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2009 Minerals Yearbook

ZEOLITES [ADVANCE RELEASE]

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ZEOLITES

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In 2009, natural zeolites were mined by 10 companies in the United States, with one other company working from stockpiled materials or zeolites purchased from other producers for resale. Mine production was 59,500 metric tons (t) in 2009 compared with 60,100 t in 2008, and U.S. consumption was 59,400 t in 2009 compared with 58,500 t in 2008. The major markets were in animal feed, odor control, pet litter, water purification, in decreasing order by tonnage. These four applications accounted for more than 75% of domestic consumption. Exports of natural zeolites (other than gem quality) were estimated to be less than 500 t, and imports were estimated to be less than 200 t. World production was estimated to be in the range of 2.8 million to 3.3 million metric tons (Mt).

Commercial zeolite deposits in the United States are associated with the alteration of volcanic tuffs in alkaline lake deposits and open hydrologic systems. In the United States, these deposits are in Arizona, California, Idaho, Nevada, New Mexico, Oregon, Texas, and Wyoming. Zeolites in these deposits are chabazite, clinoptilolite, erionite, mordenite, and phillipsite. Other components, such as orthoclase and plagioclase feldspars, montmorillonite, opal, quartz, and volcanic glass, are present in some deposits.

Production

Domestic data for natural zeolites were collected by means of a voluntary survey of the domestic mining industry. Survey forms were sent to 11 companies, and 9 responded. Responses accounted for more than 98% of the production and end-use data.

Conventional open pit mining techniques are used to mine natural zeolites. The overburden is removed to allow access to the ore. The ore may be blasted or stripped for processing by using front-end loaders or tractors equipped with ripper blades. In processing, the ore is crushed, dried, and milled. The milled ore may be air-classified based on particle size and shipped in bags or bulk. The crushed product may be screened to remove fine material when a granular product is required, and some pelletized products are produced from fine material. Producers also may modify the properties of the zeolite or blend their zeolite products with other materials before sale to enhance their performance.

Ten companies mined natural zeolites in the United States in 2009. One company did not mine zeolites during the year but sold from stocks or purchased zeolites from other producers for resale (table 1). Chabazite was mined in Arizona; clinoptilolite was mined in California, Idaho, Nevada, New Mexico, and Texas; and mordenite was mined in Nevada. Domestic production of zeolites was 59,500 t compared with 60,100 t of production in 2008. New Mexico was the leading producing State in 2009, followed by Idaho, Texas, Arizona, California, and Nevada.

During 2009, the U.S. zeolite industry was facing a major consolidation. ZEOX Corp., Vancouver, British Colombia, Canada, began discussions with Imagin Minerals, Inc., Wilton, CT, concerning a possible merger of the two companies (ZEOX Corp., 2009). Tentative plans were for ZEOX to purchase all shares of Imagin Minerals. Imagin Minerals was the leading producer of natural zeolites in North America, through its subsidiary St. Cloud Mining Co., with about 54% of the U.S. market (ZEOX Corp., 2010). In 2007, ZEOX Corp., Vancouver, British Columbia, Canada, acquired two natural zeolite producers, GSA Resources Inc. with a mine and mill in Arizona and Ash Meadows, LLC with a mine in California and mill in Nevada (Virta, 2010).

Bear River Zeolite Co. (a subsidiary of United States Antimony Corp.) reported that sales revenue decreased by 2% to $1.54 million in 2009 compared with those of 2008 and shipments decreased by 3% to 11,500 t compared with those of 2008 (United States Antimony Corp., 2010, p. 10).

Daleco Resources Corp., through its subsidiary Clean Age Minerals, Inc., had extracted about 1,300 t of clinoptilolite through September 2009 at its Marfa, TX, zeolite deposit. The company planned to use this material for product testing. Limited sales of their zeolite were made in 2009 for agricultural and wastewater treatment applications, but large-scale mining of the deposit had not commenced (Daleco Resources Corp., 2010, p. 9).

Consumption

About 59,400 t of natural zeolites was sold in 2009 in the United States compared with 58,500 t in 2008. Domestic uses for natural zeolites were, in decreasing order by tonnage, animal feed, odor control, pet litter, water purification, fungicide or pesticide carrier, wastewater cleanup, gas absorbent, horticultural applications (soil conditioners and growth media), oil absorbent, desiccant, and aquaculture. Animal feed, odor control, pet litter, and water purification applications accounted for more than 75% of the domestic sales tonnage. Increased sales of natural zeolites were reported for animal feed, desiccant, fertilizer, fungicide and pesticide carriers, gas absorbent, odor control, and wastewater treatment applications. Sales declined slightly for aquaculture, catalysts, oil absorbent, pet litter, and water purification applications.

Prices

Prices for natural zeolites vary with zeolite content and processing. Unit values, obtained through the U.S. Geological Survey canvass of domestic zeolite producers, ranged from $30 to $900 per metric ton. The bulk of the tonnage sold was between $100 and $200 per ton, which was typical of large, bulk shipments. Eyde and Holmes (2006, p. 1058) reported that

prices for industrial or agricultural applications ranged from $30 to $70 per ton for granular products coarser than 40-mesh and from $50 to $120 per ton for finer (-40 to +325-mesh) ground material.

Producers also sell custom-processed zeolites and finished products that can cost up to about $8,000 per ton when the products are sold by the kilogram. For such products as pet litter, fish tank media, or odor control applications, prices ranged from $0.50 to $4.50 per kilogram. Eyde (2009) reported that the price for modified clinoptilolite and extruded and activated chabazite products sold for as much as $8 per kilogram. Quoted prices should be used only as a guideline because actual prices depend on the terms of the contract between seller and buyer.

Foreign Trade

Comprehensive trade data were not available for natural zeolites. In 2009, exports of natural zeolites (other than gem-quality specimens) were estimated to be less than 500 t and imports were estimated to be less than 200 t. The bulk of the U.S. zeolite trade was in synthetic zeolite products.

World Review

World production of natural zeolites was in the range of 2.8 to 3.3 Mt in 2009 based on reported production by some countries, world market trends, and production estimates published in trade journals.

Natural zeolite production data are not available for most countries. Countries mining large tonnages of zeolites typically use them in low-value applications. The ready availability of zeolite-rich rock at low cost and the shortage of competing minerals and rocks are probably the most important factors for its large-scale use. It is also likely that a significant percentage of the material sold as zeolites in some countries is ground or sawn volcanic tuff that contains only a small amount of zeolites. Some examples of such usage are dimension stone (as an altered volcanic tuff), lightweight aggregate, pozzolanic cement, and soil conditioners.

Pozzolans are finely ground siliceous or siliceous and aluminous materials that react with calcium hydroxide, in the presence of moisture, at ordinary temperatures to form compounds possessing cementitious properties (Bruce, 2005).

Estimates for individual countries were: China (including pozzolan applications), 1.75 to 2.25 Mt; Jordan (nearly all for pozzolan applications), 400,000 to 450,000 t; the Republic of Korea, 160,000 to 170,000 t; Japan (including pozzolan applications), 150,000 to 160,000 t; Turkey, 100,000 t (including pozzolan applications); Slovakia, 90,000 t; the United States, 59,500 t; Ukraine (including pozzolan applications), 20,000 to 40,000 t; Hungary, 20,000 to 30,000 t; Cuba, 25,000 t; New Zealand, 17,000 to 20,000 t; Bulgaria (excluding pozzolan applications), 15,000 t; South Africa, 10,000 to 15,000 t; Australia, Russia, and Spain, 5,000 to 10,000 t each; Canada, Greece, Italy, and the Philippines, 3,000 to 5,000 t each; Mexico, 1,000 t; and Indonesia (excluding pozzolan applications), 400 to 500 t. Small amounts of natural zeolites (probably less than 1,000 to 2,000 t) also were produced in Argentina, Armenia, Georgia, Germany (excluding pozzolan applications), Serbia, and Slovenia.

Outlook

Although U.S. production declined in 2009 from that of 2008, sales of natural zeolites increased slightly. Markets for natural zeolites generally were smaller and less associated with construction and manufacturing applications than most other industrial minerals. Consequently, the global economic recession had only a relatively minor impact on the industry. Although increases in consumption in any particular market were modest, declines in other markets also were small. Sales of natural zeolites may continue to increase at a rate of 2% to 3% per year for the near future as markets tied to the environment, farming, horticulture, and ranching continue to expand.

References Cited

Bruce, D.A., 2005, Glossary of grouting terminology: Journal of Geotechnical and Geoenvironmental Engineering, v. 131, no. 12, December, p. 1534–1542.

Daleco Resources Corp, 2010, Form 10–K—2009: Securities and Exchange Commission, 68 p.

Eyde, T.H., 2009, Zeolites: Mining Engineering, v. 61, no. 6, June, p. 79.

Eyde, T.H., and Holmes, D.A., 2006, Zeolites, *in* Kogel, J.E., Trivedi, N.C., Barker, J.M., and Krukowski, S.T., eds., Industrial minerals and rocks (7th ed.): Littleton, CO, Society for Mining, Metallurgy, and Exploration Inc., p. 1039–1064.

United States Antimony Corp., 2010, Form 10–K—2009: Securities and Exchange Commission, March 29, 21 p.

Virta, R.L., 2010, Zeolites *in* Metals and minerals: U.S. Geological Survey Minerals Yearbook 2007, v. I, p. 83.1–83.3. (Accessed May 4, 2010, at http://minerals.usgs.gov/minerals/pubs/commodity/zeolites/myb1-2007-zeoli.pdf.)

ZEOX Corp., 2009, Untitled: Vancouver, British Columbia, Canada, ZEOX Corp. news release, August 24, 1 p. (Accessed May 4, 2010, at http://www.marketwire.com/press-release/ZEOX-Corporation-News-Release-TSX-VENTURE-ZOX-1034803.htm.)

ZEOX Corp., 2010, ZEOX enters letter agreement to acquire Imagin Minerals, Inc.: Wilton, CT, ZEOX Corp. news release, April 14, 2 p. (Accessed June 16, 2010, at http://www.zeoxcorporation.com/cms/Portals/zeoxcorporation.com/Press%20Releases/Zeox%20news%20release%20announcing%20letter%20agreement%20with%20Imagin%20April%2013%202010.pdf.)

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publication

Zeolites in Sedimentary Rocks. Ch. in United States Mineral Resources, Professional Paper 820, 1973.

Other

Association of Detergent Zeolite Producers, The.

British Zeolite Association.

Economics of Zeolites, The (6th ed.). Roskill Information Services Ltd., 2003.

Industrial Minerals, monthly.

International Natural Zeolite Association.

International Zeolite Association.

Mining Engineering, monthly.

Natural and Synthetic Zeolites. Ch. in U.S. Bureau of Mines Information Circular 9140, 1987.

TABLE 1

DOMESTIC ZEOLITE PRODUCERS IN 2009[1]

State and company	Type of zeolite
Arizona:	
GSA Resources, Inc. (ZEOX Corp.)	Chabazite.
UOP LLC	Chabazite/mordenite.
California:	
Ash Meadows, LLC (ZEOX Corp.)	Clinoptilolite.
KMI Zeolite Inc.	Do.
Idaho:	
Bear River Zeolite Co. (United States Antimony Corp.)	Do.
Steelhead Specialty Minerals, Inc.	Do.
Teague Mineral Products Co.	Do.
Nevada, Moltan Co., L.P.	Clinoptilolite/mordenite.
New Mexico, St. Cloud Mining, Inc.	Clinoptilolite.
Texas, Zeotech Corp.	Do.

Do. Ditto.

[1]Addwest Minerals International Ltd. worked from stocks or purchased zeolites from other producers for resale.