Selected Annotated Bibliography of High-Grade Silica of the United States and Canada Through December 1954

GEOLOGICAL SURVEY BULLETIN 1019-H

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Selected Annotated Bibliography of High-Grade Silica of the United States and Canada Through December 1954

By MARION C. JASTER

CONTRIBUTIONS TO BIBLIOGRAPHY OF MINERAL RESOURCES

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SELECTED ANNOTATED BIBLIOGRAPHY OF HIGH-GRADE SILICA OF THE UNITED STATES AND CANADA, THROUGH DECEMBER 1954

By Marion C. Jaster

ABSTRACT

This bibliography consists of about 282 annotated references concerned with high-silica (minimum SiO_2 content, 95 percent) raw materials in the United States and Canada. The annotations, arranged alphabetically by author, contain information on geology, geographic distribution, physical and chemical properties, mining, processing, and uses of high-grade materials, the more important of which are sand, sandstone, and quartzite.

Canadian and United States entries are cross indexed. The United States index is divided into two parts, a general list and a State list. In both parts, references are arranged in alphabetical order by author under each type of high-grade silica material.

INTRODUCTION

Silica occurs in many forms and associations. The term "high-grade silica," as used in this bibliography, is restricted to naturally occurring materials containing a minimum of 95 percent SiO_2. These materials include chert, "chert-clay," conglomerate, flint, gravel, quartz-mica schist, novaculite, massive quartz, quartzite, sand, "sand-clay," sandstone, and tripoli. "Chert-clay" is used here for a high-silica material in Illinois in preference to the end-use term "ganister" (Lamar, 1953); and for a natural mixture of high-silica material and clay occurring in California, the term "sand-clay" is used in preference to "Livermore ganister" (Turner, 1950; Wright, 1948).

Although high-grade silica raw materials enter principally into the metallurgical, glass, and abrasives industries, some are used for the same purposes as materials of lower grades, such as aggregate and building stone. Annual production data are not published separately for high- and low-grade silica materials.

EXPLANATION OF THE BIBLIOGRAPHY

This bibliography contains annotations on publications of the U. S. Geological Survey, U. S. Bureau of Mines, and State organizations; scientific, professional, and trade journals; and a few publications of the Ontario Department of Mines and the Canada Department of Mines. Some older references that have been superseded by more recent ones have been omitted. Reports that contain little information on high-grade silica are excluded. Material through December 1954, is included.

The annotated references are listed by authors in alphabetical order; anonymous references are listed at the end. All entries are cross indexed according to United States and Canadian references. The United States references are divided into two categories, general and States.

In the index to general references, lists of authors are arranged alphabetically under each type of high-grade silica material. The general references include information on geology, geographic occurrence, physical and chemical properties, production, mining, processing, analyses, and uses of high-grade silica materials. Also included are descriptions of several deposits distributed over large regions in several States.

State references describe deposits within a particular State and include much of the information given in general references. The State references appearing under each type of high-grade silica material are grouped according to the following categories: (a) general references for the State, (b) references concerned with particular areas within the State, (c) references concerned with counties, and (d) references concerned with independent cities. In each category, authors are listed alphabetically.

The Canadian references are listed under each types of silica material and are arranged according to area and provinces.

Listed under "silica" are those references in which the type of siliceous material is not identified.

The stratigraphic nomenclature in this report is that of the various authors and does not necessarily correspond to U. S. Geological Survey usage.

BIBLIOGRAPHY

Adams, G. I., 1929, Molding sands of Alabama: Ala. Geol. Survey Bull. 35, p. 30.

The Hartselle sandstone, which crops out in Jefferson County in the northeastern suburbs of Birmingham, has been quarried and crushed near Irondale. It is very friable, and has been used in steel foundries and in the manufacture of glass. A sand bed in the Citronelle formation crops out in a railway cut near the waterworks siding northwest of Mobile. The sand has been used in steel foundries. In the Greeley opencut brown iron ore mines, near Woodstock station, Bibb County, is a bed of sand that is also used in steel foundries.

American Foundrymen's Association, 1925, Report of certain molding sand resources of Iowa, Kentucky, New Jersey, Pennsylvania, and Wisconsin: Preprint 492, p. 4–16.

Gives location, producer, formation, physical properties, grade, and use of samples from Kentucky, New Jersey, and Pennsylvania. Some of the deposits in New Jersey yield sand that is used for steel molding. Deposits listed in Iowa and Wisconsin are not of high-purity grade.

Anderson, R. J., 1942, Pulaski, Saline, Garland, and Montgomery Counties [Ark.]: Ark. Geol. Survey County Mineral Rept. 3, p. 66–74, 87–90.

Novaculite is a hard, highly siliceous, compact material of almost pure silica content. Two commercial types are identified. The Arkansas stone is very fine grained, commonly white, has a waxy luster, is translucent on thin edges, and breaks with a conchoidal fracture. This type is valuable for the manufacture of oilstones, whetstones, and abrasives in general. The Ouachita stone is much more porous and resembles unglazed porcelain; its composition is the same as the Arkansas stone. It has fewer joints and quartz veins than the Arkansas stone but contains more cavities. It is not damaged by freezing, but, on long drying, loses its easy fracture and becomes much tougher; this type is used for railroad ballast, road metal, and, in pebbles of 2 to 4 inches in diameter, for tube mill grinding. Analyses and location of quarries and deposits are given.

Tripoli occurs in the Arkansas novaculite in Garland and Montgomery Counties. The tripoli ranges in color from white to red, is soft, fine textured, and friable. Beds range from 2 to 50 feet in thickness, and they have an overburden ranging from 2 to 6 feet in thickness. Descriptions of the occurrences are given.

Argall, G. O., Jr., 1949, Industrial minerals of Colorado: Colo. School Mines Quart., v. 44, no. 2, p. 354–361.

Gives the locations of high silica sandstone deposits, production, treatment, and marketing. These deposits are in Chaffee, Douglas, El Paso, Fremont, Jefferson, Pueblo, and Prowers Counties. The silica deposits in Jefferson and

Douglas Counties occur in the Dakota and Lykins formations. Four silica deposits in Fremont County also yield ganister. Analysis of El Paso County sand is given.

Averill, C. V., and Norman, L. A., Jr., 1951, Counties of California—Mineral production and significant mining activities, 1949: Calif. Jour. Mines and Geology, v. 47, p. 319, 344–345, 351, 357.

Foundry sand was produced from beds of Eocene sandstone south of Antioch and at Nortonville, Contra Costa County. Dune sands at Moss Beach, Monterey County, yield high-quality white sand for the foundry and glass industries. The dune deposit covers about 12 square miles. Glass sand has been produced near Corona, Riverside County. Various grades of silica and quartzite were quarried about 3 miles east of Oro Grande, San Bernardino County. This material has been used as a refractory and in the manufacture of sulfate-resistant cements.

Bain, H. F., 1907, Analysis of certain silica deposits: Ill. Geol. Survey Bull. 4, p. 185–186.

Gives analyses of silica taken from deposits at Anna and Reynoldsville, Union County, and from Thebes and McCotridge prospect, Alexander County. All material came from surface pits.

Baldwin, W. B., 1949, A preliminary report on the Sioux quartzite: S. Dak. Geol. Survey Rept. Inv. 63, 34 p.

Discusses the Sioux quartzite, also known as the Sioux Falls "granite," in the southeastern corner of South Dakota; in southwestern Minnesota, and minor occurrences in northwest Iowa, south of Rowena, S. Dak. Four quarries produce quartzite in South Dakota. Describes outcrops in Minnehaha, Turner, McCook and Hanson Counties, which may be of commercial value. Analyses and map (scale 1 in. = 5 mi.), showing outcrops in eastern South Dakota, are included.

Barrell, Joseph, and Loughlin, G. F., 1910, The lithology of Connecticut: Conn. Geol. Nat. History Survey Bull. 13, p. 199–201.

Lantern Hill quartz deposit is between Ledyard and North Stonington. It is slightly more than a mile long and, in most places, several hundred feet wide. The geology of the area is described.

Barrett, Edward, 1914, Glass sands of Indiana—Industries: Ind. Dept. Geology Nat. Res. 38th Ann. Rept., 1913, p. 41–59.

Discusses glass sand deposits and includes some analyses of the sands, qualities of Mansfield sandstone (texture, color, thickness, and workability), preparation of glass sand, Indiana limestone as an ingredient for glassmaking, and general aspects of the glass and industry. Dune sands of the lakefront at Michigan City are described as an excellent glass sand source; the sands also can be used as core sand in steel foundries.

Bascom, Florence, Clark, W. B., Darton, N. H., and others, 1909, Description of the Philadelphia district [Pennsylvania-New Jersey-Delaware]: U. S. Geol. Survey Geol. Atlas, folio 162, p. 21.

Sand (Magothy), along the south bank of Pensauken Creek in New Jersey, consists of fine to coarse angular quartz grains. Pockets or lenses of sand ranging from a few to 20 feet in thickness are distributed over an area of

several acres. It is used for filter material and in the manufacture of fire brick. Southeast of the Philadelphia district, glass sand (Cohansey) is dredged.

Bascom, Florence, Darton, N. H., Kummel, H. B., and others, 1909, Description of the Trenton quadrangle [New Jersey-Pennsylvania]: U. S. Geol. Survey Geol. Atlas, folio 167, p. 23.

Fine and coarse clean quartz sand (Magothy) occurs near Florence. It is used in steel molding and for other foundry purposes.

Bastin, E. S., 1911, Geology of the pegmatites and associated rocks of Maine: U. S. Geol. Survey Bull. 445, p. 133–137.

Describes the processing, uses, marketing, and production of quartz and other pegmatite minerals in general, and lists States where massive crystalline quartz is found. Map, scale 1:1,000,000, shows location of pegmatites.

Bayley, W. S., Salisbury, R. D., and Kummel, H. B., 1914, Description of the Raritan quadrangle [New Jersey]: U. S. Geol. Survey Geol. Atlas, folio 191, p. 30–31.

At Carey, N. J., the Green Pond conglomerate occurs in deeply disintegrated ledges, which is quarried for furnace-bottom and core sands.

Beach, J. O., 1939, Glass sands: Okla. Geol. Survey Mineral Rept. 3, 7 p.

Discusses briefly the Oklahoma glass sand deposits that have not been exploited commercially in Woods, Jefferson, and Major Counties. Also mentions that quarries near Roff, Pontotoc County, and near Mill Creek, Johnston County, are yielding high-grade silica sandstone.

Bengston, R. J., Moore, D. D., Ramsey, R. H., and Lund, R. J., 1950, Mineral resources of southeastern Ohio: Ohio Geol. Survey, Dept. Nat. Res. (Battelle Mem. Inst.), p. 59–76.

The Sharon conglomerate contains members of sandstone and quartz pebble conglomerate in Jackson and Pike Counties. It is an almost inexhaustible source of high-silica raw material. Because of its location to markets, it is not used for glass sand. To compete with West Virginia plants it must be acid treated and washed. Chemical analyses, sketch map, and bibliography on this area are included.

Beyer, S. W., 1897, Sioux quartzite and certain associated rocks: Iowa Geol. Survey, v. 6, p. 71–112.

The Sioux quartzite is a southwestward prolongation of Minnesota Point. It extends across the northwest corner of Iowa and underlies about equal areas in South Dakota and Minnesota. Its extreme eastern limit of outcrop is marked approximately by Redstone, at the junction of the Cottonwood and Minnesota Rivers; its most westernly exposure is near Mitchell on the James River. Its maximum width is 60 miles, extending from Flandreua northerly to Canton. It probably extends over an area of more than 6,000 square miles, and is from 3,000 to 4,000 feet thick. Sketch map is included.

Bieber, C. L., and Smith, N. M., 1952, Industrial sands of the Indiana dunes: Ind. Geol. Survey Bull. 7, 31 p.

Beaches formed during several stages of glacial Lake Chicago and Lake Michigan are sources of commercial sand. The commercial operations are

described. Samples were taken for laboratory determination of particle size, density separation, and chemical analysis. Composition and roundness of sand grains, as well as details of bedding, weathering, porosity, bonding, and moisture content, were studied.

The general requirements of each of the uses of dune sand are summarized. Although it is used extensively for molding sand for some types of large castings, most of it has been used as fill; smaller amounts have been utilized for asphalt paving sand, core sand, fire and furnace sand, engine sand, and glass sand. If the present supply and demand are maintained, sand operations will be possible for 50 to 100 years.

Map, scale about 1 inch = 2 miles, showing industrial sand deposits south of Lake Michigan is included.

Born, K. E., 1936, Summary of the mineral resources of Tennessee: Tenn. Div. Geol., Res. Tenn., 2d ser., p. 82, 85.

The geologic formations considered favorable for producing glass sands are the Bon Air and Sewanee (Pennsylvanian) of the Cumberland Plateau, the Clinch sandstone (Silurian) of East Tennessee, and possibly certain formations in the Tertiary and Cretaceous of West Tennessee. Glass sand is produced from the Sewanee conglomerate, 3 miles east of Sewanee. In East Tennessee, sand has been used from the Holston River; sands from the Bays Mountain area were used for experimental purposes only.

The most extensive development of tripoli is in the Collinwood district, Wayne County, in the southern part of the western Highland Rim region. It varies from a few to 60 feet thick. The deposit is in the Fort Payne and Warsaw formations (Mississippian). Tripoli is also reported in Dickson, Hickman, Johnson, and Bradley Counties.

Map, scale about 1 inch = 15 miles, showing localities of deposits is included.

Boswell, P. G. H., 1917, Notes on American high grade glass sands: Soc. Glass Tech. Jour. 1, p. 147–152.

Gives a brief description and chemical analysis of sand deposits at Ottawa, Ill., Cheshire, Mass., Berkeley Springs, W. Va., Baltimore, Md., and St. Louis, Mo.

Bowdish, F. W., and Runnels, R. T., 1952, Experimental production of feldspar and silica from several river sands in Kansas: Kans. Geol. Survey Bull. 96, pt. 6, p. 279–300.

Six river and flood-plain sand samples from the vicinity of Kansas City, Wichita, Concordia, and Salina were treated by flotation methods to determine the feasibility of producing feldspar and silica concentrates for use in glass, glass fiber, ceramic, and allied industries. The silica and residue after flotation of the feldspar is amenable to concentration to a ferric oxide content of less than 0.03 percent. These tests show that both a silica sand and feldspar product of commercial grade can be produced from the sand samples at three of the localities. Chemical and sieve analyses and flow sheets are included.

Bowen, C. H., 1953, Petrology and economic geology of the Sharon conglomerate in Geauga and Portage Counties, Ohio: Ohio State Univ. Eng. Expt. Sta. Bull. 153, 58 p.

The area is roughly triangular, and extends from Thompson in the northeastern part of Geauga County to Lake Geauga on the west, and to Windham, Portage County on the east. The Sharon conglomerate is the lowermost member of the Pottsville series (Pennsylvanian). The general areal characteristics, geologic history, and economics are discussed, and many mechanical and chemical analyses are given.

Bowles, Edgar, 1941, The geology and mineral resources of Cherokee County, Ala.: Ala. Geol. Survey Circ. 15, p. 29.

Extremely high-grade quartzite is produced from the Weisner formation (lower Cambrian), which yields material of nearly pure silica. This formation crops out extensively through the southern part of the county where it maintains a fairly uniform composition. Typical analyses are:

SiO_2	98.1 percent	97.75 percent
R_2O_3	1.3 do	1.62 do

The metal present may be aluminum, iron, or manganese.

Bownocker, J. A., 1921, Steel molding sand in Ohio: Ohio Jour. Sci., v. 21, p. 249–266.

Steel molding sands of Ohio occur in the Pottsville and Allegheny formations (Pennsylvania). The Sharon conglomerate of the Pottsville group is the larger source. It attains a thickness of 225 feet. The Allegheny formation is quarried for steel molding sands only at Strasburg, Tuscarawas County.

Many foundries, quarry locations, and chemical analyses of the sandstone, a map showing the outcrop of the Pottsville formation, and location of plants are included.

——— 1939, Glass sands and molding sands: Ohio Geol. Survey Repr. Ser. 2, p. 1–37.

Gives the age, specifications, locations, and many analyses of glass and steel molding sands of Ohio.

Branner, G. C., 1940a, Polk County [Ark.]: Ark. Geol. Survey County Mineral Rept. 1, p. 4–5, 22–23, 36–37.

Novaculite in Polk County occurs in the Arkansas novaculite formation as two types: the Arkansas stone which on the broken surface is smooth, compact, and hard; and the Ouachita stone, the surface of which is rough and porous. Most of the stone is white, although it varies in color.

Arkansas novaculite (Devonian) is divided into three lithologic units. The lower unit is almost wholly compact massive novaculite, even bedded in layers 2 to 10 feet thick, white or bluish white, with a manganiferous horizon at the top. This unit ranges from 10 to 410 feet in thickness. The middle unit is dark-colored dense novaculite in layers 1 to 5 inches thick interbedded with black cleavable shale, in beds ranging from an inch to 100 feet in thickness. Novaculite and sandstone pebble conglomerate occur at the base of this 75- to 525-foot unit. The upper unit is mostly massive light-gray to bluish-black calcareous novaculite, which, upon weathering, becomes porous, lighter colored and also yields manganese. This unit is 20 to 125 feet thick. The whole formation ranges from 250 to 950 feet in thickness.

Chemical analysis of novaculite near Hot Springs, Garland County, is given; this is believed to be representative of the Polk County novaculite.

Tripoli in Polk County is white and compact, but some is stained along joints by iron and manganese oxides. It is in the Arkansas novaculite formation and probably was formed by the leaching of the lime from the rocks. At Hot Springs, about 20 feet of tripoli is exposed in the upper unit of the Arkansas novaculite. Other occurrences also are given.

——— 1940b, Mineral resources of Benton, Carroll, Madison, and Washington Counties [Ark.]: Ark. Geol. Survey County Mineral Rept. 2, p. 19–24.

Tripoli has been mined since 1929 and the industry centers around Rogers, Benton County. Fourteen deposits have been investigated but not all have been exploited. Two deposits in Washington County and one in Madison County are reported. The tripoli at these localities is in the Boone formation (Mississippian), derived from the original cherts and cherty limestones by leaching. The deposits are generally flat lying and from 5 to 30 feet thick; the largest deposit is 30 feet thick over an area of 60 acres. Most of the tripoli is lightweight, snow white, fine grained, firm, and in places entirely free of chert inclusions and limy fragments; it generally contains more than 98 percent SiO_2.

The developed deposits contain large reserves. Many undeveloped deposits appear to be of good quality and contain large tonnages. Chemical analyses and production figures of Benton County are included.

——— 1942, Mineral resources of Arkansas: Ark. Geol. Survey Bull. 6, p. 58–60, 67–68, 78–79.

Glass sand is produced in Arkansas from the St. Peter sandstone (lower Ordovician) in Madison, Carroll, Newton, Boone, Searcy, Marion, Baxter, Stone, Izard, Sharp, and Independence Counties. It is well exposed along the White and Buffalo Rivers and many of their tributaries, where it occurs in bluffs about 40 feet high. It varies in thickness from 40 to 100 feet, with an average of about 60 feet.

Calico Rock formation (Ordovician) is an equally good glass sand exposed over a large area in southern Baxter, northern Stone, northern and western Izard, and central Fulton Counties. The formation ranges in thickness from 50 to 150 feet.

Kings River sandstone (Ordovician), also a good glass sand, crops out in the valleys of streams that have cut their channels through overlying strata of later rocks in Carroll, Madison, eastern Marion, and southern Baxter Counties. This sandstone is widely distributed. Thickness in Izard County is 80 feet, but it is less to the north and west.

Reserves of glass sand in northern Arkansas are very large.

Novaculite (Devonian) is widely distributed in the Ouachita Mountains of southwestern Arkansas. Between 200 to 300 miles of narrow belts of novaculite crop out from Pulaski County westward to Polk County. The novaculite occurs in layers from 2 to 10 feet thick.

Tripoli has been quarried and reported in Benton, Garland, Hot Spring, Pike, Baxter, Montgomery, Polk, and Washington Counties. Tripoli in north and northwestern Arkansas apparently was derived from siliceous limestone, whereas that from the west-central part of the State was derived from novaculite. It is mined both by underground and by opencut methods.

Broadhurst, S. D., 1949, A general survey of some high silica materials in North Carolina: N. C. Dept. Conserv. Devel., Div. Min. Res. Inf. Circ. 7, 34 p.

High-silica rocks in North Carolina include quartzites, quartz veins, sand,

and gravel. The higher grade quartzites occur in the mountainous area. There are a few sizable quartz veins which are quite pure, some containing 98 percent SiO_2. High-grade quartz also occurs as cores in the pegmatites of western North Carolina.

Sand and gravel of the Coastal Plain seem to be the most important silica resources. Although some treatment is necessary to bring them up to specifications, there are sizable deposits which approach general chemical requirements of the glass and refractory industries. Some of these deposits are very thin whereas others are 30 feet or more thick.

Descriptions of the rocks and localities, with analyses from each location, are included.

——— 1954, A report on the high-silica sand resources of North Carolina: N. C. Dept. Conserv. Devel., Div. Min. Res. Inf. Circ. 11, 35 p.

An appraisal of potential raw materials for the manufacture of high-silica products in North Carolina. Their physical, mineralogical, and chemical qualities are equal to other eastern United States coastal sands. For potential use as glass sand, they are favorably located with respect to markets and transportation to make them economically feasible. Tests have shown that with beneficiation they meet specifications required for high-grade glass manufacture.

Chemical and mechanical analyses and a map, scale about 1 inch = 40 miles, showing silica deposits in eastern North Carolina, are included.

Brown, G. G., 1936, Molding sands of Michigan and their uses: Mich. Dept. Conserv., Geol. Survey Div. Pub. 41, Geol. Ser. 35, 262 p.

The first part of this publication includes a discussion of the physical and chemical properties of sand and the results of the investigation of the cause of bond in naturally bonded sands. The second part is a detailed description of the sand areas and deposits throughout the State, with a table giving all the properties of the sands which have been tested. Maps of sand areas of the northern and southern peninsulas of Michigan are included.

Bryson, H. J., 1937, The mining industry in North Carolina from 1929 to 1936: N. C. Dept. Conserv. Devel., Div. Min. Res. Econ. Paper 64, p. 93.

Vein quartz occurs in Anson, Montgomery, Moore, and Harnett Counties. In places, it is found in its original position cutting the old slates; elsewhere it occurs as pebbles in the Lafayette formation of the Coastal Plain. Quartz production comes chiefly from the feldspar mines of Mitchell, Avery, and Yancey Counties. Important deposits of quartz are in Buncombe and Transylvania Counties. The Tusquitee (lower Cambrian) quartzite has been mined in Cherokee County.

Bryson, R. P., Fox, E. L., Larrabee, D. M., and others, 1947, Map showing construction materials and nonmetallic mineral resources of South Dakota: U. S. Geol. Survey Missouri Basin Studies Map 12, scale 1:500,000.

Soft white sandstone (Unkpapa) in the southeastern part of the Black Hills is pure enough to be used for glass sand. In many places, this sandstone is red or variegated and of lower purity. In places, layers of shale are interbedded.

Buckley, E. R., 1898, On the building and ornamental stones of Wisconsin: Wis. Geol. Nat. History Survey Bull. 4, Econ. Ser. 2, p. 164–254.

Discusses the Precambrian quartzite outcrops, Potsdam and St. Peter sandstones, and gives descriptions of individual quarries, with a few chemical analyses.

Buie, B. F., 1949, Industrial minerals and rocks, *in* Shiver, H. E., and others, South Carolina raw materials: Columbia, S. C., Univ., South Carolina Press, p. 116–119.

The glass sand deposits of South Carolina are in the Coastal Plain. The chemical and screen analyses indicate an abundance of glass sand suitable for use in all except the highest quality crystal and optical glass.

The Nichols deposit, Marion County, is favorably located for rail transportation. The glass sand is reported to contain 0.025 to 0.035 percent Fe_2O_3 and about 99.50 percent SiO_2. This deposit has yielded about 400 tons of sand per week for the manufacture of soft-drink bottles.

Burchard, E. F., 1905, The requirements of sand and limestone for glass making: U. S. Geol. Survey Bull. 285-N, p. 452–455.

The chemical and physical properties of certain sandstones and sand of the middle Mississippi River basin, including general proportions by weight, of various components of glass, requirements for glass sand, and chemical analyses of glass sand, are given.

——— 1906, Glass sand of the middle Mississippi basin: U. S. Geol. Survey Bull. 285-N, p. 459–472.

Geologic descriptions, quarry locations, sample descriptions, and analyses for some possible sources of glass sand in Arkansas, Illinois, Kansas, Missouri, and Wisconsin are discussed.

——— 1907a, Glass-sand industry of Indiana, Kentucky, and Ohio: U. S. Geol. Survey Bull. 315–376.

Geologic formations, quarries, utility, and analyses of samples from deposits in Indiana, Kentucky, and Ohio are described in detail.

——— 1907b, Notes on various glass sands, mainly undeveloped: U. S. Geol. Survey Bull. 315-K, p. 377–382.

Geologic details, quarry descriptions, analyses of samples, and utility are given for various sources of glass sand in Alabama, Arkansas, Florida, Georgia, Iowa, Kansas, Missouri, and Nebraska.

Burchfiel, B. M., 1936, Ceramic materials other than clays abundant in California: Mining and Metallurgy, v. 17, no. 357, p. 441–443.

High-grade silica occurs in many places in California. In general the quartz is simply quarried from the vein. Considerable quartz occurs with feldspar in the deposit at Campo, San Diego County. This deposit is in Hauser Canyon, 6 miles northeast of the mill, which is 2 miles west of Campo. Chemical analysis of typical silica from Campo shows 99.65 percent SiO_2, with 0.02 percent Fe_2O_3 and a trace of Al_2O_3.

Burwell, A. L., and Ham, W. E., 1945, New facts regarding Oklahoma raw materials for the ceramic industries: Am. Ceramic Soc. Bull., v. 24, p. 293–295.

Glass sand deposits occur in the north-central Arbuckle Mountain district.

The principal deposits are in the Oil Creek and McLish formations (Ordovician). Chemical and sieve analyses of the glass sand and a map showing geographic distribution of Oklahoma deposits are included.

Butler, P. B., 1928, Tripoli: Mining and Metallurgy, v. 9, no. 264, p. 527–531.

Discusses briefly the properties, occurrence, history, preparation, and uses of tripoli.

Buttram, Frank, 1913, The glass sands of Oklahoma: Okla. Geol. Survey Bull. 10, p. 42–91.

Glass sand deposits occur in the Arbuckle Mountains and in northeastern Oklahoma near Tahlequah. The general features, occurrence, and character of the sands are described. Analyses of the deposits, geologic map of the Arbuckle Mountains, and maps showing distribution of the Simpson formation, the Trinity sand, and the Burgen sandstone are included.

Beds of almost pure white sand are reported near Tulsa, Bartlesville, Claremore, Ramona, Cleveland, Catoosa, Muskogee, and Holdenville. Analyses show that these beds contain large amounts of ferric oxide and other impurities, making the sand suitable only for bottle glass.

Butts, Charles, 1945, Description of the Hollidaysburg and Huntingdon quadrangles [Pennsylvania]: U. S. Geol. Survey Geol. Atlas, folio 227, p. 18–19 [1946].

Stone suitable for ganister occurs in the Tuscarora quartzite. This formation is 400 to 600 feet thick and extends through the mountainous region of central Pennsylvania. It is a compact light-gray to white quartzite with a vitreous luster, and is used to make refractory brick and furnace linings. Analyses of this stone from Lock Mountain near Point View are given.

A good glass sand occurs in the Ridgeley sandstone formation at Mapleton, a few miles southeast of Huntingdon.

Butts, Charles, and Gildersleeve, Benjamin, 1948, Geology and mineral resources of the Paleozoic area in northwest Georgia: Ga. Geol. Survey Bull. 54, p. 155–156.

Most tripoli deposits occur as irregular beds from a few inches to several feet thick associated with chert layers in residuum of the Knox dolomite formation. In Chattooga County near Harrisburg, tripoli deposits are associated with the Bangor limestone formation. Small deposits near Cartersville, Bartow County, occur in areas underlain by the Shady dolomite formation. Geologic and index maps, scale 1 inch = 4 miles, are included.

California Division of Mines Mineral Information Service, 1954, Glass sand in California: v. 7, no. 6, 4 p.

Sand mined from the Ione formation (Eocene), Amador County, containing 94 percent SiO_2 was used for glassmaking before 1922.

Glass sand has been produced from the Tesla formation (middle Eocene), near Tesla, Alameda County.

Almost white fine-grained sand used for foundry sand and bottles is quarried from the middle Eocene sandstone, exposed in a 20-mile area on the northeast side of Mount Diablo in the Brentwood area, Contra Costa County.

Glass sand is produced for bottles from the lowermost sandstone of the Paleocene Silverado formation in the Corona area, Riverside County.

Sandstone layers as much as 40 feet thick are quarried for the bottle

industry from the Tejon formation (Eocene) east of Oceanside, San Diego County. The sand is fine to coarse grained and contains a moderate amount of feldspar.

A white beach and dune sand deposit (Quaternary) containing little clay and used for bottles is near Pacific Grove. It extends about 6 miles along the coast and about 1 mile inland, Monterey County. Chemical analysis of this deposit is included.

Cameron, E. N., Larrabee, D. M., McNair, A. H., and others, 1954, Pegmatite investigations 1942–45 New England: U. S. Geol. Survey Prof. Paper 255, 352 p.

Detailed geologic maps of pegmatites show small deposits of quartz as cores. Quartz also is recovered from the flotation of feldspar from a mixture of the two minerals.

Campbell, M. R., 1902, Description of the Masontown and Uniontown quadrangles [Pennsylvania]: U. S. Geol. Survey Geol. Atlas, folio 82, p. 21.

The Homewood sandstone is exposed along the Youghiogheny River west of Connellsville; also in the Chestnut-Laurel Ridge area where it is quarried on the north side of the valley. Some glass sand has been obtained from abandoned channels of the Monongahela River.

——— 1903, Description of the Brownsville and Connellsville quadrangles [Pennsylvania]: U. S. Geol. Survey Geol. Atlas, folio 94, p. 19.

Glass sand is produced from river sand near Bellevernon and at Perryopolis. It also is produced from the Homewood sandstone (Pottsville) on the east side of the Youghiogheny River about 1 mile north of Layton.

——— 1904, Description of the Latrobe quadrangle [Pennsylvania]: U. S. Geol. Survey Geol. Atlas, folio 110, p. 15.

Glass sand is quarried from the Homewood sandstone (Pottsville) half way up the western slope of Chestnut Ridge, near the town of Derry.

Carman, J. E. 1936, Sylvania sandstone of northwestern Ohio: Geol. Soc. America Bull., v. 47, p. 253–265.

Gives the distribution of the Sylvania sandstone (Devonian) and discusses its characteristics, stratigraphic relation to underlying formations, fauna, and origin. Map, scale 1 inch = 20 miles, showing the distribution of the sandstone and the location of several exposures in Lucas and part of Wood Counties, and columnar sections of the sandstone are included.

Chelf, Carl, 1941, The crushed quartz industry of Llano County [Tex.]: Tex. Univ. Min. Res. Survey Circ. 37, 2 p.

Half a mile northwest of Packsaddle Mountain, and 9 miles from the railway at Kingsland, in the Llano region, quartz is quarried from pegmatite dikes which cut the pre-Paleozoic schists, gneisses, and granites. Most dikes contain feldspar and smaller amounts of accessory materials, but some pegmatites contain clear to dark smoky quartz crystals. The most common occurrence is well-consolidated milky-colored "sugar" quartz. One outcrop is 150 yards wide and about 300 yards long. Concentrations of large tonnages are rare. The quartz is used for roofing granules.

Chicago and North Western Railway Company, 1942, Preliminary outline of mineral resources, State of Wyoming: p. 27, 60, 78.

Deposits of fine-grained tough sandstone occur near Rawlins, Carbon County, and on Baldwin Creek near Lander, Lander County. It is used for grindstones. A bedded sand deposit, 3 feet thick, covering a large area, is in the Casper formation, east of Laramie, Albany County.

Occurrence of tripoli is reported in Laramie County and at Sunrise, Platte County.

Clabaugh, S. E., Larrabee, D. M., Griffitts, W. R., and others, 1946, Map showing construction materials and nonmetallic mineral resources of Wyoming: U. S. Geol. Survey Missouri Basin Studies Map 9, scale, 1:500,000.

High-purity silica sandstone occurs in Wyoming, but due to its remoteness from markets, it has been produced only at Lovell, Big Horn County, and at Laramie, Albany County. Both quarries were inactive in 1946.

Glass sand has been produced from the Casper formation (Pennsylvanian), east of Laramie. Operation is now idle because of inaccessibility to markets.

Cleaves, A. B., 1939, The Oriskany group *in* The Devonian of Pennsylvania: Pa. Geol. Survey Bull. G 19, ser. 4, p. 92–130.

An extensive study of the Oriskany sandstone (Devonian) in Pennsylvania, together with the Oriskany of adjacent States, is discussed. Formations, thickness, and fossil representatives are given, and a correlation chart of the Oriskany group in Pennsylvania is included.

Cole, L. H., 1923, Silica in Canada, part 1, Eastern Canada: Canada Dept. Mines, Mines Br. Pub. 555, 126 p.

Comprehensive report on deposits in eastern Canada discusses types of occurrence, structural and geologic features, localities, method of testing, and uses. Maps showing the distribution of sandstone and quartzite are included.

——— 1928, Silica in Canada, part 2, Western Canada: Canada Dept. Mines, Mines Br. Pub. 686, 59 p.

Comprehensive report on deposits in western Canada discusses structural and geologic features and occurrences. Chemical analyses, mechanical tests, and an appendix on recent developments in the silica industry in eastern Canada to 1928, are included.

Cole, S. S., 1932, Effect at 1500° C. on the porosity and specific gravity of quartzites: Am. Ceramic Soc. Jour., v. 15, p. 87–106.

Quartzites from deposits commercially utilized for the manufacture of silica brick in the United States, Canada, and Europe were tested for 2 hours for porosity and apparent specific gravity before and after firing at 1500° C. Petrographic examinations were made of several of the raw quartzites, and the differences in crystalline structure are shown by photomicrographs. The rate of conversion of quartz was not constant for the quartzites reported. The porosity, after firing, ranged from 2 to 30 percent, and the apparent specific gravity ranged from 2.30 to 2.44. A fine-grained quartzite tends to give lower porosity after firing than does a coarse-grained one.

Colony, R. J., 1919, High-grade silica materials for glass, refractories, and abrasives: N. Y. State Mus. Bulls. 203–204, p. 5–31.

Lithologic character, general geology, chemical analyses, and locality of each of the following formations are given: Poughquag, quartzite, Shawangunk conglomerate, Oriskany sandstone, Potsdam sandstone, and Oneida glass sands. Suggestions are made as to operating facilities, transportation, and various specific industries in which rock from the different formations might be used. Physical tests are reported.

Crickmay, G. W., 1937, Tripoli deposits of Georgia: Ga. Div. Geol. Inf. Circ. 9, p. 3–7.

The tripoli deposits of Georgia have not been fully developed. Comparison is made with Missouri-Oklahoma and Illinois-Tennessee tripoli. It has been shown that Georgia tripoli of the amorphous type is not inferior to tripoli found elsewhere. Chemical composition, description of properties, and a spot map showing locations of tripoli deposits are included.

Dake, C. L., 1921, The problem of the St. Peter sandstone: Mo. Univ., School Mines and Metallurgy Bull., Tech. Ser., v. 6, no. 1, 228 p.

Gives a description of the St. Peter sandstone, paleogeographic interpretations, and the stratigraphy of the areas in which it occurs.

Dale, Phyllis, and Beach, J. O., 1951, Mineral production of Oklahoma 1885–1949: Okla. Geol. Survey Circ. 29, p. 21, 32.

Presents a table showing production, tonnage, and value of glass sand in Oklahoma from 1920 to 1930. Sand and gravel are included in the figures from 1931 to 1949. Tripoli production in Oklahoma and Missouri is briefly discussed.

Damon, H. G., 1943, The origin and distribution of spiculite near Lampasas, Lampasas County, Tex., *in* Texas mineral resources: Tex. Univ. Pub. 4301, p. 271–282 [1946]. *See also* Sellards and others, 1944.

Spiculite (tripoli) beds occur in the Marble Falls formation (Pennsylvania), where it crops out west and southwest of Lampasas. Outcrops of pure silica may grade into limestone, or unaltered limestone beds may alternate with beds of spiculite. Description of deposits, composition, and physical properties in Lampasas and Burnet Counties are given. A geologic map, scale about 1 inch = 1,800 feet, showing outcrops of spiculite in parts of Burnet and Lampasas Counties is included.

Darton, N. H., 1939, Gravel and sand deposits of eastern Maryland: U. S. Geol. Survey Bull. 906-A, p. 31, 34–39.

Discusses sand for glass, molding, and other uses and the requirements of the sands. Gives some localities of glass and molding sand in the area and the results of sieve tests of steel molding sands from various localities for comparison with materials from the Baltimore-Washington region.

The Brennan pit, one of the largest producers, is on the west side of Forked Creek, 2 miles west of Round Bay station; it was active from 1906 to 1920. Considerable stripping was necessary to uncover the sand, much of which was regarded as suitable for glassmaking. Borings showed it was 30 feet or more thick. Map, scale 1:62,500, showing distribution of sand and gravel in the area is included.

Darton, N. H., Bayley, W. S., Salisbury, R. D., and Kummel, H. B., 1908, Description of the Passaic quadrangle [New Jersey-New York]: U. S. Geol. Survey Geol. Atlas, folio 157, p. 26.

Molding sand has been quarried near Montville and south of Morris Plain

railroad station. Chemical analysis of the best grade of this sand underlying the Woodbridge fire clay is from 92.5 to 98 percent SiO_2, and from 1.45 to 6.55 percent Al_2O_3 and Fe_2O_3. The sand is used in foundries.

Darton, N. H., and Smith, W. S. T., 1904, Description of the Edgemont quadrangle [South Dakota-Nebraska]: U. S. Geol. Survey Geol. Atlas, folio 108, p. 10.

A deposit of Dakota sandstone suitable for grindstones is 3½ miles north-northeast of Edgemont. It is of excellent quality and uniform grain size, but the overburden is thick.

Dasher, John, Rough, R. R., and Bacon, F. L., 1943, Beneficiation of Del Monte, Calif., sand: U. S. Bur. Mines Rept. Inv. 3740, 10 p.

Gives methods of removing objectionable impurities, largely oxides of iron and aluminum, from west coast sand that otherwise would be suitable for use in the glass container industry.

Davis, F. A. W., and Johnson, Martin, 1938, Technology of the western Tennessee tripoli *in* Tripoli deposits of western Tennessee and Mississippi: Knoxville, Tenn. Valley Authority, Water Control Plan. Dept., Geol. Div., Geol. Bull. 8, p. 13–17.

Discusses the processing of tripoli from the Warsaw formation in western Tennessee Valley area. Tests have shown this tripoli is comparable to the Missouri tripoli in its high-oil obsorption. Mechanical tests are included, and a table shows the comparative screen analysis and oil obsorption for Tennessee tripoli, with standard commercial grades of Missouri tripoli, Illinois "soft" silica, and Black Fox (East Tennessee) "soft" silica.

Davis, F. F., and Vernon, J. W., 1951, Mines and mineral resources of Contra Costa County [Calif.]: Calif. Jour. Mines and Geology, v. 47, p. 580–584.

Locations of glass and foundry sand deposits in Contra Costa County are described. A map, scale about 1 inch = 80 miles, showing mineral distribution is included.

Dorisy, C. E., 1935, Index of mineral occurrences in the State of Washington: Wash. Plan. Council Pub. 3, p. 30.

Glass sand, 96 percent SiO_2, occurs near Newport, Pend Oreille County. Silica suitable for making glass is found 2 miles east of Kettle Falls, Stevens County. Reserves of high-grade sandstone in the vicinity of Denison, Spokane County, are reported to be 7 million tons.

Dunkin, D. D., 1928, Mining and preparation of St. Peter sandstone in Arkansas: Am. Inst. Min. Metall. Eng. Tech. Pub. 55, 10 p.

The St. Peter sandstone (lower Ordovician) is widely distributed in north-central Arkansas and is exposed most prominently along the slopes of the White River valley and its tributaries. The greatest thickness is at the southeastern end where it is more than 100 feet thick in many places. The deposit and methods of operations at Guion, Izard County, are described, and chemical and sieve analyses are included.

Edwards, A. C., 1926, Pioneer in the silica sand industry keeps plant abreast of times: Pit and Quarry, v. 13, no. 1, p. 58–60.

For several miles along the Illinois River, sand is mined from the St.

Peter sandstone, and is used for the manufacture of iron, steel, and glass, sandblasting, and chemical purposes. It extends into the high ground bordering the Illinois River on the north, and about 4 miles west of Ottawa. Overburden consists of 10 to 12 feet of earth and shale, a 22-inch seam of coal, and a second layer of shale. No material is stored at the plant; production is moved direct from the pit to railway cars. No attempt is made to produce molding sand during the winter because the frozen sandstone does not break as desired. However, a small amount is mined by hand during this period.

Ehlers, G. M., Stumm, E. C., and Kesling, R. V., 1951, Devonian rocks of southeastern Michigan and northwestern Ohio: Ann Arbor, Mich., Edwards Bros., Inc., 40 p.

Discusses the lithology, succession, and relationship of the Devonian strata of southeastern Michigan and northwestern Ohio. Comparison of the Devonian strata of northern Michigan and New York is made in relation to the deposition of the rocks and the chief diagnostic fossils of the various formations. A brief description of the Sylvania sandstone is given.

Geologic map, scale about 1 inch = 1 mile, showing distribution of Devonian rocks and drawing showing distribution of Sylvania sandstone and quarries in which it is exposed are included.

Emerson, B. K., 1899, The geology of eastern Berkshire County, Mass.: U. S. Geol. Survey Bull. 159, p. 78–79, 100.

Cheshire quartzite (Cambrian) suitable for the glass industry extends approximately from north of Dalton southward to Washington. At Coltsville station, the deposits are 180 feet thick. The quartzite has been quarried for glass sand in the mountains of Washington Township at Dalton. The geology and topography of the area are discussed. Buhrstone also has been quarried in the mountains in Washington Township.

Geologic map, scale about 2 inches = 1 mile, showing Cheshire quartzite at Ferncliff and East Lee, and a geologic map, scale 1 inch = 2¼ miles, showing Cheshire quartzite in the eastern half of the Housatonic quadrangle are included.

——— 1917, Geology of Massachusetts and Rhode Island: U. S. Geol. Survey Bull. 597, p. 74–75.

Discusses the Quabin quartzite of Carboniferous age. The quartzite, which is pure, white, and sugary, in many places flaggy, makes up a great part of Quabin and Felton Mountains. It was formerly used as hearthstones for iron furnaces and firestone. At Chaffee's Place, 4 miles south of Peaked Mountain, Stafford, Conn., are large quarries of quartzite and a mill where it was sawed 50 years ago.

Emmons, W. H., and Grout, F. F., 1943, Mineral resources of Minnesota: Minn. Geol. Survey Bull. 30, p. 78–89, 111–112, 134.

Grinding pebbles derived from the Sioux quartzite, which compare favorably with the Danish, Belgian, and French flint pebbles, are found on the shores of Lake Superior between Grand Portage and Pigeon Point. Recent deposits in the Lake Superior area also are used in making cores. Sioux quartzite is quarried at Pipestone, Jasper, Luverne, and formerly was produced at New Ulm. It is used for refractory molds and sandblast castings. Some screenings are sold as refractory sand for foundry use and some as ganister used in the manufacture of silica brick or furnace lining. At Pipestone, sized chips are used for roofing granules.

Jordan sandstone (upper Cambrian) is mined near Ottawa, Jordan, and other localities along the Minnesota River. It is a white to yellow medium-grained friable high-grade silica sandstone. It ranges from about 100 to 200 feet in thickness, and is exposed along the St. Croix, Minnesota, and Mississippi Rivers. It is used for sandblasting, stone sawing, other abrasive purposes, in foundries, for filter beds, and for making glass. St. Peter sandstone (lower Ordovician) is exposed in the Minneapolis-St. Paul area. It is a weakly cemented white medium- to fine-grained rock, whose sand grains are well rounded and frosted. It contains some clay and silt. It is used for rough finishing of stone, as a core sand, in foundry work, and also for making glass.

Tripoli was quarried at Stillwater. It is believed to be a silt partly interlaminated with clay that was deposited in a glacial lake.

Evans, G. L., 1943, Mineral abrasive and polishing material in Texas, *in* Texas mineral resources: Tex. Univ. Pub. 4301, p. 245–248 [1946]. *See also* Sellard and others, 1944.

Grinding pebbles occur in large thin deposits on interstream divides and in river terraces of the Gulf Coastal Plain between Guadalupe River and the Rio Grande. Pebbles also have been produced in many counties. The milled pebbles are equal in quality to foreign pebbles.

A small quantity of flint-tube-mill liner stock has been produced from the Edward formation in western Travis County. Flint occurs as thin beds and lenses as well as nodules in this formation.

Sandblast sand (rice sand) occurs mainly near the base of the Catahoula formation and in later deposits derived therefrom. The sand grains are subrounded to sharp and range from fine to coarse.

Tripoli (spiculite) deposits occur in the Pennsylvanian Marble Falls formation in Lampases and Burnet Counties.

Massive quartz occurs as vein deposits in the Precambrian rocks in the Llano region and in the Carrizo Mountains of Culberson and Hudspeth Counties. The Texas deposits are of sufficient size and quality to meet industrial requirements.

Novaculite formation (Caballos) forms prominent and extensive outcrops in the Marathon uplift in Brewster County. The strata of the novaculite have been intensely folded and fractured. Value of the novaculite is impaired if blocks are cracked and filled with material of different hardness.

Distribution map, scale about 1 inch = 75 miles, is included.

Fettke, C. R., 1918, Glass manufacture and the glass sand industry of Pennsylvania: Pa. Topog. Geol. Survey Rept. 12, 278 p. [1919].

Comprehensive report on the glass sands of Pennsylvania gives composition of glass, classification of glasses, chemical and mechanical analyses, raw materials for glass manufacture, statistics of the glass industry, location of glass sand deposits and factories.

The Oriskany glass sand deposits are in Huntingdon, Mifflin, Bedford, Blair, Carbon, Centre, and Monroe Counties. The Pottsville glass sand deposits are in Clearfield, Elk, Fayette, Forest, Jefferson, McKean, Venango, Warren, and Westmoreland Counties. Other glass sand deposits occur in river terraces. The Tuscarora sandstone, or quartzite, may also be a possible source of glass sand.

Small maps showing outcrops in specific counties and a map, scale about 1 inch = 15 miles, showing location of glass plants and glass sand quarry are included.

Fettke, C. R., 1926, American glass sands, their properties and preparation: Am. Inst Min. Metall. Eng. Trans., v. 73, p. 398–423.

Report on the technology of glass manufacture gives specifications and procedures of processing. Includes short discussion on prices and production and geographic location of raw materials in the mid-West and Eastern States.

Flint, N. K., 1951, Geology of Perry County [Ohio]: Ohio Geol. Survey, 4th ser., Bull. 48, p. 122–123.

The only sandstone presently used for glass is the Massillon. Operations in the vicinity of Glenford and Glassrock in Hopewell Township are briefly described. Analyses are given.

Frederick, C. L., 1932, Properties of silica brick manufactured from Sharon conglomerate: Am. Ceramic Soc. Jour., v. 15, p. 61–67.

Silica refractories are discussed, and a résumé of materials utilized in the manufacture of silica brick in the United States is given. Comparative tests were made on brick manufactured from Medina (Tuscarora) quartzite, Oriskany sandstone, and Sharon conglomerate of Pennsylvania. Final conclusion was that bricks made from Sharon conglomerate are equal in quality to the average silica brick. Analyses of Pennsylvania quartzite and Sharon conglomerate are included.

Frye, J. C., 1942, Kansas mineral resources for wartime industries: Kans. Geol. Survey Bull. 41, pt. 3, p. 168–169.

Short discussion on Mississippian tripoli in Cherokee County.

Fuller, J. O., 1947, Sharon conglomerate, a source of high silica raw material: Ohio State Univ. Eng. Expt. Sta. News, v. 19, no. 2, p. 48–55.

The Sharon conglomerate (Pennsylvanian) averages 95 to 99 percent SiO_2 as rounded pebbles ranging in diameter from one-eighth of an inch to 3 inches. The pebbles are generally white, but pink, rose, gray, and black are fairly common. The thickness in northeast Ohio is 175 feet, whereas in the southern part of the State it is 200 feet. Total production for industrial uses is well over 700,000 tons a year.

Chemical analyses giving locations where the samples were obtained and an outcrop map, scale about 1 inch = 64 miles, are included.

Fulton, J. A., and Smith, A. M., 1932, Nonmetallic minerals in Nevada: Pit and Quarry, v. 24, no. 11, p. 37.

Large quantities of silica associated with alunite and sulfur were quarried in the Cuprite district, Esmeralda County, from 1914 to 1918. No production in recent years has been reported.

Glass sand was mined in 1931 at Steamboat Springs, Washoe County, 10 miles south of Reno. Analysis of the sand show 99 percent SiO_2, 0.6 percent Al_2O_3, and about 0.04 percent Fe_2O_3.

Silica is mined at Overton, Clark County. This mine produces 30,000 tons of washed silica annually.

Many large deposits of silica sand occur in Clark County. Two deposits are 7 and 11 miles, respectively, northwest of Crystal; another occurs in the White Basin district, about 12 miles southeast of Crystal. Near Apex, 12 miles north of Las Vegas, hard white sandstone, interbedded with limestone, crops out, and on the Union Pacific Railroad, 30 miles south of Las Vegas, a large deposit of loosely consolidated sandstone has yielded glass sand.

Furcron, A. S., and Teague, K. H., 1943, Mica-bearing pegmatites of Georgia: Ga. Geol. Survey Bull. 48, 192 p.

Discusses quartz occurring in the mica-bearing pegmatites. Description of the deposits and a map, scale about 1 inch = 65 miles, showing five principal areas are included.

Gildersleeve, Benjamin, 1946a, Minerals and structural materials of the Pickwick, Wilson, and Wheeler reservoir areas (revised): Knoxville, Tenn. Valley Authority Rept. 2, p. 33–35.

Tripoli occurs in the Stout district, in the southwest corner of Wayne County, Tenn., and adjoining parts of Hardin County, Tenn., and Lauderdale County, Ala. The average analysis of this deposit shows 96 percent SiO_2, 1 percent Fe_2O_3, and 3 percent Al_2O_3. In the Bear Creek district, it occurs from Riverton, Colbert County, Ala., southward along the east side of Bear Creek to about 2 miles north of Margerum. On the west side of Bear Creek, the most important deposits are in the vicinity of Eastport, Tishomingo County, Miss.

The tripoli ranges in thickness from a few feet to 60 feet, the larger deposits averaging about 25 feet. No tripoli has been produced in this area since 1912.

Geologic and location maps, scale about 1 inch = 7 miles, are included.

——— 1946b, Minerals and structural materials of southwest Virginia (revised): Knoxville, Tenn. Valley Authority Rept. A, p. 34–35.

Gives locations of outcrops of the Erwin, Clinch, Oriskany, Price, and Gladeville sandstones and quartzites. The above formations have been cited as typical of the sandstones and quartzites of the area. In some places they have been used as a source of glass sand. Attention is called to the fact that sodium carbonate and other essential ingredients for glass manufacture are produced in this area. Map, scale 1 inch = 8 miles, shows location of deposits.

——— 1946c, Minerals and structural materials of the Hales Bar and Chickamauga reservoir areas [Tennessee] (revised): Knoxville, Tenn. Valley Authority Rept. 4, p. 49, 54.

Glass sand is produced from the Sewanee conglomerate (Pennsylvanian) about 3 miles east of Sewanee, Franklin County, Production in 1943 averaged about 3,500 tons per month.

Bon Air formation is a possible potential resource of glass sand.

Map, scale about 1 inch = 9 miles, showing locations is included.

Tripoli formerly was produced from a dense chert horizon of the lower Knox dolomite at Black Fox, 3½ miles south of Cleveland, Bradley County. This operation was abandoned about 1932.

Giles, A. W., 1930, St. Peter and older Ordovician sandstones of northern Arkansas: Ark. Geol. Survey Bull. 4, 187 p.

Presents a comprehensive report on the Kings River, Calico Rock, and St. Peter sandstones. The Kings River and Calico Rock sandstones are members of the Everton formation (lower Ordovician). The Kings River sandstone ranges from 2 to 40 feet in thickness, and averages about 25 feet. It is chemically pure and averages above 99 percent SiO_2. Calico Rock sandstone ranges from 50 to 150 feet in thickness, and averages about 100 feet. The SiO_2 content averages above 98 percent. St. Peter sandstone (Ordovician) ranges in thickness from 10 to 200 feet. The grains are generally frosted and pitted. The SiO_2 content exceeds 98 percent.

These sandstones are widely distributed, but the St. Peter is the only sandstone being exploited at present. Sieve analyses; map, scale about 1 inch = 13 miles, showing outcrops of Calico Rock sandstone; and maps, scale 1 inch = 1 mile, showing location and surface outcrop of St. Peter sandstone are included.

Glenn, L. C., 1914, A tripoli deposit near Butler, Tenn.: Tenn. Geol. Survey, Res. Tenn., v. 4, no. 1, p. 29–35.

Tripoli occurs on the Matherley farm at Cobb Creek, 2½ miles northwest of Butler, Johnson County. It occurs in the Watauga formation (Cambrian) where it is interbedded with shale and limestone more than 800 feet thick. Most of the particles range from 0.0015 mm to 0.16 mm in diameter. Analysis, origin, mining, and uses are included.

Glover, S. L., 1936, Nonmetallic mineral resources of Washington: Wash. Div. Geology Bull. 33, p. 12–13, 94–96.

Sandstone suitable for abrasives occurs in the Eocene rocks of the Puget Sound area and in Chelan and Kittitas Counties. The Miocene and Oligocene rocks in the Olympic Mountains are possible sources of abrasive sandstones. Pulpstone has been quarried from a deposit at Wilkerson, Pierce County, and in Skagit County. Whetstones were quarried from an 8-foot bed in Skamania County between White Salmon and Stevenson. Sandstone with a high percentage of silica but which would require beneficiation before it could be of commercial use as high-purity silica occurs in Stemilt Canyon, south of Wenatchee, Chelan County. The Swauk sandstone, after beneficiation, contains 98 to 99 percent SiO_2; it occurs 3 miles south of Wenatchee, Chelan County. Sands of the Hammer Bluffs formation in King County overlie Eocene rocks a few miles east of Auburn, and crop out in the Hammer Bluffs and Green River region. Some samples, after washing, were satisfactory for glass. Green glass was produced from the Kummer sandstone in northwestern Washington.

A dike of white quartz, 50 feet wide and 96.6 percent pure, is near Wenatchee. A large quartz vein occurs near Merritt, Chelan County. Vein quartz is mined at Rockport, Skagit County. The Denison (Latshaw) pegmatitic quartz deposit is about 7 miles south of Denison and 13 miles north of Spokane, Spokane County. This deposit extends over an area of 3½ acres. The stained surface quartz averages about 95 percent SiO_2 and the fresher rock about 98 percent SiO_2. Quartz in the Chuckanut formation in Whatcom County is found on the northeast shore of Samish Lake in the NE1/4 sec. 26, T. 37 N., R. 3 E., on the Saar Creek, southeast of Sumas, and in the NW1/4 sec. 17, T. 40 N., R. 5 E.; the latter deposit, which is 80 feet thick, is reported to contain 98 percent SiO_2 and very little Fe.

Quartzite occurs at Kettle Falls, Stevens County, and south of Spokane near the north center of NE1/4 sec. 15, T. 24 N., R. 43 E., Spokane County. It also is reported 8 miles east of Enumclaw.

Goldstein, August, Jr., and Hendricks, T. A., 1953, Siliceous sediments of Ouachita facies in Oklahoma: Geol. Soc. America Bull., v. 64, p. 428–430.

Certain sedimentary rocks crop out in the Ouachita Mountains; these contain large amounts of silica disseminated through a relatively thick series of novaculite beds. Four lithologic types, including novaculite and spiculite chert, are present. The stratigraphy and petrography of these types are given in detail, with extracts from other authors.

Gould, C. N., 1908, Glass sand *in* Preliminary Report on the mineral resources of Oklahoma: Okla. Geol. Survey Bull. 1, p. 44–46.

Glass sand in Oklahoma occurs in three regions, near Tahlequah, in the Arbuckle Mountains, and north of the Red River in southern Oklahoma. The glass sand at Tahlequah is in the Bergen sandstone, which is a massive moderately fine grained light-brown rock. The formation ranges from a thin stratum to beds more than 100 feet in thickness. The Arbuckle Mountain glass sand occurs in the Simpson formation, which is composed of three members. Some limestone is interbedded with the sandstone, which in places is 100 feet thick. In southeastern Oklahoma, glass sand occurs in the Trinity sandstone which crops out as a band ranging in width from 5 to 15 miles along the southern base of the Arbuckle and Ouachita Mountains, extending from Marietta to the Arkansas line. Localities near Marietta, Atoka, and Antlers are said to yield good glass sand.

——— 1910, Brief chapters on Oklahoma's minerals: Okla. Geol. Survey Bull. 6, pt. 2, p. 94–96.

Gives a brief discussion on the tripoli industry of Oklahoma. Tripoli occurs in the Boone formation in the vicinity of Seneca, Mo., and in the area of Spring and Grand Rivers and north of the Arkansas River. Small amounts occur near Tahlequah and near Spavinaw Creek. Oklahoma tripoli is not suitable for filters.

Novaculite occurs in the eastern part of the Ouachita Mountains, near Hot Springs, Ark. The same formation passes westward into Oklahoma where it is exposed near Talihina and Otoka. Possible potential resources are east of the Missouri-Kansas-Texas Lines between Stringtown and Otoka and in the Potatoe Hills east of Talihina and north of Tuskahoma.

Gould, C. N., and Beach, J. O., 1930, Oklahoma glass sands: Okla. Geol. Survey Mineral Rept. 3, 12 p.

Sands suitable for the manufacture of various grades of glass occur in three localities in Oklahoma: in the Simpson formation in the Arbuckle Mountain region of Pontotoc, Johnston, Murray, and Carter Counties, in the Trinity sandstone north of the Red River in south-central and southeastern Oklahoma, and in a small area in the Burgen sandstone near Tahlequah in northeastern Oklahoma. Brief description is given of the locality and deposits. A map, scale 1 inch = 43 miles, showing distribution of glass sands in Oklahoma is included.

Grimshaw, R. W., 1953, The quantitative estimation of silica minerals: Clay Mineral Bull., v. 2, no. 9, p. 2–7.

Discusses the importance of silica and siliceous materials for refractory purposes. Analyses of samples from various localities are included.

Grimsley, G. P., 1909, History of the glass sand industry in West Virginia: W. Va. Geol. Survey, v. 4, p. 375–390.

Gives a description of the glass sand producing plants as they existed in 1909, a classification of glass, location of deposits, list of companies, and many analyses.

——— 1916, Jefferson, Berkeley, and Morgan Counties [W. Va.]: W. Va. Geol. Survey County Repts., p. 222, 224, 313, 321–344.

Discusses the Oriskany sandstone at Berkeley Springs and the properties of the Antietam sandstone in Jefferson County. Describes the glass sand resources, glass plants, mining, milling, economical features, and companies engaged in the glass sand industry of the eastern Panhandle counties. A few chemical analyses are given. Maps, scale 1:62,500, showing the topography and general and economic geology are included.

Griswold, L. S., 1892, Whetstones and the novaculites of Arkansas: Ark. Geol. Survey Ann. Rept. for 1890, v. 3, 443 p.

Presents a comprehensive report on deposits of whetstones and novaculites known before 1892. Localities are listed in Arkansas, Georgia, Oklahoma, Maine, Maryland, Massachusetts, and New Hampshire. Deposits in Arkansas are described in detail. Chemical analyses and analyses of tripoli from Seneca, Mo., and of novaculite from Marquette, Mich., are included. Geologic map, scale 1 inch = 3 miles, of the novaculite region in Arkansas accompanies the report.

Ham, W. E., 1945, Geology and glass sand resources, central Arbuckle Mountains, Okla.: Okla. Geol. Survey Bull. 65, 103 p.

Describes the glass sand deposits in the Arbuckle Mountains. These deposits are in the Oil Creek and McLish formations of the Simpson group (Ordovician). They range in thickness from 150 to 400 feet and in width from 500 feet to 1½ miles, and have an overburden 3 to 20 feet thick of loose iron-stained sandy soil or clay.

Crude sands contain 97.82 to 99.57 percent SiO_2, 0.09 to 0.40 percent Fe_2O_3, 0.04 to 1.16 percent Al_2O_3, and very little CaO and MgO. Sieve analyses show 83 to 90 percent fine to very fine sand (Wentworth scale). The average median diameter of the sands is 0.142 mm, and the average sorting coefficient is 1.20.

Map showing localities of glass sand in Oklahoma is included.

Hanley, J. B., Heinrich, E. W., and Page, L. R., 1950, Pegmatite investigations in Colorado, Wyoming, and Utah, 1942–1944: U. S. Geol. Survey Prof. Paper 227, 125 p.

Discusses quartz occurring in pegmatites in Colorado, Wyoming, and Utah, which might be a possible source of glass sand, and includes 17 plates, 34 figures, and 7 tables.

Harris, G. D., 1941, Report on the geology of Lee County, Tex.: Tex. Univ. Min. Res. Survey Circ. 33, p. 4–5, 6–8.

The Carrizo sand crops out in Lee County. The area of outcrop is about 1 mile wide in the northeast corner and is at least 5 miles wide in the southwest part of the county. Thickness exceeds 200 feet. The lower part of the Carrizo consists of tan and white medium-grained sands, with one or two layers of bluish sand or siltstone. The upper part of the formation consists of iron-stained massive sandstone, with a conglomerate ironstone cap. The Queen City sand is exposed in Lee County in an outcrop that ranges in width from 1 to 3 miles.

Harton, B. H., 1953, Ouachita chert facies, southeastern Oklahoma: Am. Assoc. Petroleum Geologists Bull., v. 37, p. 788–796.

The Arkansas novaculite includes three divisions, lower, middle and upper. It not only is related to faulting but also to widespread solution and redeposition of silica. The lower and upper divisions, originally shale and shaly limestone, have been altered chemically by replacement of clay minerals by silica through action of ground waters. In the middle division, the process of segregation of silica within the belt of deformation was aided and controlled by conditions developed during overthrusting. The age of the middle division is Devonian and lower Mississippian. Specific locations are given for those divisions where novaculite occurs. The theory is advanced that the excessive deposition of silica in the Ouachita region was produced by alteration during the orogenic process.

Havell, R. F., and McVay, T. N., 1939, Beneficiation of some Alabama glass sands: Am. Ceramic Soc. Bull., v. 18, p. 429–431.

Studies were made on the beneficiation of beach sands southeast of Mobile, on the Gulf of Mexico. Tests have shown the following: Iron content may be lowered by tabling from 0.093 to 0.169 percent Fe_2O_3 to 0.057 to 0.066 percent Fe_2O_3. Grain-size distribution of the sands is satisfactory for glass manufacture. It might be possible to recover small amounts of zircon, kyanite, ilmenite, and rutile as byproducts.

Proposed flow sheet for possible treatment of sands, mechanical and chemical analyses, and tables giving percentage grain counts of heavy minerals are included.

Heinz, C. E., 1937, Tripoli, *in* Industrial Minerals and Rocks: New York, Am. Inst. Min. Metall. Eng., 1st ed. p. 911–922.

Discusses the properties, origin, and mining of tripoli in the United States and lists five districts where it occurs. Missouri-Oklahoma district includes Racine and Seneca, Newton County, Mo., and Peoria, Ottawa County, Okla.; Illinois district includes Alexander and Union Counties; Tennessee-Georgia-Alabama district; Tennessee Valley district, where Tennessee, Alabama, and Mississippi join; and Arkansas 6 miles from Rogers, Benton County.

Hewett, D. F., Callaghan, Eugene, Moore, B. N., and others, 1936, Mineral resources of the region around Boulder Dam: U. S. Geol. Survey Bull. 871, p. 169–170.

A 300-foot crossbedded sandstone member of the Supai formation forms a cliff along the mountain front several miles west of Bard. Because of the crossbedding, there is a great variation in composition and size of grains. The sandstone, which contains a small amount of iron and some lime, is used for molding sand. The reserves are said to be inexhaustible.

Extensive deposits of quartz sand crop out northeast and southwest of the Muddy Mountains. In the northeastern area, large sand deposits occur in the Jurassic(?) sandstone and in dunes. Silica is quarried from the Overton fanglomerate, 5 miles south of Overton. Some of the deposits are reported to average 99.2 percent SiO_2. Other analyses included show a slightly lower percentage.

Dune sand in Magnesite Wash, 2 miles south of Overton, is suitable for making colored bottle glass.

Exploratory work is being done in the Overton fanglomerate, southwest of Muddy Mountains.

Chemical analyses are included.

Hewitt, D. F., 1951, Silica in Ontario: Ont. Dept. Mines Indus. Mineral Circ. 2, 16 p.

This report gives a brief discussion of the occurrences, characteristics, and uses of silica deposits in Ontario. Mining, milling, beneficiation, and marketing are also mentioned. Workable deposits consist of unconsolidated silica sand, sandstone, quartzite, and pegmatitic quartz. The main silica resources in Ontario are the Lorrain quartzite (Precambrian), Potsdam sandstone (Cambrian), Medina sandstone (Silurian), Sylvania sandstone (Devonian), and the unconsolidated sands (Quaternary and Recent).

Chemical analyses of samples from most deposits are given. Map, scale 1 inch = about 25 miles, showing the distribution of quartzite deposits and a map, scale 1 inch = about 38 miles, showing the location of sandstone deposits are included.

Hickok, W. O., IV, and Moyer, F. T., 1940, Geology and mineral resources of Fayette County, Pa.: Pa. Geol. Survey, 4th ser., Bull. C 26, p. 53–59, 299, 311, 487–488, 492–494.

Discusses the Connoquenessing and Homewood sandstones (Pottsville). Several quarries and one mine are on Chestnut Ridge, along the Youghiogheny River and Dunbar Creek, where 40 to 50 feet of the Upper Connoquenessing sandstone and about 40 to 50 feet of Homewood sandstone have been worked. Both formations are composed of light-buff to white coarse-grained heavy-bedded sandstone. Sands from these formations must be washed to be suitable for the better grades of glass. Silica refractories are produced from these sands. Geologic and topographic maps, scale 1:62,500, of Fayette County, are included.

Hodge, E. T., 1938, Northwest silica minerals, *in* Market for Columbia River hydroelectric power using northwest minerals: Portland, Oreg., War Dept., Corps of Engineers, U. S. Army, North Pacific Div., sec. 2., v. 1, 175 p., v. 2, p. 177–189.

Discusses the silica deposits of Idaho, Washington, and Oregon and localities other than the Pacific Northwest; gives a detailed discussion on the technology of silica. Maps showing location, topography, and geology are included.

Hoeman, E. C., and Redfield, R. C., 1943, Industrial sand from the Eocene Rockdale formation in Texas, *in* Texas mineral resources: Tex. Univ. Pub. 4301, p. 283–300 [1946]. *See also* Sellards and others, 1944.

Sand strata in the Simsboro member of the Rockdale formation (Eocene) crop out in many counties in the Texas Coastal Plain. Geologic and geographic description, properties, and analyses of the deposits are given. After beneficiation this sand may be used for foundry, molding, filter and engine sands, flint glass, abrasives, sand-lime and silica brick, sodium silicate, and silicon carbide.

Holmquist, P. J., 1947, Details of the quartz transformation in silica bricks: Ingeniörs vetens. akad. Handl. 192 (The Royal Swedish Academy of Eng. Sci. Proc.), 19 p.

Several observations indicate that the transformation of quartz in bricks may be essentially accelerated by subordinate admixed substances. Even very small quantities of alkali metals are highly active in the formation of easily fusible mixtures of alkali silicates and fluid eutectics.

Petrographic examinations have shown that burning gives rise to two products in the silica bricks. One consists of a fine grained mixture of tridymite and glassy slag (sometimes also containing slag minerals) of the groundmass; the other consists of coarser grains, mainly composed of

heterogenous cristobalite which often contains remnants of nontransformed quartz.

Honess, C. W., 1923, Geology of the southern Ouachita Mountains of Oklahoma, part 1, Stratigraphy, structure, and physiographic history, p. 19–139; part 2, Geography and economic geology, p. 54–58: Okla. Geol. Survey Bull. 32.

Discusses the general features of the Arkansas novaculite formation, which has three lithologic units. The lower consists of massive white novaculite; the middle contains thin layers of dense dark novaculite interbedded with shale; and the upper is chiefly massive calcareous novaculite. The maximum thickness does not exceed 600 feet.

Two types of commercial material are the Arkansas stone and the Ouachita (Washita) stone. The Arkansas stone, a true novaculite, is homogeneous, gritty, fine-grained, has low porosity (0.25 percent) and a conchoidal fracture. Chemical analyses indicate a content of 99 percent SiO_2. The Ouachita stone is chemically similar to the Arkansas stone, but its dull luster and porosity of 5 percent exclude it from the classification of a true novaculite. The cryptocrystalline silica of the Ouachita stone is denser around the rims of minute rhombohedral cavities; the rims of these cavities accomplish the sharpening of tools rubbed across the stone. The Arkansas stone is better adapted for fine finish work done on whetstones, whereas the Ouachita stone is better for the coarse cutting as done on scythestones. Reserves are large. Geologic map, scale 1 inch = 1 mile, of the southern Ouachita Mountains is included.

Hudson, W. C., 1946a, Investigation of the Miami-West Palm Beach belt of silica sand in Florida: U. S. Bur. Mines Rept. Inv. 3865, 5 p.

The Miami-West Palm Beach belt of silica sand extends 65 miles northward from Miami to West Palm Beach. The width of the belt is more than a mile and the deposits range from 4 to more than 7 feet in thickness. The long, narrow sand terrace is 10 to 30 feet above sea level. Most of it is flat but sand dunes occur near the northern end. The possible glass sand is believed to end a few miles north of West Palm Beach because of the increased content of black sands, especially near Stuart. Overburden is about 1 foot thick. Chemical and mechanical analyses of the sand and a map, scale about 1 inch = 11 miles, showing the glass sand belt are included.

——— 1946b, Investigation of the McLeod glass-sand pits Wheeler County, Ga.: U. S. Bur. Mines Rept. Inv. 3859, 3 p.

The McLeod pits are on the southeast side of the Little Ocmulgee River, Wheeler County. They are about 1 mile long and one-fourth mile wide. Overburden is about 6 to 11 feet thick. Thickness of sand is about 5 feet. Chemical and mechanical analyses of sample are given, and location map, scale 1 inch = 19 miles, is included.

Huey, A. S., 1948, Geology of the Tesla qaudrangle, California: Calif. Div. Mines Bull. 140, p. 61.

Abandoned glass sand prospects of the Tesla formation are in San Joaquin and Alameda Counties. The mining of glass sand in the Tesla area has been limited by the more ready accessibility and higher quality of the white sands near Mount Diablo, Contra Costa County. "Livermore ganister," a natural mixture of silica sand and clay, occurs in Alameda County. It is confined to a

single stratigraphic unit and is used in foundries as a ladle-patching and furnace-lining material. Geologic map, scale 1:62,500, is included.

Huttl, J. B., 1937, A glass sand enterprise on the Pacific Coast: Eng. Min. Jour., v. 138, no. 12, p. 29–31.

The report describes operations of the Silica Co. of California, about 3 miles southeast of Brentwood, a station on the Santa Fe Railway. The deposit is of Eocene age and consists of compact sandstones in which a workable bed of amber-colored sand occurs, ranging in thickness from 30 to 40 feet. The mining and processing of the sand are discussed, illustrated by a flow sheet.

Jahns, R. H., Griffitts, W. R., and Heinrich, E. M., 1952, Mica deposits of the southeastern Piedmont; part 1, General features: U. S. Geol. Survey Prof. Paper 248–A, 102 p. *See also* Prof. Papers 248–B, C, D, E, F.

Discusses quartz occurring in pegmatites in Virginia, North Carolina, Georgia, South Carolina, and Alabama. Includes 1 plate, 31 figures, and 14 tables.

Jensen, N. C., 1942, Marketing silica (Quartz, tripoli, diatomite, etc.): U. S. Bur. Mines Inf. Circ. 7202, 39 p.

Describes various forms of silica, discusses their occurrence, properties, and uses, and gives production and prices. Includes list of buyers.

Jewell, W. B., 1931, Geology and mineral resources of Hardin County, Tenn.: Tenn. Geol. Survey Bull. 37, p. 80–85.

Tripoli occurs in the Fort Payne and Warsaw formations. Descriptions of the occurrences and chemical analyses are given.

Flint for tube-mill lining has been produced on a small scale in Wayne County, but none has been exploited in Hardin County. Map, scale 1 inch = 1 mile, showing areal geology of Hardin County is included.

Jillson, W. R., 1938, The Saint Peter sandstone in Kentucky: Louisville, Ky., Standard Printing Co., Inc., 46 p.

Discusses the occurrence of St. Peter sandstone in Franklin, Gallatin, Harrison, Menifee, Estill, and Madison Counties, giving the regional geology and outline of its stratigraphic correlatives.

Johnson, J. H., 1934, Paleozoic formations of the Mosquito Range, Colo.: U. S. Geol. Survey Prof. Paper 185–B, p. 20–21.

The Sawatch quartzite lies directly upon the eroded surface of the Precambrian rocks. Generally the formation consists of hard, massive bedded grayish-white quartzite. Locally there are thin basal conglomerate beds composed of well-rounded and polished grains of bluish-gray quartz, about pea size, well cemented with silica. The quartzite differs considerably in thickness in different localities. Near Trout Creek it is absent or very thin; at Weston Pass, about 60 feet of it appears to be present; and, in the Leadville and Alma districts, it is about 120 to 130 feet thick.

Little information from adjoining areas indicates Upper Cambrian age, probably middle Upper Cambrian, for the quartzite.

Cross sections showing the thickness of the quartzite throughout the area are given, but no analyses as to the purity of the rock are included.

Johnson, M. E., 1935, The mineral industry of New Jersey for 1933: N. J. Dept. Conserv. Devel. Bull. 42, p. 13.

A quartzite deposit about 1½ miles west of Wharton, adjacent to the Delaware, Lackawanna and Western Railroad, is quarried for use in foundries, filters, and cement flux. Most of the rock, part of the Green Pond conglomerate, is white but some is iron stained. Random and grab samples showed 95.78 percent SiO_2 and 0.68 percent Fe_2O_3.

Jones, W. B., 1938, Glass sands of Alabama: Am. Ceramic Soc. Bull., v. 17, p. 327–328.

The Mohawk deposit of the Shades formation (lower Pottsville) near Ohatchee, Calhoun County, is a massive bedded sandstone and conglomerate, ranging in thickness from 40 to 80 feet. The texture ranges from a medium fine-grained sandstone to a conglomerate consisting of small water-worn pebbles. The sandstone is almost pure white. There is little overburden. The tract is 1 mile square and about 3 miles northwest of Ohatchee, near rail and water transportation. Outcrops and test pits have disclosed tonnage calculated at 100 million tons. Chemical and mechanical analyses from the deposit are given.

The Gulf Beach sands of southern Baldwin County exceed 20 feet in thickness. Most of the deposit is 5 feet above and 15 feet below sea level. Production is done by dredging. It is somewhat higher in ferric oxide and lower in silica than the Mohawk deposit. It has good transportation facilities. A chemical analysis is given.

The author believes that the materials of these two deposits are the only ones in the State suitable for supplying glass sand of high quality.

Keith, M. L., 1946, Sandstone as a source of silica sands in southeastern Ontario: Ontario Dept. Mines 55th Ann. Rept., pt. 5, 36 p.

This area is in parts of Frontenac, Leeds, and Lanark Counties, extending from Kingston to Brockville along the St. Lawrence River and from the St. Lawrence River northward beyond Perth and Smiths Falls. The sandstone is in the Potsdam formation (Precambrian). The thickness ranges from less than 72 feet to 280 feet. This sandstone is used for foundry work, blast sand, and for the manufacture of silicon carbide; it could be used for glass sand if demand required. Each area is described, giving chemical and mechanical analyses. The Kingston Silica Mines deposit is reported to contain about 10 million tons of sandstone. A mill flow sheet and histograms showing the size analysis of a sandstone sample of the deposit and a map, scale 1:126,720, showing the distribution of the Potsdam sandstone of part of southeastern Ontario are included.

Kinney, D. M., 1948, Glass sand and other special sands, *in* Geological resources of the Trinity River tributary area in Oklahoma and Texas: Tex. Univ. Pub. 4824, p. 143–147.

Sands suitable for glass are found in the Arbuckle Mountains near Tahlequah in northeast Oklahoma, southeast Oklahoma, north-central Texas, and the Gulf Coastal Plain of Texas. The sands of the Arbuckle Mountains occur in the Oil Creek and McLish formations of the Simpson group (Ordovician). The Oil Creek sand is the base of the Simpson group and ranges from 150 to 400 feet in thickness. The McLish sand is about 165 feet thick and overlies the Oil Creek sand. Sands near Tahlequah occur in the Burgen sandstone (Ordovician). Sands in southeast Oklahoma and north-central Texas occur in the Trinity sand (Lower Cretaceous). The outcrop is from 5 to 20 miles wide. Sources for glass sand are rare. However, south of the main body of the Trinity sand in Texas, a sand deposit in the lower Trinity is being mined for making bottle and glass containers. The Gulf Coastal Plain of Texas yields the Carrizo, Queen City, and Sparta sands (Eocene). These sands may be suitable for glass, but, for the most part, they contain too much iron and are too fine grained. The Trinity, Carrizo, Queen City, and Sparta sands cross the Trinity River basin, but deposits of sufficient purity for the manufacture of common bottle glass are rare.

Production figures are not available, but reserves of the Oil Creek and McLish formations are said to be very large. Reserves at Santa Anna, Tex., are also large.

Map, scale about 1 inch = 70 miles, showing distribution of glass sand and other special sands in the Trinity River tributary area is included.

Knapp, G. N., 1923, The foundry sands of Minnesota: Minn. Geol. Survey Bull. 18, p. 17–22, 62–65.

Describes the sands in Minnesota, giving the best use of each, localities where they occur, and some chemical and mechanical analyses of the sands. Coarser quartz sand is sometimes desired for cores in heavy work in gray iron and steel foundries. This material is obtained from the Jordan formation (Cambrian). The material preferred for core work is a quartz sand with the least possible amount of silt and with little or no clay. The St. Peter sandstone (lower Ordovician) is well suited for this work. Sioux quartzite (upper Huronian) withstands attrition and abrasion to a remarkable degree and is in demand as pebbles for ball mills.

Knechtel, M. M., Larrabee, D. M., Fischer, E. C., and others, 1948, Map showing construction materials and nonmetallic mineral resources of Montana: U. S. Geol. Survey Missouri Basin Studies Map 11, scale 1:750,000.

Rock that probably forms part of the Tertiary "lake beds," 15 miles southwest of Dillon, Beaverhead County, is used for fluxing and silica brick in copper converter work, and might be used for the manufacture of glass. A quarry at Columbus, Stillwater County, has produced material for grindstones.

Knight, Nicholas, 1926, Iowa glass sand [abs.]: Pan-Am. Geologist, v. 46, p. 402–403.

At several points in Linn County, along the Chicago, Milwaukee, St. Paul and Pacific Railroad between Marion and Cedar Rapids; and also along the old county highway sandstone occurs in marked unconformity upon limestone of Devonian age. Fossils clearly indicate that this sandstone is of Carboniferous age. Analyses show this material to be nearly 99 percent SiO_2. The several exposures seem to warrant a moderate glass industry.

Krynine, P. D., Klepper, M. R., and Glasser, M., 1940, Mineralogy of the Mapleton glass sand: Pa. State College, Mineral Industries Expt. Sta. Tech. Paper 51, p. 88–94.

Report on the technology of the Oriskany sandstone in a quarry at Mapleton and at Mount Union. Mechanical analyses and histograms are included.

Krynitsky, A. I., and Raring, F. W., 1951, Sieve analyses of silica sands: Am. Foundrymen's Soc. Trans., v. 59, p. 117–120.

A study of sieve analyses of silica sand was undertaken to determine the

precision of the American Foundrymen's Society fineness test for foundry sands. The primary purpose of the investigation was to determine whether the type of sieve shaker used has any significant effect on the analytical results for a given sample and the reproductibility of a sampling technique. Conclusions were that, under the conditions of the analyses made in the study, the vibratory and rotary type sieve shakers will yield approximately the same results on a given sample with the same set of sieves.

Kummel, H. B., and Gage, R. B., 1907, The glass-sand industry of New Jersey: N. J. Geol. Survey Ann. Rept., 1906, p. 77–96.

Sands along the Maurice River below Millville, in the region around Vineland and Williamstown, may be a source of glass sand. Glass sand has been mined at Egg Harbor and west of Salem.

Description of the deposits, method of mining, and physical properties are described; chemical analyses of 13 washed glass sands from New Jersey and 1 from Pennsylvania are given; a few mechanical analyses are included.

Ladoo, R. B., and Myers, W. M., 1951, Nonmetallic minerals: New York, McGraw-Hill Book Co., Inc., 2d ed., p. 423–431, 561-566.

Gives a general description of the geographic distribution, physical properties, mining, milling, specifications and tests, production, consumption, grades and prices, utilization of silica, and contains a bibliography.

Lamar, J. E., 1928, Geology and economic resources of the St. Peter sandstone of Illinois: Ill. Geol. Survey Bull. 53, 175 p.

Describes the distribution, lithology, thickness, structure, origin, and geologic history of St. Peter sandstone in Illinois. Discusses in detail its structural, physical, and compositional features, giving special attention to the impurities, and production methods of local quarries; lists and specifies requirements for more than 100 uses of sand; describes methods of sampling and testing and tabulates the results of these tests. Mentions briefly undeveloped deposits of possible commercial value.

——— 1953, Siliceous materials extreme southern Illinois: Ill. Geol. Survey Rept. Inv. 166, 39 p.

Most silica produced in southern Illinois is from the Clear Creek formation. Recently silica also has been produced from the Grassy Knob formation at Olive Branch. All mines currently producing tripoli from the Clear Creek formation are west of Elco and Mill Creek. Specific gravity, weight per cubic foot, and porosity of silica are given, along with character of deposits of commercial silica, mining, processing, uses, and resources.

Novaculite Gravel Co. pit near Tamms, Alexander County, is described as to character, occurrence, resources, mining, processing, uses; chemical and sieve analyses are included.

It is thought that ganister deposits in southern Illinois occur in the Hartline formation, although some may have been formed also from calcareous siliceous beds of the Springville formation. Chemical analyses of ganister from the Hartline formation are given. Ganister in Alexander County is discussed as to character of the deposits, mining, processing, uses, resources, and origin.

Larrabee, D. M., Clabaugh, S. E., Griffitts, W. R., and others, 1947, Map showing construction materials and nonmetallic mineral resources of

Colorado: U. S. Geol. Survey Missouri Basin Studies Prelim. Map 10, scale 1:500,000.

Silica sand has been produced from white sandstones and quartzite in Douglas, El Paso, Fremont, and Pueblo Counties. These sandstones crop out along the mountain front, and similar sandstones and quartzites crop out in a belt from Orient, Saguache County, northwestward to Leadville and Aspen. Among the formations that contain white sandstone and quartzite are the Uncompahgre formation, the Sawatch and Ignacio quartzites, and the Lyons sandstone.

Le Chatelier, H., and Bogitch, B., 1918, Manufacture of silica brick: Am. Inst. Min. Metall. Eng. Trans., v. 60, p. 134–161.

Discusses the methods of investigation, the tridymite network, independent variables, and manufacturing operations of silica brick.

Leith, Andrew, 1935, The Pre-Cambrian of the Lake Superior region, the Baraboo district, and other isolated areas in the upper Mississippi Valley: Kans. Geol. Soc. 9th Ann. Field Conf., p. 329–331.

The Baraboo quartzite is massive, well cemented, almost pure, and about 4,000 feet thick. Some thin beds of slate occur between the layers of quartzite. Geologic map, scale about 1 inch = 4 miles, of the Baraboo district is included.

Levings, G. V. B., 1923, Marketing of tripoli: Eng. Min. Jour.-Press, v. 116, p. 631–632.

Gives a brief discussion of tripoli, including its properties, uses, and location of producing areas—stressing tripoli from Seneca, Mo.—and marketing.

Libbey, F. W., 1950, Oregon's mineral industry in 1950: Ore.-Bin, v. 13, no. 1, p. 4.

Metallurgical silica is mined and processed at Rogue River, Jackson County, Oreg.

Littlefield, M. S., 1925, Natural-bonded molding sand resources of Illinois: Ill. Geol. Survey Bull. 50, p. 100, 122–125.

Describes a deposit of weathered chert mined and shipped as ganister near Elco and the occurrences of high-purity silica in Kandall, Lake, and La Salle Counties.

Loughlin, G. F., 1912, The gabbros and associated rocks at Preston, Conn.: U. S. Geol. Survey Bull. 492, p. 24, 53, 106, 110, 135–146.

The Lantern Hill quartz deposit forms a high narrow ridge 1¼ miles long and about 1,000 feet wide along the west boundary of North Stonington. Analyses show pulverulent quartz is 98 to 99.4 percent SiO_2.

Another quartz mass similar to the Lantern Hill occurs a mile north of Glasgo village in Griswold. The origin and geology of the quartz mass and a complete petographic description of the quartz and wall rock are discussed.

Maps, scale 1:62,500, showing location and geology of deposits are included.

Lowe, W. B., 1926, The phenomena of the Sioux quartzite: Pit and Quarry, v. 12, no. 8, p. 82–84.

Sioux quartzite (Huronian) occurs along the Big Sioux River: it is the only quartzite of any commercial value in South Dakota. Maximum width is believed to be 60 miles, extending across the northwestern corner of Iowa. It underlies about equal areas in South Dakota and Minnesota. The formation probably extends over an area of 6,000 square miles. It is fine grained and friable. Thickness is estimated to be from 1,500 to 4,000 feet.

Density and acid tests are given. The fusion point is very high. This quartzite has many uses; among them is furnace converter linings for steel mills.

Lowry, W. D., 1947, Foundry sand produced near Eugene, Oreg.: Am. Inst. Min. Metall. Eng., v. 173, p. 532–541.

Report on the steel foundry sands near Eugene, Oreg., includes the history, geology, properties, and a map, scale about 1 inch = 50 miles, showing the location of deposits. Gives a flow sheet of a current operation and references.

——— 1954, Silica sand resources of western Virginia: Va. Polytech. Inst., Eng. Expt. Sta. Ser. Bull., 96, 62 p.

This report describes the geology of the silica sand deposits, giving descriptions of the deposits and mechanical and chemical analyses. Map, scale about 1 inch = 25 miles, showing localities is included.

McAllister, H. E., and Bartram, J. W., 1947, Handmade glass tableware, a potential new industry for Colorado: Colo. Univ., Bur. Business Research, p. 12, 17–20.

A sand deposit meeting all the requirements of glass sand is being worked in a hogback west of Denver. Sand deposits near Colorado Springs are also found suitable for the glass industry. Other deposits near Pueblo have been analysed and found suitable, after beneficiation, for glassmaking.

Analysis of sand produced near Denver: SiO_2 — 99.5 percent, Fe_2O_3 — 0.029 percent, Al_2O_3 — 0.261 percent, CaO — 0.00 percent, MgO — 0.03 percent, loss on ignition — 0.18 percent.

Analyses of 2 potential glassmaking sands of Colorado Springs:

1	*Percent*	2	*Percent*
SiO_2	98.56	SiO_2	97.98
Al_2O_3-TiO_2	.85	Al_2O_3-TiO_2	1.55
Al_2O_3	.81	Fe_2O_3	.068
Fe_2O_3	.038	Ignition loss	.40
MgO	.02		
CaO	.06		
K_2O	.05		
Na_2O	.04		
Ignition loss	.34		

The deposit from which sample 1 was taken yields washed sand possibly suitable for making flint glass, containers and tableware. However, it exceeds 0.003 percent Fe_2O_3 standards set up by the American Society for Testing Materials.

Samples of sand from deposits near Pueblo were submitted to Colorado University for analyses. They were adequately high in silica, but the iron content was too high, running 0.059 percent. With beneficiation, this sand might be suitable for glassmaking.

McGrain, Preston, 1952, Recent investigations of silica sands of Kentucky: Ky. Geol. Survey, ser. 9, Rept. Inv. 5, 14 p.

Gives requirements, specifications, chemical, and physical analyses of glass sand. Hardinsburg sandstone near Marion, Crittendon County, and Bethel sandstone near Princeton, Caldwell County, seem to offer the best possibilities for sources of sand for high-grade glass in the State. Map showing sources of analyzed sands is included.

Machin, J. S., and Tooley, F. V., 1937, Decolorization of southern Illinois silica: Ill. Geol. Survey Rept. Inv. 47, p. 5–35.

Possible methods of decolorizing silica are classified roughly as high-temperature methods, wet bleaching with acids alone or in the presence of reducing agents, and electrical or magnetic separation of iron compounds. Experimental investigations of three wet leaching methods employing first, hydrochloric acid; second, sulfuric acid; and third, a combination of an active metal with sodium bisulfite and sulfuric acid, indicate that it is technically feasible to bleach by any of the three methods investigated.

McNamara, E. P., 1938, Introduction to ceramics: Pa. State Coll., School Mineral Industries, v. 2, p. 79–95.

Describes forms of silica: quartz, tridymite, and cristobalite, their formation and occurrence, Oriskany and St. Peter sandstone occurrences, the commercial forms of silica. Chemical analyses of some American sands, sandstones, and quartzites are given; also a table showing ferric oxide in different types of glass sand and screen analyses of glass sands.

Metcalf, R. W., 1940a, Grinding pebbles: Stone, v. 61, p. 468, 470.

Describes the resources of quartzite pebbles and silex liners and summarizes foreign sources, namely Denmark and France, markets for export, and the domestic supply situation.

——— 1940b, Grinding pebbles and tube-mill liners: U. S. Bur. Mines Inf. Circ. 7139, 5 p.

Artificially rounded grinding pebbles have been produced from quartzite deposits near Jasper, Minn., and from the Sioux quartzite near East Sioux Falls, S. Dak. No production has been reported for 15 years. Before 1936, pebbles were used from the beaches between Oceanside and Encinitas, Calif. Although somewhat harder than Danish flint pebbles, the California pebbles wore out faster on hard material, being coarser grained and rougher than the Danish pebbles. However, their cost is less than one-half the price of Danish pebbles.

Various types of stream or beach pebbles have been produced locally in the Rocky Mountain region for use in metallurgical mills.

Tube-mill liners, and possibly artificially rounded-grinding pebbles, formerly were supplied from the Ocala limestone beds in Florida and from the Fort Payne chert near Iron City, Tenn.; they also were obtained from a quartzite belt of central and southeast Pennsylvania, and in Calhoun, Talladega, Cherokee, Clay, and Cleburne Counties, Ala.

——— 1949, Tripoli, *in* Industrial Minerals and Rocks: New York, Am. Inst. Min. Metall. Eng., 2d ed., p. 1074–1101.

Discusses tripoli with respect to composition, physical properties, mining, milling, specifications, uses, marketing, and deposits in Alabama, Arkansas, Georgia, Illinois, Mississippi, Missouri, Oklahoma, Pennsylvania, Tennessee, and some foreign deposits. Chemical analyses, production data, and a bibliography are included.

Meyers, T. R., 1941, Some New Hampshire quartz deposits, preliminary report: N. H. State Plan. Devel. Comm., Mineral Resources Survey, pt. 7, 21 p. Rept. N. H. Plan. Devel. Comm., pt. 6, 21 p.

Discusses only the larger deposits of quartz in New Hampshire. The deposits are grouped into three types; silicified zones, quartzites and quartz conglomerates, and pegmatites. Emphasis is placed upon the study of silicified zones. Geology and some chemical analyses of the deposits examined are given; also a map, scale about 1 inch = 20 miles, showing distribution and types of quartz deposits examined.

Miser, H. D., 1943, Quartz veins in the Ouachita Mountains of Arkansas and Oklahoma (their relations to structure, metamorphism, and metalliferous deposits): Econ. Geology, v. 38, p. 105–106.

Quartz veins are hydrothermal deposits of probable magmatic origin, and novaculite is the result of progressive metamorphism. Dynamic metamorphism had produced fracturing, shearing, and preferred orientation of the grains in some novaculites. The oilstone quarries in the Arkansas novaculite near Hot Springs, Ark., are in an area that has been metamorphosed to a greater extent than elsewhere in the Ouachita Mountains, except in the mountains a few miles north of Broken Bow, Okla.

Miser, H. D., and Purdue, A. H., 1929, Geology of the De Queen and Caddo Gap quadrangles, Arkansas: U. S. Geol. Survey Bull. 808, p. 162–166, 178–180.

Discusses the Arkansas novaculite deposits which occur in three lithologic units. The novaculite for the most part is massive, breaks with a conchoidal fracture, and ranges in color from yellow to white. It occurs in beds of a maximum thickness of almost 1,000 feet. At Hot Springs, two commercial types are mentioned. The Arkansas stone is fine grained and suitable for sharpening fine edges of tools. The Ouachita (Washita) stone is porous. Novaculite pebbles range from a fraction of an inch to 10 inches in diameter. Most of the pebbles are white with a bluish tint, but many are red, gray, green, yellow, brown, and black. They are comparatively brittle, which may hinder the economic use in tube mills. The basal part of the Arkansas novaculite is composed almost wholly of silica, which is white, free from impurities, and is used for pottery. The purest grade might be used for making optical glass. Tripoli deposits occurring in the Arkansas novaculite are described.

Modes, C. H., 1932, Sand supply and the glass industry on the Pacific Coast: Ceramic Industry, v. 18, p. 254, 266, 268, 270.

Gives locations, sources, production, and chemical analyses of glass sand in California, and analyses of glass sand from Missouri, Pennsylvania, Illinois, and New Jersey for comparison. Data on Belgian sand imports are included.

Moore, E. S., and Taylor, T. G., 1924, The silica refractories of Pennsylvania: Pa. Geol. Survey, 4th ser., Bull. M 3, 100 p.

Gives a detailed description of the Tuscarora and Chickies quartzite. Chemical analyses and map, scale about 1 inch = 15 miles, showing localities of quartzites used as ganister for silica brick are included.

Murphy, T. D., 1954, Silica, *in* Mineral resources of Clark County, Nev.: Nev. Bur. Mines Bull. 55, 6 p.

The Eureka quartzite, the Supai, Aztec, and Baseline sandstones, and

certain deposits of eolian sand are of sufficient purity to be potentially commercial in Clark County. Although practically all of these materials have been exploited, only the Baseline sandstone and eolian sand are currently used. Four companies in the Overton area ship both crude and dry finished products that are used by the foundry, glass, and chemical industries.

Market specifications favor the present utilization of the sands from Clark County for glass melting, but a substantial tonnage is consumed by the West Coast foundry trade. The Eureka quartzite may be considered a potential resource for refractory and metallurgical use.

Raw material resources of most type of silica seem to be substantial but not inexhaustible. Finished products shipped from the Overton area to West Coast industries must always compete with sources of supply in southern California.

Murray, H. H., and Patton, J. B., 1953, Preliminary report on high-silica sand in Indiana: Ind. Geol. Survey Progress Rept. 5, 35 p.

From 1850 to 1910, high-silica sands were produced in Indiana from dunes along the Lake Michigan shores; the Pendleton sandstone (Devonian) at Pendleton, Madison County; the Mansfield formation (Pennsylvanian) near Loogootee, Martin County; the Linton (Staunton) formation (Pennsylvanian) near Coxville, Parke County; the Ohio River formation (Tertiary) in eastern Harrison County and southeastern Washington County. At present, all high-silica sand used by the glass industries is imported from other States.

The report gives stratigraphic units sampled, descriptions of selected exposures, and chemical and spectrographic analyses. Map, scale 1:1,000,000, showing location of samples of sand and sandstones is included.

Nevin, C. M., 1929, The sand and gravel resources of New York State: N. Y. State Mus. Bull. 282, p. 116–117.

Glass, core, and blast sands have been produced at Cleveland, Oswego County. This deposit is a continuation of the large sand plain between Rome and Oneida Lake. Thickness is about 15 feet; overburden, 2 feet. Chemical and mechanical analyses are given.

Another extensive area of beach and dune sands suitable for core work occurs in Oswego County, along the east shore of Lake Ontario near Selkirk. Sieve tests are given for samples of this sand.

New Hampshire State Planning and Development Commission, 1949, Mineral resources in the Lakes region: p. 3.

Quartz used for glass and abrasives had been mined near Sandwich and Strafford in the Lakes region. Most of the material came from pegmatite deposits and from large silicified or fault zones. Map, scale 1 inch = 8 miles, showing distribution of deposits is included.

Newland, D. H., 1919, The mineral resources of the State of New York: N. Y. State Mus. Bull. 223–224, p. 154–156, 220–221, 241, 272–276.

The Shawangunk conglomerate, a hard, firmly cemented pebbly light-gray sandstone ranges from 50 to 300 feet in thickness, thinning northeastward. Millstones are quarried in the Shawangunk Mountain area, from the vicinity of High Falls, near Kingston, southwestward into New Jersey and Pennsylvania. Extensive quarrying has been done near Kyserike, St. Josen, Granite, and Kerhonkson. In the past it was quarried for glass sand at Ellenville.

Beach sand from the Oneida Lake region has been used for glass, fire, and core sand.

Potsdam sandstone crops out on the northern, eastern, and southern borders of the Adirondacks. The beds range from a few inches to more than 2 feet in thickness. Deposits in the vicinity of Moira and Bangor, Franklin County, have been worked for glass sand.

Quartzite of high quality occurs at Port Henry and Fort Ann. White granular sandstone 96 to 99 percent SiO_2 at Keck Center, Fulton County, is used for ferrosilicon manufacture. Poughquag quartzite occurs in the Highland region. It is very hard and tough, suitable for tube-mill lining, and probably for chemical and metallurgical purposes.

The Oriskany sandstone crops out at Oriskany Falls, Oneida, and near Union Springs, Cayuga County.

Vein quartz, used for abrasives, was quarried near Fort Ann and Port Henry.

Nixon, E. K., Runnels, R. T., and Kulstad, R. O., 1950, The Cheyenne sandstone of Barber, Comanche, and Kiowa Counties, Kans., as raw material for glass manufacture: Kans. Geol. Survey Bull. 86, pt. 3, p. 43–84.

Results of chemical, mineralogical, mechanical and spectrographic analyses show that Cheyenne sandstone (lower Cretaceous), which crops out in southern Kansas, is suitable for both glass and foundry sands. All data indicate that reserves are adequate for commercial operation of sands amenable to standard methods of beneficiation established by the American Ceramic Society and the National Bureau of Standards.

Nordberg, Bror, 1954, Producing high-grade silica from sandstone: Rock Products, v. 57, no. 4, p. 126–127, 130, 180, 182.

Sand for all grades of glass except optical is obtained from the Hardinsburg sandstone, 1 mile east of Marion, Ky. Daily production includes 12 carloads of glass and foundry sand. Includes description of plant and sieve analyses.

Oregon Department of Geology and Mineral Industries, 1951, State of Oregon map showing principal mineral deposits, scale 1:100,000; Key to Oregon mineral deposits map, by R. S. Mason: Oreg. Dept. Geology and Mineral Industries (Misc. paper no. 2).

Shows location of the following silica deposits:

Owen: T. 33 S., R. 12 W., Powers District, Curry County.
Bristol: sec. 30, T. 36 S., R. 3 W., Gold Hill District, Jackson County.
Hugo: sec. 5, T. 35 S., R. 6 W., Grants Pass District, Josephine County.
Hauser: T. 24 S., R. 13 W., Coos Bay District, Coos County.
Eugene: sec. 34, 35, T. 17 S., R. 4 W., Lane County.
Luckiamute: sec. 30, T. 9 S., R. 4 W., Polk County.

Oklahoma Geological Survey, 1942, Utilization of glass sand: Director's Bienn. Rept. 1941–42, p. 29–31.

Deposits of sand suitable for glass manufacture occur in Pontotoc, Johnston, Murray, Carter, Cherokee, and Love Counties. Analyses are given.

Page, L. R., and others, 1953, Pegmatite investigations 1942–1945, Black Hills, S. Dak.: U. S. Geol. Survey Prof. Paper 247, 228 p.

Discusses quartz occurring in pegmatite dikes in the Black Hills. Report includes 45 plates, 37 figures, and 4 tables.

Parker, J. M., III, 1952, Geology and structure of part of the Spruce Pine district, North Carolina: N. C. Dept. Conserv. Devel. Bull. 65, p. 21.

Discusses high-grade quartz occurring as cores or pods in pegmatites suit-

able for the manufacture of glass, and also fairly high silica quartz recovered as a byproduct from the froth-flotation production of feldspar. Geologic map, scale 1 inch = 2,000 feet, is included.

Parkinson, G. A., and Barnes, V. E., 1943, Grinding pebbles deposits in western Gulf Coastal Plain of Texas, *in* Texas mineral resources: Tex. Univ. Pub. 4301, p. 47–54 [1946].

Numerous deposits of flint suitable for grinding pebbles occur west of the Guadalupe River. The gravels of the Colorado and Brazos Rivers contain abundant flint pebbles unsuitable for grinding purposes. The stratigraphy, lithologic character, and source of many of the deposits are given. Map, scale about 1 inch = 75 miles, showing distribution by counties is included.

Parmelee, C. W., 1932, Progress report on the study of southern Illinois silica as a pottery material: Ill. Geol. Survey Rept. Inv. 24, p. 3–7.

Tripoli, locally called "silica," occurs in deposits that range in thickness from a few feet to almost 50 feet in the Clear Creek formation (Devonian). Results of investigations of southern Illinois tripoli for pottery manufacture are given. Tests show that quartz sand, "flint," and French pebble flint are superior to tripoli for this purpose.

Parmelee, C. W., and Harman, C. G., 1946, Southern Illinois novaculite and novaculite gravel for making silica refractories: Ill. Geol. Survey Rept. Inv. 117, 55 p.

Extensive deposits of novaculite and of novaculite gravel occur in Alexander and Union Counties. The novaculite is a cryptocrystalline material containing approximately 97 percent silica; novaculite gravel contains a small amount of clay. The character and properties of the novaculite when properly crushed, graded, bonded with lime, and fired correspond closely with commercial refractory silica brick. Better brick can be obtained by mixing with the novaculite a certain proportion of extremely fine grained silica or tripoli obtainable in the same area as the novaculite and novaculite gravel.

Patty, E. N., and Glover, S. L., 1921, The mineral resources of Washington with statistics for 1919: Wash. Geol. Survey Bull. 21, p. 111–113, 132–133.

Pegmatitic quartz deposit estimated to contain several million tons of almost pure quartz occurs as a hill, 650 feet in diameter, in sec. 14, T. 27 N., R. 42 E., 12 miles north of Spokane and 6 miles from the Great Northern Railway. The quartz is used chiefly to make silica brick.

The Denny-Renton Co. deposit on McClellan Pass Highway, east of Enumclaw, King County, and a deposit on the Siegmund ranch, 1 mile north of Clay City, Pierce County, supply material for use in the manufacture of silica brick.

Some molding sand has been produced in King, Spokane, and Pierce Counties.

Phalen, W. C., 1910, Description of the Johnstown quadrangle [Pennsylvania]: U. S. Geol. Survey Geol. Atlas, folio 174, p. 14.

Gives chemical analysis of glass sand from the Pottsville formation on the west flank of Laurel Ridge, near Seward.

Plummer, F. B., 1942?, A new quartz sand horizon in the Cambrian of Mason County, Tex.: Tex. Univ. Circ. 22, 2 p.

Erna sand (upper Cambrian) crops out along the valley of Leon Creek,

southeast of Erna. It is a pure very friable sand. Mechanical and chemical analyses and a sketch map, scale about 1 inch = 1 mile, showing sand localities are included.

Popoff, C. C., 1949, Investigation of silica deposits near the Skagit River, Skagit County, Wash.: U. S. Bur. Mines Rept. Inv. 4472, 16 p.

Describes three large vein quartz deposits near Marblemount. Analyses are included.

Price, P. H., 1929, Pocahontas County [W. Va.]: W. Va. Geol. Survey County Rept., p. 346–348.

Discusses the Droop sandstone, which covers several hundred acres on Droop Mountain. This sandstone meets the requirements of glass sand. The White Medina sandstone near Minnehaha Springs also offers possibilities for glass sand. Chemical analyses of the sand are given. Geologic and topographic maps, scale 1:62,000, are included.

——— 1938, Geology and natural resources of West Virginia: W. Va. Geol. Survey Repts., v. 10, p. 291, 335, 380–384.

Presents a general discussion on occurrences of high-grade silica sand and uses, production from 1902–23, and occurrences of "grindstone." Geologic map, scale 1 inch = 16 miles, is included.

Purdue, A. H., and Miser, H. D., 1923, Description of the Hot Springs district [Arkansas]: U. S. Geol. Survey Atlas, folio 215, p. 10–11.

Novaculite is quarried at several places on the mountain ridges northeast of Hot Springs. Two commercial types are described. The Arkansas stone is a homogeneous gritty stone, fine grained and siliceous. This type is used in the manufacture of oilstones, but it is best adapted to finishing the sharpening of tools that have had a preliminary sharpening with a coarser abrasive. The Ouachita (Washita) stone resembles the Arkansas stone but it is more porous, and has the appearance of unglazed porcelain. It is used mainly for making whetstones for larger tools.

The basal part of the Arkansas novaculite is composed almost wholly of silica, some of which may be suitable for making optical glass. The middle part of the formation has weathered to a soft porous fine-grained white to cream-colored tripoli.

Purdy, C. P., Jr., 1953, Directory of Washington mining operations, 1953: Wash. Dept. Conserv. Devel. Inf. Circ. 21, p. 4–5, 48, 50–53, 56, 59–60, 63.

Gives a list of the active mining operations in Washington and the current status of activities. Map, scale 1 inch = about 40 miles, shows silica deposits.

Quinn, Alonzo, Ray, R. G., and Seymour, W. L., 1948, Bedrock geology of the Pawtucket quadrangle, Rhode Island and Massachusetts, *in* The geology and ground-water resources of the Pawtucket quadrangle, Rhode Island: R. I. Indus. Comm. Geol. Bull. 3, p. 11–12, 18–19, 25.

Westboro quartzite occurs along the Blackstone River between Albion and Berkeley; although predominantly massive, thin beds of quartz-mica schist occurs throughout the formation. The thickness ranges from about 1,000 feet near Lonsdale to about 3,000 feet northwest of Ashton.

Vein quartz more than 1,000 feet wide and a mile long makes up the western face of Diamond Hill. Numerous quartz veins cut the Grant Mills

granodiorite west of Thompson Hill. Chemical analysis shows the quartz to be 98.7 percent SiO_2.

Ralston, O. C., 1937, Quartz and silica in Washington, *in* Annual report of the nonmetals division, fiscal year, 1937: U. S. Bur. Mines Inf. Circ. 6974, p. 11–13.

Vein quartz near Mica, Spokane County, can be used for glass, potter's flint, and ceramic glazes. The cost of mining and beneficiation of vein quartz in this area prevents it from competing with the Belgian sand.

Quartzites in Stevens County and the Wenatchee sands of the Swauk formation can be used for amber and colored glasses and possibly for abrasives in steel foundries.

Tertiary sandstones of Washington might be used for amber glass, where the feldspar content is low.

Richardson, C. H., 1920, The glass sands of Kentucky: Ky. Geol. Survey, ser. 6, v. 1, 149 p.

Gives a comprehensive discussion of sandstones, including the history of glass in the United States, classification of sands, raw materials, location of deposits, and analyses.

Ries, Heinrich, 1949, Special sands, *in* Industrial Minerals and Rocks: New York, Am. Inst. Min. Metall. Eng., 2d ed., p. 965–979.

The report gives the distribution, properties, mining methods, and specifications for preparation of sands for commercial use of glass, filter, abrasive, blasting, and steel molding sands. A bibliography is included.

Roalfe, G. D., 1937, New silica sand plant in Nevada: Rock Products, v. 40, no. 8, p. 86–87.

Describes silica deposits about 4 miles northwest of Arden on Salt Lake Route of Union Pacific Railroad. The silica is used in steel foundries. Estimated reserves are 25 million tons.

Rose, K. E., 1950, Silica sand from south-central Kansas for foundry use: Kans. Geol. Survey Bull. 86, pt. 4, p. 89–104.

Cheyenne sandstone of Barber, Comanche, and Kiowa Counties is said to be a satisfactory source of silica sand for preparing molding sand and cores. The Cheyenne sands are characterized by a low percentage of minus 140-mesh particles and by a broad grain-size distribution. Chemical and sieve analyses, cumulative curves, and a map, scale about 1 inch = 2 miles, showing localities are included.

Ross, D. W., 1919, Silica refractories—Factors affecting their quality and methods of testing the raw materials and finished ware: Bur. Standards Tech. Paper 116, 84 p.

Discusses the properties of silica refractories and the preparation necessary to obtain the best silica brick. The harder parts of the Medina formation in Blair and Huntingdon Counties, Pa., have proved particularly suited for steel furnace work. About 60 percent of the silica brick manufactured in the United States is made from this formation. The remainder comes largely from the Baraboo formation of Wisconsin. A table showing the geologic column with reference to commercial quartzites for silica refractories is included.

Rothrock, E. P., 1944, Mineral resources, part 3 *of* A geology of South Dakota: S. Dak. Geol. Survey Bull. 15, p. 147–154, 207.

Quartzites of the Sioux formation are in the valley of the Big Sioux River at Dell Rapids, Sioux Falls, East Sioux Falls, in the valley of the Vermillion River at Parker, in Wolf Creek at Salem, Pierre Creek at Alexandria, and in the James Valley south of Mitchell. The quartzite is more than 97 percent SiO_2. Chemically, the stone could be used for refractories, ganister, and silica brick. Tests and chemical analyses of the quarries at Sioux Falls and Dell Rapids are included.

Sampson, R. J., and Tucker, W. B., 1931, Feldspar, silica, andalusite, and cyanite deposits of California: Calif. Dept. Nat. Res., Div. Mines, Mining in California, v. 27, p. 432–450.

Describes the occurrence of silica deposits in California, giving some mechanical and chemical analyses. Map, scale 1 inch = 80 miles, shows location of the principal deposits.

Santmyers, R. M., 1931a, Quartz and silica—part 1, General summary: U. S. Bur. Mines Inf. Circ. 6472, 15 p.

Presents material introductory to three reports relative to occurrence and uses of quartz and silica. It also contains a flow sheet from deposit to consumer.

——— 1931b, Quartz and silica, part 2, Quartz, quartzite, and sandstone: U. S. Bur. Mines Inf. Circ. 6473, 20 p.

Presents data on uses, markets, prices and producers of optical quartz, piezoelectric quartz, fused quartz glass, agate, ferrosilicon, fluxing quartz, quartz for acid towers, fillers, refractories, ceramics, the abrasive industry, and dimension stone.

——— 1931c, Quartz and silica, part 3, Sand and miscellaneous silicas: U. S. Bur. Mines Inf. Circ. 6474, 17 p.

Gives uses, market prices, and other information on fused silica glass and silicon carbide; building, paving, molding, glass, fire or furnace, abrasive, filter, and engine sands; and roofing granules, sand-lime brick, tripoli, and diatomite.

Schafer, G. H., 1942, Rice sands in Polk and adjoining counties [Texas]: Tex. Univ. Circ. 41, p. 1–3.

"Rice sand," which contains a high percentage of quartz, occurs in Polk, Trinity, Tyler, and Walker Counties in the Jackson (Eocene), Catahoula (Oligocene), and Willis (Pliocene) formations. Deposits are briefly described and screen analyses of some of the deposits are given. This sand is suitable for molding sand.

Schrader, F. C., 1908, Description of the Independence quadrangle [Kansas]: U. S. Geol. Survey Geol. Atlas, folio 159.

Sandstone about 10 feet thick and suitable for making glass occurs in the Buxton formation 4 miles northwest and 2 miles north of Caney. Other exposures are farther north. A noteworthy deposit is in the SE1/4 sec. 22, Fall River Township, about 4 miles southwest of Fredonia. The rock is exposed over an area of 10 to 15 acres and is about 12 feet thick.

Schrader, F. C., Stone, R. W., and Sanford, Samuel, 1917, Useful minerals of the United States: U. S. Geol. Survey Bull. 624, 412 p.

The more important occurrences of useful minerals including silica are listed by States. Some of the deposits are briefly described.

Searle, A. B., 1923, Sands and crushed rocks; their uses in industry: London, Oxford Tech. Pubs., v. 2, p. 192–205.

Discusses silica glass, alkali glasses, purpose served by sand in glass, sources of sands, chemical and mineral composition, shape and size of grains, specification of sand for glass manufacture, preparation of glass sands, and testing.

Sellards, E. H., and Evans, G. L., 1943, Index to Texas mineral resources, *in* Texas mineral resources: Tex. Univ. Pub. 4301, p. 359–383, pl. 1 [1946]. *See also* Sellards and others, 1944.

Résumé of occurrence of silica in the State.

Sellards, E. H., Evans, G. L., and Hendricks, Leo, 1944, Mineral locality map of Texas, scale 1:1,000,000, *in* Texas mineral resources, 1943: Tex. Univ. Pub. 4301, pl. 1 [1946].

Map shows occurrence of minerals, rocks, oil and gas.

Shaw, E. W., and Munn, M. J., 1911, Description of the Foxburg and Clarion quadrangles [Pennsylvania]: U. S. Geol. Survey Geol. Atlas, folio 178, p. 17.

The Connoquenessing and Homewood sandstones are quarried near Upper Hillville and north of Foxburg. The rock is almost pure silica. Near Upper Hillville it is treated as ganister and made into silica brick. North of Foxburg it is used for molding sand, for grinding plate glass, and as engine traction sand.

Shaw, Edmund, 1937, Mining and milling methods and costs at the glass sand plant of P. J. Weisel, Inc., Corona, Calif.: U. S. Bur. Mines Inf. Circ. 6937, 16 p.

Includes a good description of marine sand deposits in an area about 25 miles long and 4 miles wide, sieve and chemical analyses, a flow sheet of the silica plant, and a locality map.

Shead, A. C., 1928, Chemical analyses of Oklahoma mineral raw materials: Okla. Univ. Bull. 14, p. 25–27, 80–83.

Gives location, description, and chemical analyses of the Burgen sandstone (lower Ordovician), Cherokee County; Silo sandstone (upper Cretaceous), Bryan County; Simpson sands (lower and upper Ordovician), Murray and Johnston Counties; and Trinity sands (lower Cretaceous), Johnston, Marshall, Carter, and Love Counties.

Sheakley, H. L., and Coolidge, D. J., 1942, Use of silica sand in the glass industry in Missouri: Am. Inst. Min. Metall. Eng. Tech. Pub. 1538, 6 p.

Describes in general the occurrence and distribution of the St. Peter sandstone in Missouri. Properties, mining methods, and comparative analyses of St. Peter sandstone from Crystal City are given.

Sherzer, W. H., 1917, Description of the Detroit district [Michigan]: U. S. Geol. Survey Geol. Atlas, folio 205, p. 18.

Sylvania sandstone, 7 miles northwest of Monroe, Monroe County, has been

mined for a number of years for glass and abrasive purposes. East of Rockwood, Wayne County, a pit opened through more than 15 feet of till has reached 75 feet of sand, and is said to be available for the same purposes. Analyses of both deposits are given.

Siebenthal, C. E., and Mesler, R. D., 1908, Tripoli deposits near Seneca, Mo.: U. S. Geol. Survey Bull. 340–J, p. 429–437.

Tripoli occurs in the Boone formation in the vicinity of Seneca and Racine. The deposits range in thickness from 4 to more than 12 feet, and overburden from 2 to more than 3 feet.

Analyses of tripoli near Senéca and a sketch map, scale 1 inch = about 2½ miles, showing location of deposits are included.

Singewald, J. T., Jr., 1928, Notes on feldspar, quartz, chrome, and manganese in Maryland: Md. Geol. Survey, v. 12, p. 131–157.

Gives production, uses, occurrences, distribution, quarrying, milling, and economic aspects of the Maryland flint industry. Map, scale 1 inch = 1 mile, showing locations of quarries in Harford County, and map, scale 1 inch = 3 miles, showing locations of quarries in Baltimore, Carroll, and Howard Counties, are included.

Smith, E. A., 1884, List of the ores and minerals of industrial importance occurring in Alabama: [Ala. Geol. Survey], p. 10.

Friable quartz rock occurs in T. 22 N., R. 16 E., in Chilton County, and also in Randolph, Tallapoosa, northwest Macon, Lee, Chambers, and other counties.

In the Tennessee Valley the siliceous cherty rocks of the lower Carboniferous period at many places yield a fine white friable silica that may be used for making glass.

Smith, W. H., 1949, Sand and gravel resources in northern Ohio: Ohio Geol. Survey Rept. Inv. 6, p. 20.

Describes production of silica and silica pebbles from the Sharon conglomerate which occurs in the western part of Jackson County, and in parts of Summit, Portage, and Geauga Counties. Outliers extend into parts of Medina, Cuyahoga, and Lake Counties. The Sharon is a medium- to coarse-grained sandstone containing scattered thin pebble beds. The parts most extensively quarried are the zones of true conglomerate containing large quantities of pebbles. These pebble zones form long, narrow north-south bands which represent deposition in channels cut into the underlying Mississippian rocks.

Sosman, R. B., 1927, The properties of silica: Am. Chem. Soc. Mon. Ser. 37, 885 p.

Discusses the fundamentals, phases and their transformations, symmetry and structure, thermal and mechanical energy, and applications of silica; also silica in the electric and magnetic fields and in the periodic electromagnetic field.

Spain, E. L., Jr., 1936, Tripoli deposits of the western Tennessee Valley: Am. Inst. Min. Metall. Eng. Tech. Pub. 700, 17 p.

The deposits described occur over the greater part of Wayne County and the southeast part of Hardin County, Tenn., and in the northeast and northwest part of Mississippi and Alabama, respectively. Origin and stratigraphy

are discussed. Analyses of tripoli from Hardin County, Tenn., and a map showing location of deposits of the western Tennessee Valley are included.

Stead, F. W., and Stose, G. W., 1943, Manganese and quartzite in the Lick Mountain district, Virginia: Va. Geol. Survey Bull. 59, p. 15–16.

Gives locations of Erwin quartzite deposits in the Lick Mountain district. Description of 3 quartzite workings and 7 analyses of quartzite ranging from 97.63 percent to 99.37 percent SiO_2 are listed.

Reserves for the Lick Mountain district are estimated at about 2 million tons of metallurgical grade quartzite.

Map, scale 1 inch = 200 feet, showing plan and sections of quartzite workings at the west end of Sand Mountain and map, scale 1:31,250, showing geology and structure sections of the Lick Mountain area are included.

Stenzel, H. B., 1938, Glass sands in Leon County, Tex.: Tex. Univ. Bur. Econ. Geology Circ. 9, 1 p.

Outcrops of the Carrizo, Queen City, and Sparta formations in Leon County furnish glass sand. Some beds are 40 feet thick. Sand soil produced by weathering from these beds is also suitable for glassmaking. These soils reach a thickness of more than 8 feet.

Stenzel, H. B., Fountain, H. G., Jenke, A. L., and Weissenborn, A. E., 1948, Natural abrasives, *in* Geological resources of the Trinity River tributary area in Oklahoma and Texas: Tex. Univ. Pub. 4824, p. 56–57, 60–61, 65.

Grinding pebbles occur in the gravel deposits of the major stream valleys in Texas. All production is in Bastrop, Frio, Llano, and Travis Counties. Texas produced 5,341 short tons in 1943.

Rice sand deposits occur in lenticular bodies near the base of the Catahoula formation (Tertiary) in Trinity, Polk, Walker, and San Jacinto Counties. It is believed reserves are large. Producers, localities, and mechanical analyses are listed. Map, scale 1 inch = 70 miles, showing occurrences is included.

Fine-grained quartzites and quartzitic sandstones of the Stanley and Jackfork (Pennsylvanian) formations in the Ouachita Mountain region of Oklahoma may be suitable for the manufacture of millstones and buhrstones.

Oklahoma novaculite (Devonian) occurs in central McCurtain County. Smaller exposures are known in the Potatoe Hills area in southeastern Latimer and northern Pushmataha Counties, and near Atoka and Stringtown, Atoka County. Map, scale 1 inch = 70 miles, shows outcrops.

Stoll, W. C., 1950, Mica and beryl pegmatites in Idaho and Montana: U. S. Geol. Survey Prof. Paper 229, 64 p.

Discusses quartz occurring in pegmatites in Idaho and Montana. Includes 9 plates, 25 figures, and 25 tables.

Stone, R. W., 1919, Sand and gravel, *in* Our mineral supplies: U. S. Geol. Survey Bull. 666–G, p. 47–49.

Gives a brief history of glass, molding, and abrasive sands, the productive States, and production figures.

——— 1925, Molding sands of Pennsylvania (preliminary report): Pa. Topog. Geol. Survey Bull. 87, 20 p.

The location of high-purity silica deposits in Butler, Elk, Erie, Jefferson, Lycoming, Mercer, Mifflin, and Venango Counties are listed. Mechanical tests of molding sands are included.

Stone, R. W., 1928, Molding sands of Pennsylvania: Pa. Geol. Survey, 4th ser., Bull. M 11, 94 p.

Deposits and operations are classified and described either as natural-bonded (low silica) molding sand or as silica and core sand. Mechanical analyses and resulting histograms are furnished on a large and representative list of samples. Map showing location of sand is included.

——— 1939, The minerals of Pennsylvania—Non-metallic minerals: Pa. Geol. Survey, 4th ser., Bull. M 18–C, p. 32–35.

Summarizes the occurrence, distribution, and development of vein quartz deposits in Adams, Chester, and Cumberland Counties, Pa.

Stose, G. W., 1932, Geology and mineral resources of Adams County, Pa.: Pa. Geol. Survey, 4th ser., Bull. C 1, p. 129–13.

Describes the occurrence, development, and utilization of vein quartz, Adams County, Pa. Geologic map, scale 1:125,000, and topographic map, scale 1:62,500, are included.

——— 1946, Structure of Lick Mountains, Va.: Am. Jour. Sci., v. 244, p. 189–199.

The Lick Mountains are a small isolated group of mountains in the Appalachian Valley about 8 miles north of the main front range. They are in an anticline exposing thick resistant Lower Cambrian quartzites in parallel south-dipping plates which are upthrust on their north sides. The Erwin quartzite is the most important formation in the study of the structure of the area. The main body of the formation is a massive resistant quartzite about 350 feet thick. Analyses of selected beds 60 to 80 feet thick are given.

Stose, G. W., and Jonas, A. I., 1933, Geology and mineral resources of the Middletown quadrangle, Pennsylvania: U. S. Geol. Survey Bull. 840, p. 12–17, 69–71.

Describes the occurrence and character of the Chickies quartzite in the Middleton quadrangle. Analysis and geologic map, scale 1:62,500, are included.

Stose, A. J., and Stose, G. W., 1944, Geology of the Hanover-York district, Pennsylvania: U. S. Geol. Survey Prof. Paper 204, p. 81.

Gives locations of quarries in Chickies quartzite, Chickies slate, and Antietam quartzite. Geologic map, scale 1:62,500, shows outcrops.

Stose, G. W., and Swartz, C. K., 1912, Description of the Pawpaw and Hancock quadrangles [Maryland–West Virginia–Pennsylvania]: U. S. Geol. Survey Atlas, folio 179, p. 21.

The Oriskany sandstone crops out in many places in the Pawpaw and Hancock quadrangles, but it is only pure enough for glass sand in the Warm Spring Ridge, which extends southwest in West Virginia from the Potomac River opposite Hancock, Md. The sandstone is pure quartz, white, medium to fine grained, and free from silt and other fine debris, except particles of milky cryptocrystalline silica. The oldest mine is 2 miles from Hancock, on top of Warm Spring Ridge. Several quarries are in operation. The sand is reported to contain 98 to 99.8 percent SiO_2.

Stout, Wilber, 1946, Mineral resources of Ohio: Ohio Geol. Survey Inf. Circ. 1 (revised), ser. 4, p. 20–23, 27–28, 31.

Summarizes the occurrence and distribution, and describes the mineralogy of sandstone, conglomerate, flint, and ganister in the State.

Stow, M. H., 1938, Conditions of sedimentation and sources of the Oriskany sandstone as indicated by petrology: Am. Assoc. Petroleum Geologists Bull., v. 22, p. 541–564.

Exposures of the Oriskany formation were examined, and samples collected between Monroe County, N. Y., and Monroe County, W. Va. The lithologic character of the Oriskany and adjacent formations at 10 localities is described. Samples were studied by the usual methods of sedimentary petrography.

Two distinctly different heavy mineral suites were found. The assemblage of tourmaline, zircon, rutile, leucoxene, indicative of derivation from sedimentary rocks, was characteristic of the Oriskany south of New York. The assemblage of garnet, hypersthene, kyanite, biotite, and amphiboles, in addition to those minerals just mentioned, is indicative of derivation from crystalline rocks as well as sedimentary rocks. This assemblage was confined to the Oriskany of New York.

The minerals indicate that south of New York the Oriskany sediments were derived from sedimentary formations exclusively, probably from Cambrian and Silurian sandstones, and that in the New York area they were derived from crystalline rocks of the Adirondacks as well as from sedimentary formations.

Map, scale about 1 inch = 100 miles, showing the generalized outcrop of Oriskany sandstone from Genessee County, N. Y., to Giles County, Va., is included.

Symons, H. H., 1946, California mineral production and directory of mineral producers, 1945: Calif. Div. Mines Bull. 137, p. 102–103.

Silica suitable for glass occurs in Contra Costa, Monterey, Riverside, and San Bernardino Counties. The industry is of limited importance because much of the available material is not of the quality to produce first-grade colorless glass. Total silica production in California since the beginning of the industry in 1899 is given.

Teas, L. P., 1921, Preliminary report on the sand and gravel deposits of Georgia: Ga. Geol. Survey Bull. 37, 392 p.

Includes a general discussion of classification, properties, uses, prospecting, production and marketing of sand and gravel; detailed descriptions of deposits by counties; chemical and screen analyses; map, scale 1:1,500,000, showing distribution of deposits; and bibliography.

Thiel, G. A., 1935, Sedimentary and petrographic analysis of the St. Peter sandstone: Geol. Soc. America Bull., v. 46, p. 559–613.

The St. Peter sandstone in Illinois, Missouri, Arkansas, and Oklahoma is a composite marine sandstone formed in a shallow sea characterized by retreats and readvances of the marine environment. The upper 6 or 8 feet of the St. Peter sandstone in the upper Mississippi Valley is much coarser grained than the lower levels. The sands 10 to 40 feet from the top of the formation are more rounded and frosted in the area of the upper Mississippi Valley; however, there is a decrease in grain size from north-central Illinois northward to the present margin of the formation. The sands of the St. Peter are too well sorted and rounded to have been derived directly from an area of maturely weathered granite.

Samples of the St. Peter sandstone were collected in Arkansas, Oklahoma, Missouri, Illinois, Iowa, Wisconsin, and Minnesota and were subjected to uniform laboratory tests and methods of calculating textural analysis, heavy residuals, and other characteristics of correlative value.

Thiel, G. A., and Schwartz, G. M., 1932, Geology and development of Minnesota's nonmetallic-mineral resources: Pit and Quarry, v. 24, no. 6, p. 24–28.

Describes quarries in Sioux quartzite (upper Huronian) in Nicollet, Pipestone, Cottonwood, Rock, and Watonwan Counties. Quartzite also occurs north of the Mesabi range in St. Louis County. Much of this material is used for ball-mill liners and grinding pebbles.

The Jordan (upper Cambrian) sandstone crops out along the Minnesota River and the Mississippi River below Red Wing. The sandstone is almost pure silica and is used in the glass industry. The St. Peter (lower Ordovician) sandstone is exposed in Minneapolis and St. Paul; it consists of about 200 feet of almost pure silica sand, but the iron content is too high for making cores.

Formations that are used for foundry sands are the Sioux quartzite, Jordan sandstone, Kettle River sandstone, and St. Peter sandstone.

Trainer, D. W., Jr., 1927, The geology of molding sand deposits: Am. Foundrymen's Assoc. Repr. 428, 11 p.

Discusses types of molding sand deposits: lake, commonly of glacial origin, terrace; deposits along abandoned drainage lines, those of estuarine character; deposits associated with terminal moraine material; those in terraces of outwash material; marine; those along the shores of present lakes, and dunes.

——— 1928a, The molding sands of Maryland: Md. Geol. Survey, v. 12, p. 29–89.

Discusses the requisite properties of molding sands; permeability, bond strength, general geology of molding sand deposits, occurrence and properties of the deposits. Describes occurrences in the State.

——— 1928b, Molding sands of Wisconsin: Wis. Geol. Nat. History Survey Bull. 69, p. 21–22, 23, 43, 55, 78–93.

No steel molding sands are produced in Wisconsin. Blast sand, known as "Red flint" because of its red color, is produced for cleaning castings. Deposit in SW1/4 NW1/4 sec. 15, T. 17 N., R. 13 E., Green Lake County, 1 mile south of Chicago, Milwaukee, St. Paul and Pacific Railroad may be a possible source for steel molding sands. Samples taken from this deposit are steel sand grade.

Possible sources for steel molding sands are in Fond du Lac, Green Lake, Columbia, Sauk, La Crosse, and Buffalo Counties. The St. Peter sandstone is in general too fine for steel sands but excellent for core sand.

Future prospecting of outwash terraces or sand plains for sources of coarse molding sand and of glacial lake deposits of the Berlin district for sources of fine molding and core sands may prove profitable. Samples from Cambrian sandstone are of steel sand grade.

Mechanical analyses are included.

Tuck, Ralph, 1930, Classification and specifications of siliceous sands: Econ. Geology, v. 25, p. 57–64.

Gives definitions of sand from various sources. The properties are the amount of clay, mineralogic composition, purity, size of grain, distributed grading, uniformity of grain size, and the angularity of the individual grains. Classifying sands according to uses cannot be done successfully, because the same sand may be adapted to several uses. Table of classification and specifications of siliceous sands, some sieve tests, and a selected bibliography are included.

Tucker, W. B., and Sampson, R. J., 1931, Nonmetallic minerals; Calif. Dept. Nat. Res., Div. Mines, Mining in California, v. 27, p. 376–377.

Emsco ganister deposits are approximately 2½ miles northeast of Wilde siding on the Santa Fe Railway, about 20 miles northeast of Oro Grande. The entire upper part of the cone-shaped hill is composed of quartzite, about 200 feet thick. This property is abandoned, and operations have been transferred to a similar deposit approximately 9 miles east and slightly north of Victorville. Here the quarry face is 300 feet long and 20 feet high. The quarry is about 1 mile from the railroad.

The Kennedy, or Atlas Fire Brick Co. deposit, is about 4 miles northwest of Wilde siding on the Santa Fe Railway. The deposit is similar to the Emsco deposit and is probably a continuation of the same quartzite belt.

Turner, M. D., 1950, Sand and gravel, *in* Mineral commodities of California: Calif. Div. Mines Bull. 156, p. 254–258.

Descriptive report giving the geologic formation, mining methods, and locations of foundry sand, ganister, and glass sand in California.

Twenhofel, W. H., 1946, Mineralogical and physical composition of the sands of the Oregon coast from Coos Bay to the mouth of the Columbia River: Oreg. Dept. Geology and Mineral Industries Bull. 30, 65 p.

Describes the beach sands of the area and includes many chemical and mechanical analyses.

Tyler, P. M., 1950, Special methods for the beneficiation of glass sand: Am. Inst. Min. Metall. Eng. Trans., v. 187, p. 1139–1142.

Methods are given for the beneficiation of the poorer quality glass sand deposits.

United States Bureau of Mines, 1924–31: Mineral resources of the United States.

These annual publications list statistics on silica production, consumption, uses, prices, imports, and exports. Domestic production generally reviewed by States. Includes brief statements on annual developments in the silica industry.

——— 1932–52: Minerals Yearbook.

These annual publications list statistics on silica production, consumption, uses, prices, imports, and exports. Domestic production generally reviewed by States. Includes brief statements on annual developments in the silica industry.

United States Geological Survey, 1882–1923: Mineral resources of the United States.

These annual publications list statistics on silica production, consumption, uses, prices, imports, and exports. Domestic production generally reviewed by

States. Includes brief statements on annual developments in the silica industry, with certain volumes going into more detail on occurrence and resources.

Utley, H. F., 1942, Crude silica-sand output doubled to meet war demands of foundries: Pit and Quarry, v. 35, no. 2, p. 41–44.

Outcrops of St. Peter sandstone in the vicinity of Ottawa, Ill., provide practically pure silica sand, most of which is sold to steel foundries as molding sand and for core making. Best exposed in the bluffs along the Illinois and Fox Rivers. Maximum overburden 38 feet. Analyses of seven types of crude sand produced at Ottawa are included.

Valentine, G. M., 1949, Inventory of Washington minerals, part 1, Nonmetallic minerals: Wash. Dept. Conserv. Devel., Div. Mines and Geology Bull. 37, p. 73, 75, 89–91, 93–94.

Résumé of occurrence and economic uses of deposits of vein quartz, silica sand, sandstone, and quartzite in the State. Map, scale about 1 inch = 23 miles, shows occurrences.

Vanderwilt, J. W., 1947, Mineral resources of Colorado, part 1, Metals, nonmetals, and fuels: Colo. Min. Res. Board [Bull.], p. 262–264.

Describes three sandstone beds about 3 miles southeast of Waterton in Douglas County and another bed about three-fourths of a mile north of Waterton in Jefferson County.

The Molding Sand Quarry, Helmer Quarry, Kassler Quarry, Little Quarry, and Roxborough Park deposit are discussed, giving location and chemical analysis for each deposit. Location map, scale about 1 inch = 40 miles, is included.

Vernon, R. O., 1943, Florida mineral industry: Fla. Geol. Survey Bull. 24, p. 121–139.

Subrounded quartz and quartzite pebbles, together with minor amounts of chert, limonitic sandstone, and limestone occur as stream deposits in the Escambia, Apalachicola, Flint, and Chattahoochee Rivers. These deposits might be of commercial value. Mining of sand and gravel in Florida is done by dredging; some small operations are roadside pits. The sand industry is in Polk, Hillsborough, Orange, Putnam, and Dade Counties. The high-grade sand is used for blasting, glass sand, and filter aggregates.

Vestal, F. E., 1938, Tripoli deposits of Mississippi, *in* Tripoli deposits of western Tennessee and Mississippi: Knoxville, Tenn. Valley Authority, Water Control Plan. Dept., Geol. Div., Geol. Bull. 8, p. 8–12.

The best known tripoli deposits is about 1 mile southwest of Eastport. The tripoli deposits in Mississippi are part of the Iuka formation of the lower Iowa series of the Mississippian system. Appreciable quantities of tripoli have been shipped from a mine in the SW1/4 sec. 26, T. 2 S., R. 11 E.

——— 1950, Carroll County geology [Mississippi]: Miss. Geol. Survey Bull. 67, p. 55, 61, 93.

Sand in the channel of Palusha Creek, sec. 35, T. 19 N., R. 3 E., near the southern boundary, and sands from the Coila Creek, NE1/4 sec. 4, T. 17 N., R. 2 E., might be used for the manufacture of green or amber glass.

Voskull, W. H., and Sweeny, A. R., 1936, Illinois mineral industry in 1934: Ill. Geol. Survey Rept. Inv. 39, p. 40–48.

Treats briefly the economic possibilities of the uses of glass sand in Illinois, distribution of glass manufacturing industry in the United States, and the glass market.

Wadell, Hakon, 1935, Volume, shape, and roundness of quartz particles: Jour. Geology, v. 43, p. 250–280.

The report discusses the methods of measuring the volume, shape, and roundness of sedimentary quartz particles.

Watson, T. L., 1907, Mineral resources of Virginia: Lynchburg, Va., J. P. Bell Co. (Virginia-Jamestown Exposition Comm.), p. 216, 392–396.

Glass sand is derived from the Potsdam sandstone along the eastern edge of the Middle Valley region. Deposits of high grade sand occur at Balcony Falls, Rockbridge County; at Stapleton Mills, Amherst County; about 9 miles northwest of Salem, Roanoke County; at the foot of Potsdam Mountain, southeast of Greenville, Augusta County; and in the vicinity of Waynesboro. Includes analyses.

Molding sands of superior quality, strength, and a certain degree of fineness are found in the Coastal Plain. Chemical analyses and physical tests are given on molding sands in the vicinity of Richmond, Petersburg, and Fredericksburg.

Quartz has been mined from large pegmatite dikes near Amelia Court House, Amelia County, and from a bedded deposit in crystalline schists near Falls Church, Fairfax County. White pure crystalline quartz occurs three-fourths of a mile west of Wirtz Post Office, Franklin County.

——— 1919, Glass-sand resources of Virginia: Am. Ceramic Soc. Jour., v. 2, p. 794–803.

Summarizes the occurrence and stratigraphic distribution of sands, sandstones, and quartzites considered sources of silica raw material suitable for glassmaking in the State. Analyses are included.

Weidman, P. A., 1942, The Berea sandstone of the Cleveland area: Ohio State Univ. Eng. Expt. Sta. News, v. 14, no. 5, p. 14–21.

The Berea sandstone of the Waverly series (Mississippian) occurs as an irregular band in the southeastern part of Ashtabula County. It crops out westward through Lake, Geauga, Cuyahoga, Lorain, and Erie Counties, and then turns southward at Norwalk to form a broad north-south belt extending to the Ohio River. Thickness varies from 50 to more than 225 feet. A description of the geology, physical character, and mineralogy of the sandstone is given, including some chemical analyses.

Weidman, Samuel, 1904, The Baraboo iron-bearing district of Wisconsin: Wis. Geol. Nat. History Survey Bull. 13, Econ. Ser. 8, p. 1–2, 22–46.

The Baraboo district in Sauk and Columbia Counties, Wis., is about 28 miles long, and ranges from 2 to 12 miles in width. The area is about 225 square miles. The Baraboo quartzite occurs throughout the largest part of the district. This quartzite is hard, brittle, vitreous, and consists of rounded medium-sized grains of quartz cemented by secondary quartz.

Massive beds of quartzite vary in thickness and at many places are interleaved with quartz schist. Describes the structure of the Baraboo quartzite localities.

Geological map, scale 1 inch = 1 mile, of the district is included.

——— 1907, The geology of north-central Wisconsin: Wis. Geol. Nat. History Survey Bull. 16, Sci. Ser. 4, p. 41–53, 82–84, 366–408, 560–563, 600–603.

Discusses the Rib Hill and Powers Bluff quartzites, giving their occurrence and petrographic character. Analysis of the Rib Hill quartzite shows 99.07 percent SiO_2. Thin sections of the Powers Bluff quartzite closely resemble sections of the medium-grained Rib Hill quartzite. The Potsdam sandstone and its conglomeratic beds are described. Geologic map, scale 1 inch = 3 miles, and outcrop maps, scale about 1 inch = 1½ miles, are included.

Weigel, W. M., 1926, Preparation and use of industrial special sands: Am. Inst. Min. Metall. Eng. Trans. 1569–H, 14 p.

Special sands are those classified as filter, sand blast, potter, flooring, fire or engine, standard, burnishing sands, sand for magnesium oxychloride cement-plasters, and sand for chemical and metallurgical uses. New Jersey, Pennsylvania, West Virginia, Ohio, Illinois, Minnesota, and Missouri produce some of these sands. Mining methods, some uses and properties of the sands, and possible fields for research are discussed.

——— 1927, Technology and uses of silica and sand: U. S. Bur. Mines Bull. 266, 204 p.

Summarizes mining and quarrying methods and uses of silica and sand in the United States and foreign countries. Chemical and screen specifications used by manufacturers are included.

Wells, F. G., Gates, G. O., Grantham, R. M., and others, 1940, Preliminary geologic map of the Grants Pass quadrangle, Oregon: Oreg. Dept. Geology and Mineral Industries, scale 1:125,000.

Discusses silica deposit of very pure quality is in the SE1/4 sec. 30, T. 36 S., R. 3 W., Jackson County. The deposit occurs as a lens-shaped body about 1,000 feet long and 200 feet wide. The silica generally is pure and white but is impure along the western edge of the lens.

Whitlatch, G. I., 1937, Tripoli: Tenn. Dept. Conserv., Div. Geology Markets Circ. 1, p. 3–12.

Occurrence and general uses of tripoli in the Missouri-Oklahoma and Illinois-Tennessee areas are described. Analyses are included.

——— 1938, The ceramic resources of Tennessee: Am. Ceramic Soc. Bull., v. 17, p. 290–291.

Glass sand and potter's flint, 99 percent SiO_2, occur in the Sewanee conglomerate, of the Cumberland Plateau area.

Molding sand is mined from the Ripley formation (Cretaceous) in Benton and Carroll Counties. The annual production is estimated to be 30,000 tons.

Tripoli occurs in extensive deposits along the western valley of the Tennessee River. It is milled at Collinwood, and analyses show more than 99 percent SiO_2 and less than 0.02 percent Fe_2O_3.

Whittemore, J. W., and Dear, P. S., 1940, Ceramic silica possibilities in Virginia: Va. Polytech. Inst., Eng. Expt. Sta. Ser. Bull. 43, 23 p.

Requirements of silica sand for the ceramic industries are discussed, publications on ceramic silica in Virginia are reviewed, and ceramic silica plants in Virginia are described.

Petrographic examinations and mechanical and chemical analyses have been made on many samples from different parts of the State. The results are discussed with reference to ceramic silica possibilities. These studies indicate that many silica deposits suitable for use as ceramic raw materials are favorably located for quarrying with respect to transportation and abundant fuel supplies.

Wilkerson, A. S., and Comeforo, J. E., 1948, Some New Jersey glass sands: Rutgers Univ. Bur. Mineral Research Bull. 1, 155 p.

The field relations, mineral and chemical composition, and results of laboratory beneficiation of 24 silica sand samples are described. The samples were collected in central and southern New Jersey, south and east of New Brunswick and Trenton. Of the 24 samples collected, 19 were found suitable, after treatment, for use as high-quality glass sand. The mineralogy, methods of treatment, and uses of the sands are discussed. Map, scale 1 inch = 27 miles, showing locations is included.

Willman, H. B., and Payne, J. N., 1942, Geology and mineral resources of the Marseilles, Ottawa, and Streator quadrangles [Illinois]: Ill. Geol. Survey Bull. 66, p. 71–80, 234–243, 344–348.

The St. Peter sandstone crops out along the Illinois valley west from Fox River to the west side of the Ottawa quadrangle and forms high bluffs along both sides of the valley west of Buffalo Rock. It also is exposed in the eastern part of the LaSalle quadrangle, west of the Ottawa quadrangle, and along Fox River Valley, with small outcrops along Indian, Buck, and Crooked Leg Creeks in the Ottawa quadrangle, and Brumbach and Mission Creeks in the Marseilles quadrangle.

The mineralogical and chemical composition of the deposits are described. Many chemical analyses show SiO_2 content greater than 97 percent; average SiO_2 content after beneficiation, 99 percent. Maps included are geologic map of Ottawa and Marseilles quadrangles, scale 1:62,500; bedrock topographic maps, Ottawa and Marseilles quadrangles, scale 1:62,500; isopach maps showing thickness of St. Peter-Glenwood formations, scale 1 inch = 5 miles; and map showing graphic logs of deep wells in north-central Illinois, scale 1 inch = 5 miles.

Wilson, E. D., and Roseveare, G. H., 1949, Arizona nonmetallics; a summary of past production and present operations (revised): Ariz. Bur. Mines Bull. 155, Mineral Tech. Ser. 42, v. 20, no. 2, p. 41, 44.

Quartzite for reverberatory furnace lining has been produced from a deposit west of Douglas. A few thousand tons of silica was mined from the Dixie claims, 40 miles northeast of Phoenix. Sand from the Coconino sandstone (Permian) at Meteor Crater, 18 miles west of Winslow, is used for the manufacture of glass and in the foundry industry.

Wilson, Hewitt, Skinner, K. G., and Couch, A. H., 1942, Silica sands of Washington: Wash. Univ. Eng. Expt. Sta. Bull. 108, p. 21–22, 32, 45–46, 48, 52–53.

Many silica deposits occur in Washington, but most are not high enough in silica content, or contain too many impurities, to be used in the glass and steel industries. Vein deposits in Eocene sandstone may be developed if factors other than quality are favorable.

The Brown deposit is in the Swauk formation, 2 miles from Appleyard, Chelan County. Thickness ranges from 150 to 200 feet and estimated reserves are 430,000 tons. Sample of this deposit showed 99.4 percent SiO_2 and 0.1 percent Fe.

Brooke deposit, at Hammer Bluff, King County, contains 97.2 percent SiO_2 and 0.1 percent Fe.

Siegmund deposit is in sec. 30, T. 17 N., R. 4 E., Pierce County. The SiO_2 content is 95.1 percent and Fe is 0.6 percent.

Stoner deposit is three-fourths of a mile north of the Jennings and Nestes bridge, Skagit County. The SiO_2 content is 99.6 percent and Fe is 0.13 percent.

Scheel deposit is in sec. 16, T. 36 N., R. 11 E., Skagit County. The SiO_2 content is 99 percent and Fe is 0.47 percent.

Sample of vein quartz in NW1/4 sec 17, T. 40 N., R. 4 E., Whatcom County, showed 99.3 percent SiO_2 and 0.3 percent Fe.

Map showing localities of sampled sand deposits is included.

Wilson, Hewitt, and Zvanut, F. J., 1936, Properties of quartz sands washed from kaolins of the Pacific Northwest: Wash. Univ. Eng. Expt. Sta. Bull. 88, 42 p.

Studies were made of the purification of quartz sand and the removal of muscovite mica and heavy iron minerals in the Spokane district of eastern Washington and in Latah County, Idaho. After beneficiation, colored glass is made from sands at Troy, Idaho, and Mica, Wash. These studies were made to determine the possibility of utilizing the quartz recovered from the purification of kaolin. Tests and sieve analyses and suggested flow sheet for kaolin washing and sand concentration are included.

Witherow, C. N., 1933, Silica as a refractory material: Brick and Clay Record, v. 82, p. 123–124, 137, 164–165, 171, 208–209.

Discusses the properties of silica, silica in special refractories, its physical and chemical nature, its reaction to heat, physical forms of silica, silicate minerals, and properties of fused silica. Types of sandstones and quartzites and sillimanite and mullite refractories are also discussed. Chemical analyses are included.

Woodward, H. P., 1932, Geology and mineral resources of the Roanoke area, Virginia: Va. Geol. Survey Bull. 34, p. 136–137.

Sands from the Clinch and Clinton sandstones near Roanoke and deposits in the Catawba Valley, about 9 miles northeast of Salem, were used for making glass. In general, the sandstones of the Price formation are too clayey and carbonaceous for making glass.

Analyses of sand and sandstone from Catawba Mountain and Catawba Valley are given. Map, scale 1:125,000, showing the geology of the Roanoke area and map, scale 1 inch = 1 mile, showing geologic structure sections across the Roanoke area are included.

Woodward, T. P., and Guena, A. J., Jr., 1941, The sand and gravel deposits of Louisiana: La. Geol. Survey Bull. 19, 365 p.

Report consists mainly of data sheets for each locality, listed alphabetically by parish. Many sieve and some chemical analyses are included. In most places the silica content is high, but the iron content is also somewhat high for use in the glass industry.

Map, scale 1 inch = 12 miles, showing localities and map, scale 1 inch = 4 miles, showing general geology are also included.

Wright, L. A., 1948, California foundry sands: Calif. Jour. Mines and Geology, v. 44, p. 37–72.

California is self-sufficient in foundry sands of all general types except high-grade silica sands. Five dune areas along the California coast, at San Francisco, Lapis, Del Monte (Moss Beach), Oceano Beach, and El Segundo Beach are contributing clay-free felspathic sands. These sands are suitable for cores.

Three foundry sands produced in California have silica contents high enough to meet steel-casting requirements. Two of these are obtained from the Eocene sediments west of Mount Diablo in Contra Costa County; the third is a machine-crushed silica rock from a deposit near Montrose in southern California.

Two natural mixtures of refractory clay and high silica sand, are used as patching materials and to a lesser degree, in synthetic sand mixes. Both are from Eocene sediments, one from the Livermore area, the other from the vicinity of Trabuco Canyon in the Santa Ana Mountains.

Many sieve analyses and a few chemical analyses are included.

Wright, L. A., Stewart, R. M., Gay, T. E., Jr., and Hazenbush, G. C., 1953, Mines and mineral deposits of San Bernardino County, Calif.: Calif. Jour. Mines and Geology, v. 49, p. 4–5, 196–197.

Silica (quartz) recently has been produced in San Bernardino County. The principal sources are quartzite beds and lenses in the Paleozoic metamorphic series near Oro Grande and Barstow. Felsite from the Ivanpah deposit in the Castle Mountains also is marketed as a silica rock. It is used chiefly in refractories and in sulfate-resistant cement. Map, scale 1 inch = 80 miles, showing distribution of silica is included.

Wyer, S. S., 1922, The Smithsonian Institution's study of natural resources applied to Pennsylvania's resources: U. S. Natl. Mus., p. 86–91, 109–112.

Discusses glass sand and the manufacture of glass. The glass industry is confined to the western and central part of the State; the latter area is more important in production and quality of sand.

Deposits occur at Falls Creek, Clearfield County; Daguscahonda, Elk County; at Dunbar and along the Monongahela River near Belle Vernon, Fayette County; in the vicinity of Mapleton, Huntingdon County; in Jefferson County; in the vicinity of Vineyard and at Granville along the main line of the Pennsylvania Railroad between Huntingdon and Lewistown, Mifflin County; at Kennerdell and Rockmere station near Oil City, Venango County; in Warren County; and in Westmoreland County. Map, scale 1 inch = 28 miles, showing glass sand quarries and plants is included.

Cambrian sandstone, quarried for whetstone, occurs in the South Mountains near Allentown, Lehigh County.

Ganister is mined for silica brick at Pattonsville, Bedford County; McKee

Gap and Point View, Blair County; Water Street Gap, Huntingdon County; Beartown, Lancaster County; Edge Hill, Montgomery County; and near Bowmans, Carbon County.

Millstone occurs at East Earl and Lincoln, Lancaster County.

Crushed quartzite is produced at Exton and Honeybrook, Chester County, for fire sand.

Quartz-mica schist is quarried at Edge Hill and Glenside, Montgomery County. It is used for the manufacture of cupola blocks, furnace bricks, silica bricks, and fire mortar.

Anonymous, 1926a, Nevada Pacific Company plans extensive operations: Pit and Quarry, v. 13, no. 1, p. 92–93.

Deposit of 640 acres of silica sand occurs near Las Vegas on the Salt Lake Route of the Union Pacific Railroad. The sand grains are round and compare in quality to the Ottawa silica. Used in foundries and for glass manufacture. The exposed deposit is estimated to contain 100 million tons.

——— 1926b, New modern silica sand operation opens up in Wisconsin: Pit and Quarry, v. 12, no. 4, p. 103–104.

A sandstone deposit occurs on a 35-acre tract 5 miles north of Westfield, Marquette County. Tests show that the sandstone averages 99 percent SiO_2 and is very low in impurities. The sand grains are sharp, and the fusion point is 3,128°F.

The report describes the operation of the plant, which has a crushing capacity of 150 to 200 tons per hour, with a drying and screening capacity of 50 tons per hour.

——— 1926c, New plant makes sand-lime brick from pure silica deposit: Rock Products, v. 29, no. 14, p. 53–55.

In Florida, sand containing 99.6 percent SiO_2 and practically free from iron occurs 7 miles from Lakeland, near Galloway. The deposit is 13 feet deep; the lower half is below the water table. Brick is now being made from this sand. Because of its purity, it would also make excellent glass sand.

——— 1926d, Possibilities for the glass industry in the South: Glass Worker, v. 45, no. 19, p. 15.

Glass sand occurs in three areas in Oklahoma; the most extensive is in the Arbuckle Mountains. The Trinity sandstone occurs in the southeastern part of the State. In the northeastern part of the State, the Bergen sandstone is 50 to 100 feet thick.

The St. Peter sandstone (Ordovician) is exposed in Missouri and Arkansas. It is composed of very pure quartz sand, averaging more than 99 percent SiO_2 and less than 0.10 percent Fe. The formation averages 80 feet in thickness and crops out in a belt 150 miles long and as much as 15 miles wide. The sand is uniform in grain size, averaging about 0.154 mm. The maximum thickness is 200 feet. In the past 2 years nearly 90,000 yards of sand were produced at one of three exposures. Some of the glass sand used in Arkansas comes from Oklahoma.

Of the southern States east of the Mississippi, West Virginia has the most important glass sand deposits. The Piedmont province contains deposits of pure quartzite used for making glass. The Cambrian and Silurian formations in the mountain province are the most important sources of glass sand. The Clinch sandstone (Silurian) is exceptionally pure and may be used for optical glass. The same formation in Tennessee is reported to have favorable outcrops for furnishing good glass sand. Glass is also made from the sands dredged from the St. Johns River, Fla.

Anonymous, 1926e, Silica sand taken out by dredging: Rock Products, v. 29, no. 15, p. 48–49.

Chemical analyses of silica sand near Millville, N. J., is about 99.5 percent SiO_2. Some of the unwashed sand was used for chemical glassware. All the sand can be washed to an exceptionally pure grade or glass and silicate of soda. The deposit contains some gravel and large amounts of molding sand.

——— 1926f, Underground mining protects purity: Pit and Quarry, v. 12, no. 9, p. 93–95.

The St. Peter sandstone mined at Pacific, Mo., is known locally as the Pacific, Crystal City, and Cap au Gres sandstone. The formation is massive and shows indistinct bedding. It averages more than 99.0 percent SiO_2 and less than 0.01 percent Fe_2O_3.

——— 1932, Shenandoah Silica Company builds new mill: Ceramic Age, v. 20, no. 5, p. 181–182.

Silica deposit on Cold Run Ridge near Gore, Va., has the same pure quartz sand as other deposits in the Oriskany sandstone and is similar to the deposit at Berkeley Springs, W. Va. The sandstone crops out on the side of the ridge in beds 4 to 7 feet thick, which dip about 45° toward the base of the mountain. Drilling and blasting are necessary in quarrying. The deposit is near rail transportation.

——— 1944, Alabama today and tomorrow: Manufacturers Record, v. 113, no. 8, p. 87.

Molding sand is obtained at several localities near the foundry industries of Birmingham, Gadsden, and Anniston. Production of molding sand in 1942 was 105,371 tons. Deposits of glass sand occur in Baldwin County near the Gulf Coast and in Calhoun County in northeast Alabama. These sands are of the highest grade used by the glass industry, including sand for plate and optical glass.

——— 1946, Sand and gravel covers coastal plain: Rock Products, v. 49, no. 5, p. 78, 82.

Glass sand (99 percent SiO_2) is obtained at Gate City, Ala., from sandstone of lower Carboniferous age.

The Tuscaloosa formation (Cretaceous) contains a practically unlimited supply of all grades of sands, and some parts of the Ripley formation (upper Cretaceous) has some excellent sands, including glass sand.

Map showing distribution of silica sand, Gate City, Jefferson County, and Ohatchee, Calhoun County, is included.

——— 1953a, Jeanette Creek Mining and Development Co.: Eng. Min. Jour., v. 154, p. 140.

A large silica deposit is being developed about a mile north of Bergdorf, Idaho County, Idaho.

——— 1953b, Min. World, v. 15, no. 2, p. 103.

Four companies in the Northwest obtain silica from a quarry at Denison, Wash. In 1952, this quarry produced 140,000 tons of silica.

Anonymous, 1953c, Processing silica for refractory brick: Rock Products, v. 56, no. 9, p. 114, 116, 118, 120.

The Sharon conglomerate (Pennsylvanian) is quarried 6 miles north of Windham near Nelson's Ledges, Ohio. This very friable quartz conglomerate average 60 feet in thickness. The overburden is 5 to 20 feet thick.

Two types of refractory silica brick are made from this rock. One consists of about 96 percent SiO_2; 1–2 percent oxides, in which Al_2O_3 and Fe_2O_3 predominate; and 2–3 percent lime which is added as a bond. The second type, used in higher temperature furnaces, is quality controlled so that the total content of alumina, titania, and alkalies does not exceed 0.5 percent.

A flow sheet of operations in the manufacture of refractory brick accompanies the article.

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