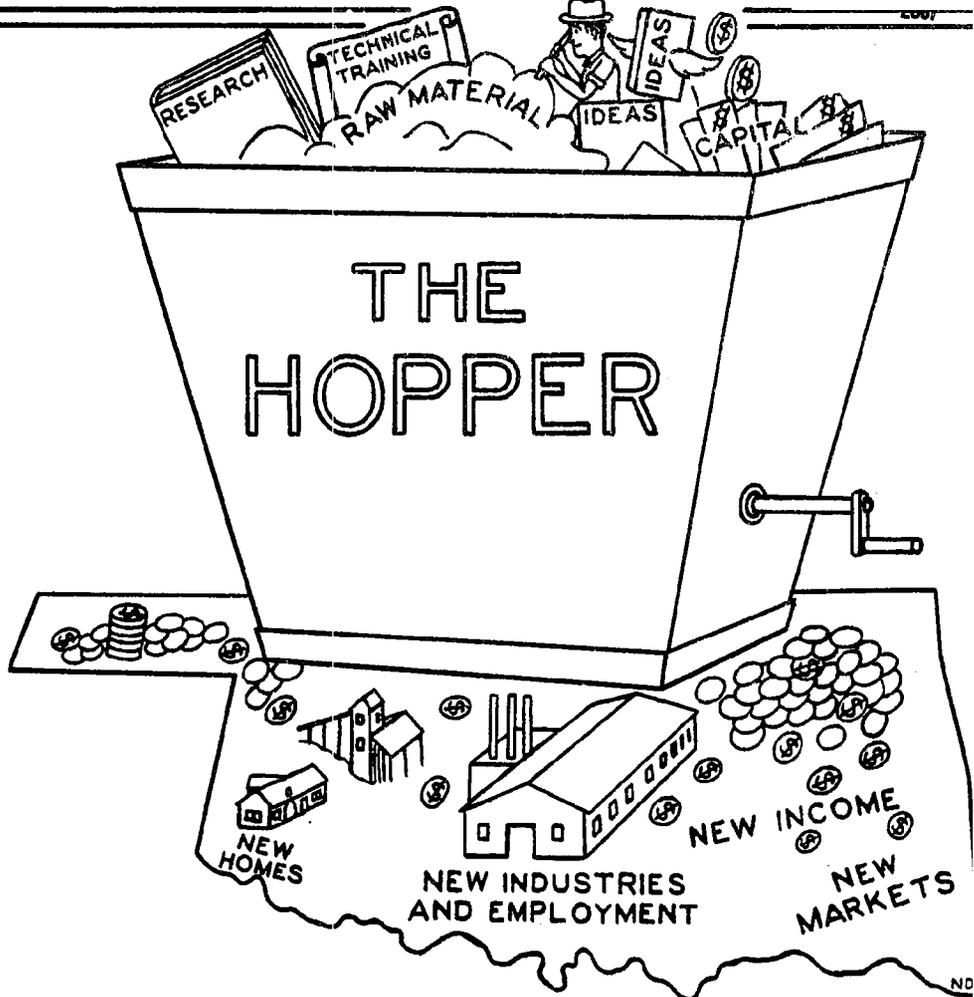
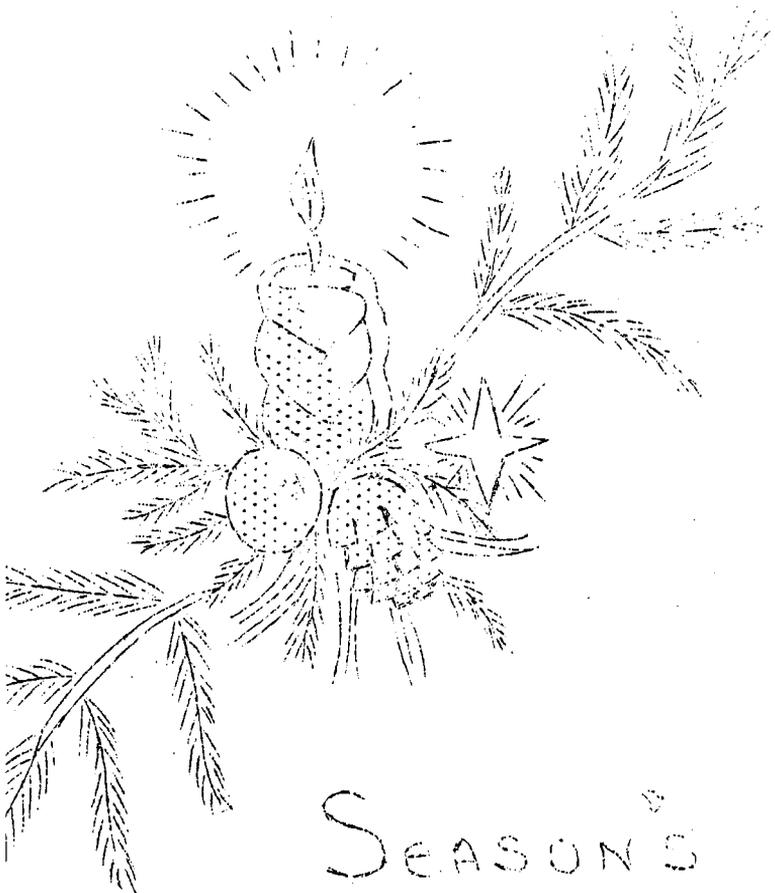


OKLAHOMA LIBRARY - DOCS
DEDICATED TO OKLAHOMA'S DEVELOPMENT



PUBLISHED IN THE OFFICE OF THE
OKLAHOMA GEOLOGICAL SURVEY
NORMAN, OKLA.



SEASON'S
Greetings

CHATS IN THE TRI-STATE DISTRICT
by
Ernest Blessing, Deputy Mining Supervisor
U. S. Geological Survey
Miami, Oklahoma

Published with permission of the
Director of the U. S. Geological Survey

delivered at
Southwestern Regional Meeting, A.I.M.E.
Norman, Oklahoma, October 17, 1950

The purpose of this paper is to give general information concerning chat, its source, characteristics, uses, and the tonnage available in the Tri-State District.

Chat is generally defined as mine dirt or crude lead-zinc ore, which upon milling yields a middling product that must be crushed and subjected to further treatment for recovery of the metal values. As used in the Tri-State District, however, and in this article, the term chat denotes the coarse tailings or waste products resulting from the concentration by milling of the lead and zinc dirt.

The Tri-State District covers an area of approximately 2,000 square miles, including contiguous parts of northeastern Oklahoma, southwestern Missouri, and southeastern Kansas. Two principal mining fields have been developed, namely, the Oronogo-Webb City-Dueneweg, and the Oklahoma-Kansas. ¹/ Smaller mineralized areas have been found throughout the District, especially near Galena, Kansas, and Waco, Aurora, Granby, Joplin, and Seneca, Missouri.

Mining began in the District in 1848. Since that year, the District has produced lead and zinc concentrates valued at approximately \$1,850,000,000 from an estimated 400,000,000 tons of mine dirt.

Although mineralized horizons have been mined from the grass roots to depths between 450 and 500 feet below the surface, the principal sources of ore are at depths between 150 and 300 feet.

The terms used by the miners and mill men to describe the various mine and mill products are peculiar to the District and are used in this article. They are defined briefly as follows:

Dirt--mineralized rock that can be mined and milled at a profit.

Chat--denotes loosely the coarse tailings or rejects resulting from the concentration by milling of the lead and zinc dirt; usually the coarser grades of material ranging in size from $1\frac{1}{2}$ inch to No. 8 sieve size. The Central Mill, owned and operated by the Eagle-Picher Mining and Smelting Company, is the only mill in the District producing a chat size larger than $\frac{1}{2}$ inch.

Chat Sand--the material next finer than chat; generally the material ranging from No. 8 sieve size down to No. 100 sieve size.

Slime--the material finer than chat sand that results from the final milling, generally by flotation, and consists of a product ranging downward from No. 30 sieve size to minus No. 200 sieve size. Float tails and sludge are somewhat similar, and these terms are used to some extent for slime.

File Run Chat--a material composed of chat and chat sand, and at times slime, which ranges in sieve size from $1\frac{1}{2}$ inch down to No. 200 mesh.

Screened Chat--a material produced by screening pile run chat. Such material can be varied in size to conform to almost any specification; generally a number of screened products are obtained from the same chat pile.

Chat is a material that varies slightly in character and quality, depending upon the character of the formations mined to produce the dirt for milling operations. Examples are afforded by the relatively high limestone content of chat in the Chitwood area, and the relatively high chert, or silica, content of chats in the Webb City area.

Chat consists of chert or flint, limestone, dolomite, calcite or spar, locally called tiff, shale, and minor amounts of minerals such as sphalerite (zinc sulphide), galena (lead sulphide), and marcasite (iron disulphide). Chert or flint is the principal component, and is a brownish-gray, bluish-gray-to-gray rock composed of microcrystalline silica, having a splintery conchoidal fracture.

Prior to the turn of the century, chats were considered a waste product of the milling operations. About 1900, the Missouri Pacific Railroad Company began using chats for railroad ballast. In 1902 the Webb City-Joplin Ballast Company was formed, and in 1905 the Independent Gravel Company of Webb City entered the field. With the formation of these companies, the properties and uses of chat received wider recognition and a new industry was established in the District.

It is well known that the Tri-State District and its vicinity have only a limited amount of available materials suitable for concrete aggregate, other than chat. The enormous supply and relatively low cost of chat, as a by-product of lead and zinc mining, have precluded the commercial exploitation of competitive materials.

The approximate chemical analysis of chat in the Oklahoma-Kansas field, as supplied by the U. S. Bureau of Mines, is as follows:

<u>Name</u>	<u>Per Cent</u>
Silica, SiO ₂	94.5
Aluminum oxide, Al ₂ O ₃	1.4
Ferric oxide, Fe ₂ O ₃	0.6
Calcium oxide, CaO	1.6
Magnesium oxide, MgO	0.2
Carbon dioxide, CO ₂	1.0
Lead and zinc sulphides	0.7

Chat piles that have been exposed for long periods to weathering contain minor amounts of deleterious substances resulting from the oxidization of sulphide minerals such as zinc carbonate and calcium sulphate. 2/ These substances, as shown by tests, retard the initial set of concrete. Such contaminants, in large part, can be eliminated by processing pile run chats.

Although the chemical analyses of chats vary only moderately throughout the District, the physical or screen analyses vary substantially.

The variations in the chemical and sieve analyses are due, in large part, to the character of the rock formations being mined; for example, the Independent---screened chat, a product from the Sheet Ground horizon of the Webb City, Missouri, area is very low in lime but very high in silica, whereas the Chitwood Pile--chat sand, high in lime, was mined from a formation containing more than an average amount of limestone.

The "Sink and Float Process," used at the Central Mill, influences the end product of the milling operation. In this process, locally referred to as the "Cone Plant," the cones are filled with a ferrosilicon "medium" or slurry, which is very fine ferrosilicon mixed with water to obtain a specific gravity of approximately 2.70. 3/ The prepared dirt feed, all minus 1½ in. sq. sieve size, carrying dolomite, spar, and limestone having specific

gravities from 2.70 to 2.90, tends to sink through the medium, and this sink product, after the recovery of the lead and zinc minerals, serves to increase the lime content of the float tails, whereas the float from the cone product contains less lime than the mill feed.

Flotation was first tried in the Tri-State District in 1915 to 1917, ^{4/} but the results were not satisfactory. In 1924, further experimental work on flotation resulted in better over-all recovery of metal values.

Prior to the general adoption of flotation, the mills produced coarser chats than thereafter. Early records disclose a higher percentage of chats retained on the 3/8 in. sq. sieve and a lower percentage retained on the 1/100 in. sq. sieve than at present.

In the early days, with an abundance of high-grade dirt available, little thought was given to mill efficiency, and as a result the tailings from most of the mills were high in mineral content. About the time that flotation was being introduced into the District, metallurgists began sampling various chat piles, and the best chats were leased for remilling. Tailing mills, designed especially for the processing of fine chats, were constructed. To date, not only have millions of tons of this material been remilled, but the product from some of the first tailing mills has been remilled a second time. Needless to say, the remilling process has been a big factor in increasing the percentage of fine chats throughout the District.

During the recent war years, 1942 to 1945, the chat business boomed. Chat from the Tri-State District was shipped as far as Florida and was a big factor in the building of highways and railroad spur lines, in maintenance of regular track under heavy and fast service, and in construction of air

fields and other Army installations. Users could depend upon its quality and availability to meet the demands of war construction.

The principal marketers of chat in the Tri-State District are:

<u>Name</u>	<u>Address</u>
Baxter Chat Company	Baxter Springs, Kansas
Diplomat Gravel Company	Galena, Kansas
Eagle-Picher Mining and Smelting Company, Chat Division	Miami, Oklahoma
Scott Fones	Baxter Springs, Kansas
Independent Gravel Company	Webb City and Joplin, Missouri
Interurban Chat Company	Pittsburg, Kansas
C. Y. Semple	Baxter Springs, Kansas
R. W. Skinner Chat Company	Miami, Oklahoma
Youngman Mining Company	Picher, Oklahoma

The above-mentioned companies are actively engaged in the selling of either pile run or screened and washed chats. All have advertised the worth of their materials and are striving to find new markets to absorb their production.

Through the efforts of these companies and their predecessors, an estimated 200,000,000 tons of chats have been sold or otherwise removed from the District. From figures supplied by the railroads handling this material, approximately 70 to 75 per cent $\frac{5}{7}$ goes to the railroads for ballast, and the remaining 25 to 30 per cent is sold as commercial chat. Material in the latter category goes into the construction of highways, foundations, and sidewalks, and into concrete building blocks, blasting sands, and shingle coating.

The chat industry is affected by climatic conditions; cold weather idles most of the processing

plants, as low temperatures preclude the easy handling of frozen chats, and state and municipal governments as well as highway contractors have never formed the habit of stockpiling for later use.

Events of the past summer have tended to depress the chat industry to some extent. The exceedingly wet spring and summer have curtailed sales, railroad cars have been in tight supply, and an increase in freight rates has changed a normally optimistic attitude on the part of the producers to one of pessimism. A few examples of the effect of the freight rate increase are as follows:

Shipments from Baxter Springs, Kansas:

<u>To</u>	<u>Mileage</u>	<u>Freight Rate per Ton</u>	
		<u>Old</u>	<u>New</u>
Wichita, Kansas	161	\$1.24	\$1.67
Kansas City, Missouri	160	1.23	1.55
Independence, Kansas	65	.75	1.14
Altamont, Kansas	27	.40	.66

The new rates went into effect on May 25, 1950. They definitely restrict the distance commercial chats can be shipped competitively from the Tri-State District, and by simple economics, permit materials such as limestone, river gravel, and sand to compete with chat in areas formerly served by this aggregate. The sale of chats for railroad ballast has not been curtailed in like degree.

Many laboratories have tested chats. The National Crushed Stone Association has thoroughly tested chats in use as railroad ballast and track maintenance, and the State Highway Commissions of Kansas, Missouri, and Oklahoma have each made exhaustive tests of chats for use in all types of highway construction and maintenance.

Chat reserves in the Tri-State District are

estimated at 160,000,000 to 200,000,000 tons. In the early years, a saturation point in the demand for chats was expected, but after fifty years, no such point has been reached and doubt has grown that a saturation point will ever be reached. With the reserve tonnage already available plus that being added currently by continued mining activities, and with no permanent softening of demand in sight, the chat business, which started when a waste product of the mining industry became a by-product, may fairly be expected to remain in successful competition with the processors of limestone, river gravel, etc. for an additional half century at least.

* * * * *

ACKNOWLEDGMENTS

This paper was written at the request of H. I. Smith, Chief, Mining Branch, Conservation Division, U. S. Geological Survey, Washington, D. C.

The writer received the generous support of all the officials of the chat companies throughout the Tri-State District, geologists, mining engineers, metallurgists, and others. Acknowledgment is hereby made to each for the cooperation, advice, assistance, and freely given access to available data. Information was furnished by A. J. Martin, Chief Engineer, Northeastern Oklahoma Railroad; John I. Salling, Sales Manager, Eagle-Picher Mining and Smelting Company, Chat Division; Scott Fones; J. P. Lyden, Geologist, and R. K. Stroup, Chief Mining Engineer, both of Eagle-Picher Mining and Smelting Company; and H. E. Saunders, Baxter Chat Company.

The processing plants of the several companies were open for inspection by the author at all times and information was furnished him freely.

REFERENCES

- 1/ Fowler, George M., Tri-State Geology: Eng. and Min. Jour., vol. 144, No. 11, 1943, p. 75.
- 2/ Gibson, W. E., Engineer of Tests, Kansas State Highway Commission.
- 3/ Isern, Elmer, Central Mill: Eng. and Min. Jour., vol. 144, No. 11, 1943, p. 97.
- 4/ Anderson, C. O., Milling Practice in the Tri-State District: The Mining Congress Journal, vol. 15, No. 11, 1929, p. 893.
- 5/ Thirtieth Annual Report, Northeast Oklahoma Railroad Company, 1949, p. 15.

* * * * *

OF MEN AND MOUNTAINS

by

A. L. Burwell

"The struggle of man against man produces jealousy, deceit, frustration, bitterness and hate. The struggle of man against the mountain is different. Man then bows before something that is bigger than he. When he does that, he finds serenity, humility, and dignity."

This quotation is taken from Of Men and Mountains by William O. Douglas in which the writer is talking about the mountains of western Washington State. He might have, with equal accuracy, been talking about the Wichita Mountains or the Ouachita Mountains of Oklahoma, the latter being somewhat better known as Kiamichi. It makes little difference whether one is in the presence of the bald granite grey peaks of the Wichitas or the pine green long ridges of the Ouachitas, that Something makes itself manifest. The geologist, mineralogist,

and amateur gem searcher all acknowledge the fact. The fisherman casting onto the clear blue water of the Wichita lakes or flipping the fly into the rips or still deep pools of the Ouachita streams knows it is there, even though he has difficulty lifting his eyes from the water long enough to behold the mountains. Presumably the Arbuckle Mountains exert the same effect on those who become acquainted with its tremendous masses of limestone stretching for miles in tombstone formation and the beauty of its waterfalls.

Cf Men and Mountains might well be the title of the story of men of the Oklahoma Geological Survey and their work, beginning long before statehood and extending down to and including the present. The work of the geologist on the prairies and in the blackjack country has produced untold wealth in the form of petroleum oil and gas. This is the type of work that shows results and receives acclaim, as it well should, but it is the work of the geologist in the mountains that has furnished much of the basic geologic information upon which this success was built. Furthermore, the work in the mountains is now "paying off" in new industries and expansion of old ones established because of knowledge of the mountains. The men working in the mountains found "serenity, humility, and dignity" due to the presence of something bigger than they. They have also found, mapped, and evaluated many metallic and non-metallic mineral deposits of which the state may well be proud. The acclaim may come later, but if not, they still have had a wonderful time.

* * * * *