CALIFORNIA NON-FUEL MINERAL PRODUCTION 2017

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Based on preliminary data for 2017 from the U.S. Geological Survey (USGS) National Minerals Information Center, California ranked fifth – after Nevada, Arizona, Texas, and Alaska – in the value of non-fuel mineral production (USGS, 2018). The market value of non-fuel mineral production for California was $3.6 billion – approximately 4.7 percent of the nation's total (USGS, 2018).

The USGS provided the California Geological Survey (CGS) with production statistics for 23 non-fuel mineral commodities based on their surveys of the mineral industry in 2017. California led the nation in the production of diatomite and construction sand and gravel and was the only U.S. producer of boron and rare earth elements. Texas was the only state to produce more portland cement than California in 2017 (USGS, 2018). Other mineral commodities produced in the state are listed in Table 1.

Based on data from the California Department of Conservation's Division of Mine Reclamation (DMR), there were about 1,042 active mines in California during 2017, and of those, 663 reported the production of non-fuel minerals. Approximately 5,500 people were employed at these mines and their processing facilities (California Employment Development Department, 2018).

INDUSTRIAL MINERALS

Industrial minerals accounted for 92 percent of the value of non-fuel minerals produced in California in 2017. Construction grade sand and gravel, portland cement, and crushed stone – the solid ingredients of concrete – were the top three mineral commodities for the year, in both quantity and value (Table 1). The building and paving industries consume large quantities of these construction materials, which together made up 67 percent of the value of California's 2017 minerals market. These resources are essential to the state's economy, both to maintain existing infrastructure and to provide for new construction.

Boron minerals ranked fourth in value, though because there are only two producers in the state, production values are withheld to protect proprietary company information. In December 2017, a third company – American Pacific Borate and Lithium Limited (APB) – released the results of a scoping study on its wholly-owned Fort Cady Project.

Table 1. Amount and value of non-fuel mineral production[1,2]. Modified from unpublished USGS data, subject to change; official USGS final 2017 data will be published in the California chapter of the USGS Mineral Yearbook, Area Reports: Domestic 2017, Volume II.

Mineral	2015		2016[R]		2017[P]	
	Quantity[3] (short tons)	Value (thousands)	Quantity[3] (short tons)	Value (thousands)	Quantity[3] (short tons)	Value (thousands)
Cement:						
Masonry	207,200	$20,800	246,900	$28,600	242,500	$25,800
Portland	10,769,500	$887,000	10,923,800	$1,020,000	10,582,100	$907,000
Clays[4]	768,300	$40,690	867,500	$55,980	774,900	$50,840
Gemstones	NA	$880	NA	$850	NA	$770
Gold[5]	[6] 160,800	[7] $187,440	[6] 141,700	[7] $177,640	[6] 221,100	[7] $276,790
Gypsum (crude)	760,600	$5,930	945,800	$11,900	897,300	$6,510
Sand & gravel:						
Construction	106,923,100	$1,090,000	112,434,600	$1,230,000	105,159,400	$1,120,000
Industrial	2,050,300	$66,100	1,962,100	$55,000	1,785,700	$54,200
Stone:						
Crushed	42,328,300	$331,000	50,375,100	$431,000	45,855,700	$370,000
Dimension	23,100	$7,780	20,900	$6,890	18,700	$6,750
Combined commodities[8]		$751,000		$1,127,000		$742,000
Total - all minerals		**$3,389,000**		**$4,145,000**		**$3,561,000**

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Quantities are rounded to the nearest 100 units. Values are rounded to the nearest $10,000 and totals to the nearest $1,000,000.

[3] Gold quantities in troy ounces.

[4] Clays includes bentonite, kaolin, common, and montmorillonite (fuller's earth).

[5] Lode and placer deposits.

[6] Data from California Department of Conservation, Division of Mine Reclamation (DMR).

[7] Values calculated using quantities from DMR and unit price derived from USGS data.

[8] Values for boron, diatomite, feldspar, lime, magnesium compounds, pumice, pumicite, rare earths (2015), salt, silver, soda ash, sodium sulfate (2015), and zeolites are combined to avoid disclosing company proprietary data.

[R] Revised from previous non-fuel mineral production report.

[P] Preliminary.

NA = Not available.

Borates were produced at the site in the late 1980s, and APB currently holds a mining conditional use permit with the San Bernardino Land Use Services Department (American Pacific Borate & Lithium Limited, 2017). The value of boron production is included in the "combined" value in Table 1 and the "other" category on the pie chart.

Aggregate

Total production of construction aggregate (sand and gravel, crushed stone) in 2017 was 151 million tons valued at $1.49 billion, down from revised 2016 numbers (Table 1). California consumed an average of about 180 million tons of construction aggregate (all grades) per year from 1986-2016 (Clinkenbeard & Gius, 2018).

The cost of construction aggregate – a low-unit-value, high-bulk-weight commodity – is heavily dependent on the distance it must be hauled from its source (Clinkenbeard & Gius, 2018). Several factors, including the increasing cost to truck aggregate from the nearest sources, have made aggregate importation by ship and barge economically preferable for some coastal markets in the state. Sand and gravel imported by ship from British Columbia came into ports in the San Francisco area and into the Port of Long Beach (Polaris Materials Corporation, 2017). Aggregate from Mexico, primarily sand, came into the San Diego market area (Gius et al., 2017). The quantity of aggregate imported into California remains small when compared to the overall consumption of aggregate in the state.

Cement

Portland cement production at nine plants throughout the state (Portland Cement Association, 2017) totaled 10.6 million tons valued at $907 million in 2017, a decrease in quantity and value from the revised 2016 figures (Table 1). USGS Mineral Industry Surveys indicate imports of all hydraulic cement types into San Francisco, Los Angeles, and San Diego ports totaled approximately 1.6 million tons (van Oss & Neely, 2018).

Rare Earth Elements

Although not reported to USGS through their mineral industry survey, a revised annual report submitted to DMR indicated that mining of bastnaesite ore resumed at Mountain Pass in San Bernardino County during 2017, after a production hiatus in 2016. There were no other domestic producers of rare earth elements in 2017 (USGS, 2018). Production quantity was withheld to protect proprietary company data.

METALS

Metals made up the remaining eight percent of the value of non-fuel minerals produced in California. Gold dominated California's metals market in 2017 – totaling over 98 percent of the value of the state's metals production. The quantity and value of 2017 gold production increased 56 percent from 2016.

The state's largest gold producer was the Western Mesquite Mine in Imperial County – approximately 168,800 troy ounces for the year (New Gold, Inc., 2018). The Soledad Mountain Mine in Kern County produced 46,041 troy ounces during 2017, its first full year of commercial production (Golden Queen Mining Co. Ltd., 2017).

In addition to the above-mentioned lode mines, placer gold was recovered as a byproduct from many sand and gravel mines in the northern and central parts of the state. California also has several small lode mines that sporadically produce gold, including specimens for the collector market.

Silver is a byproduct of gold production in California and in 2017 made up less than two percent of the state's total metal production by value. The Soledad Mountain Mine was the source of nearly all the silver – over 239,000 ounces – produced during the year (Golden Queen Mining Co. Ltd., 2017).

Iron ore was mined almost exclusively in San Bernardino County and used in the production of portland cement. Because of this primary end-use in its unrefined oxide form, iron ore is considered an industrial mineral, despite its metallic mineralogy.

MINERAL RESOURCE CONSERVATION

The CGS Mineral Land Classification (MLC) Project, a mandate of the Surface Mining and Reclamation Act (California Public Resources Code § 2710, et seq.), continued to support mineral resource conservation by providing maps of significant mineral resource zones to land-use planners and decision-makers.

Since its inception in 1978, the MLC project has completed over 100 classification studies in areas covering approximately one-third of the state. A priority is placed on conducting and updating classification studies near California's population centers that are subject to urban expansion or other irreversible land uses that would preclude mineral extraction (California State Mining and Geology Board, 2000). Figure 1 shows the outlines of 34 MLC study areas that focused specifically on aggregate resources. They encompass over 85 percent of California's population (Clinkenbeard & Gius, 2018), all of whom depend on locally-sourced construction aggregate.

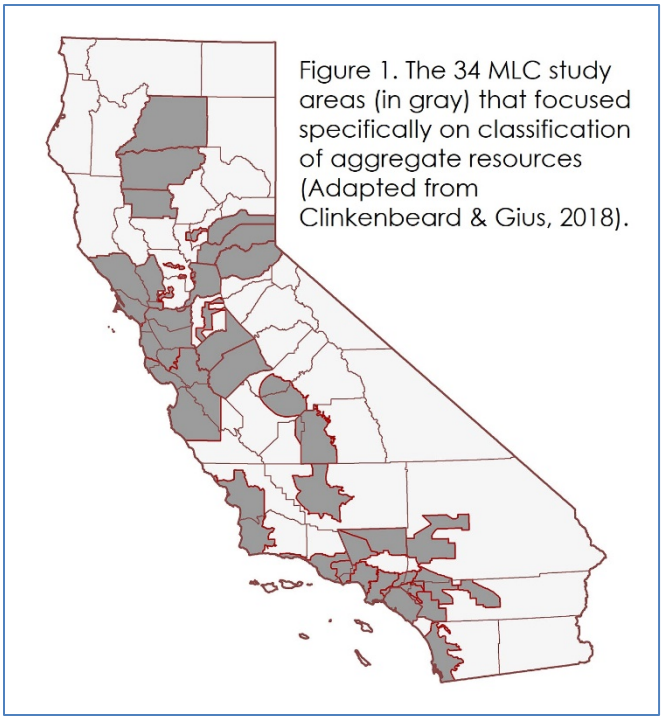


Figure 1. The 34 MLC study areas (in gray) that focused specifically on classification of aggregate resources (Adapted from Clinkenbeard & Gius, 2018).

During 2017, CGS assisted the State Mining and Geology Board by classifying mineral resource zones in western San Diego County (see Gius et al., 2017). Classification updates were ongoing in the Greater Sacramento Area, South San Francisco Bay, Saugus-Newhall, and San Fernando Valley regions.

LAWS PERTAINING TO MINERAL RESOURCES

In April, the Legislature passed Senate Bill 1 (SB1), "The Road Repair and Accountability Act of 2017," which is expected to generate, in part, over $3 billion a year through 2027 specifically for the maintenance and rehabilitation of local roads and streets, and state highways, bridges, and culverts (Beall, et al. 2017). In a memorandum to California Department of Transportation (Caltrans) district directors, Agency Director Malcolm Dougherty emphasized the increased need for aggregates that projects funded by SB1 will generate (Dougherty, 2018).

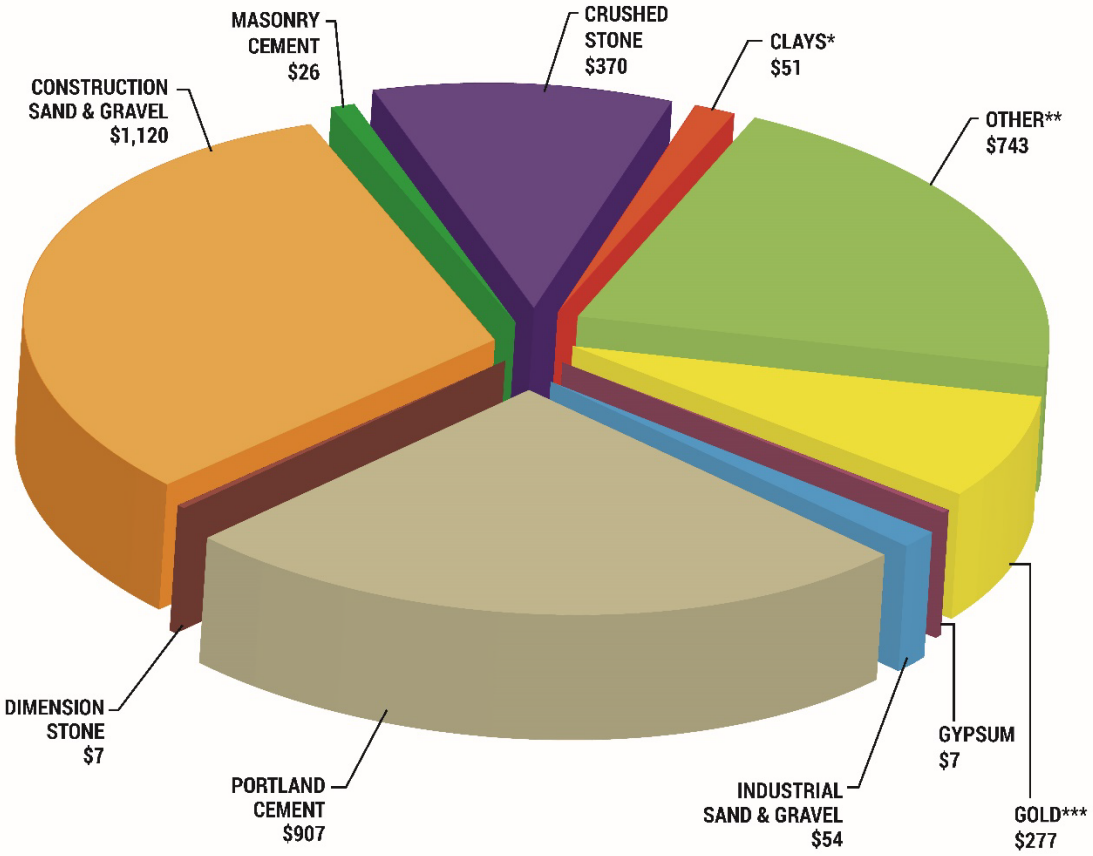
In December, President Trump signed Executive Order No. 13817: A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals. The Order defines critical minerals as those essential to the economic and national security of the United States that have a supply chain that is vulnerable to disruption due to import reliance (Exec. Order No. 13817, 2017). In response, the Secretary of the Interior produced a list of 35 minerals meeting those criteria (Petty, 2018). Over 25 minerals from that list have previously been mined in California (Murdoch et al., 2008).

REVISIONS TO 2016 DATA

Based on revised data for 2016 from USGS and DMR, the market value of non-fuel minerals increased from $3.38 to $4.15 billion. This increase was due primarily to significant adjustments to boron, construction sand and gravel, portland cement, and crushed stone. The revised 2016 data appears in Table 1.

CALIFORNIA
NON-FUEL MINERAL PRODUCTION
2017

Total Value $3.6 Billion



Values for commodities displayed on chart are in millions of dollars.

* includes bentonite, kaolin, common, and montmorillonite (fuller's earth)

** includes boron, diatomite, feldspar, gemstones, lime, magnesium compounds, pumice, pumicite, salt, silver***, soda ash, and zeolites

*** value calculated using quantities from the California Division of Mine Reclamation and unit price derived from the U.S. Geological Survey (USGS) data

California
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REFERENCES

American Pacific Borate and Lithium Limited. (2017). *Fort Cady Project – Scoping Study*: http://americanpacificborate.com/fort-cady-project/ (accessed March 12, 2019).

Beall, J.T., et al. (2017). *The Road Repair and Accountability Act of 2017*. California Legistlative Counsel's Digest. Senate Bill 1.

California Employment Development Department. (2018). *Industry Employment & Labor Force – by Annual Average, March 2017 Benchmark: https://www.labormarket info.edd.ca.gov/data/employment-by-industry.html* (accessed March 23, 2019).

California Public Resources Code. Division 2. Chapter 9. Sections 2710-2796.5. *The Surface Mining and Reclamation Act of 1975.*

California State Mining and Geology Board. (2000). California Surface Mining and Reclamation Policies and Procedures: Guidelines for Classification and Designation of Mineral Lands, p. 27. https://www.conservation.ca.gov/smgb/Guidelines/Documents/ClassDesig.pdf (accessed April 22, 2019).

Clinkenbeard, J.P. & Gius, F.W. (2018). *Aggregate Sustainability in California.* California Department of Conservation – California Geological Survey. Map Sheet 52.

Dougherty, M. (2018). *2018 Aggregate Resource Policy Statement and Tools.* California Department of Transportation – Memorandum to District Directors dated March 1, 2018.

Exec. Order No. 13817, 3 C.F.R. 3. (2017). A Federal Strategy To Ensure Secure and Reliable Supplies of Critical Minerals.

Gius, F.W., Busch, L.L., & Miller, R.V. (2017). Update of Mineral Land Classification: Portland Cement Concrete-grade Aggregate in the Western San Diego County Production-Consumption Region, California. California Department of Conservation - California Geological Survey. Special Report 240.

Golden Queen Mining Co. Ltd. (2017). *Form 10-k 2017*: https://www.goldenqueen.com/ assets/docs/pdf/financials/GQM.Form10K.MASTER.pdf (accessed April 17, 2019).

New Gold, Inc. (2018). *New Gold Delivers on 2017 Production and Cost Guidance and Provides 2018 Outlook* [Press Release]: http://www.newgold.com/investors/ NewGoldNews/PressReleaseDetail/2018/New-Gold-Delivers-on-2017-Production-and-Cost-Guidance-and-Provides-2018-Outlook/ (accessed April 19, 2019).

Murdoch, J., Webb, R.W., Campbell, I. & Learned, E.M. (2008). *Minerals of California.* California Department of Conservation – California Geological Survey. Bulletin 189.

Petty, T.R. (2018). *Final list of Critical Minerals 2018*. 83 Federal Register 97 pp. 23295-23296.

Polaris Materials Corporation. (2017). *Polaris announces Q3 2017 sales volumes, further increase to full year sales expectations* [Press Release]: http://www.polaris materials.com/media-center/news/index.php?content_id=280 (accessed April 16, 2019).

Portland Cement Association. (2017). *California Cement Industry*: https://www.cement.org/docs/default-source/market-economics-pdfs/cement-industry-by-state/calif-statefacsht-17-d2.pdf?sfvrsn=b77fe6bf_2 (accessed April 18, 2019).

U.S. Geological Survey. (2018). *Mineral commodity summaries 2018*: U.S. Geological Survey, 200 p.: https://doi.org/10.3133/70194932 (accessed March 23, 2019).

van Oss, H.G. & Neely, P.R. (2018). *Mineral Industry Surveys: Cement in December 2017*. U.S. Geological Survey: https://minerals.usgs.gov/minerals/pubs/commodity/cement/mis-201712-cemen.pdf (accessed April 17, 2019).