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GYPSUM MINING IN NEVADA

By Dave Bieber, PG | Manager of Geology/Survey, West Division, Martin Marietta

While Nevada is best known for metals production, gypsum has also been produced in significant quantities. Notable gypsum sources include the Gypsum Cave Mine, Apex Mine complex, and Blue Diamond Hill in Clark County; the Lovelock Gypsum Mine and Empire Gypsum Mine in Pershing County; the Adams Claim Gypsum Mine and Ludwig Mine in Lyons County; and the Heart of Nature Mine in Esmeralda County. The primary uses of the gypsum from these sources are in gypsum-based agricultural and construction additives.

WESTERN POZZOLANS FOR CEMENT

By Tom Newman, CPG | Chief Geologist, Holcim (US) Inc.

Pozzolans have been rediscovered, again, with a New Purpose! We'll concentrate on natural pozzolans in the western US. We'll discuss the history of natural pozzolans. The chemistry of pozzolan and cement. Updates on why pozzolans are important. After all, the Romans perfected pozzolans with lime millenniums ago. Why are pozzolans so important in the 21st Century!

Pozzolan Definition: a siliceous or silico-aluminous material that will, in finely divided form and in the presence of moisture, chemically react with calcium compounds at ordinary temperatures to have cementitious properties.

PROPOSED CLASSIFICATION OF POTENTIAL REACTIVITY OF CONCRETE AGGREGATE

By Steve Stokowski, CPG, PG | Stone Products Consultant

IUGS and ASTM C294-C295 rock classification schemes are inadequate for concrete aggregate. With normal portland cement, and some developing cement varieties, concrete aggregate may contain components with variable abundance and reactivity (ASR, ACR, oxidation, or a reaction with water). Reactivity is often increased in some varieties of polymorphic minerals, in amorphous crystal structures, by a fine grain size (generally indicated as <50µ or <62µ), by high crystallographic strain (undulatory extinction >25° in quartz), and by intracrystalline permeability. A better method would be to first classify rock according to its inferred potential reactivity for any reason during the service life conditions of normal PC concrete. The service life is often less than 25 years for minor structures, 50 years for pavement, 100 years for buildings, and 300-500 years for major structures. An advanced, alternative classification would classify the potential reactivity with other cementitious binders.

Proposed potential reactivity classification of concrete aggregate with normal or other cement binders:
Extremely Reactive
Considerably Reactive
Moderately Reactive
Rarely Reactive
Contributory Reactive
Non-Reactive

INDUSTRIAL MINERALS OF NEVADA

By James E. Faulds | Professor, State Geologist, Director of the Nevada Bureau of Mines and Geology, University of Nevada, Reno

Industrial minerals produced in Nevada include aggregate, barite, cement, clays, diatomite, dimension stone, dolomite, gypsum, lime, limestone, lithium, magnesium, perlite, potassium alum (kalinite), pozzolan, salt, semiprecious gemstones (opal), silica, and zeolites. Nevada is rich in industrial minerals due to its complex tectonic history, including 1) Cambrian to Devonian passive margin development, 2) late Devonian to early Tertiary crustal shortening, 3) Oligocene to Quaternary regional extension, 4) late Miocene to recent transtension, and 5) periodic magmatism through Mesozoic and Cenozoic time. For example, diatomite is largely derived from lacustrine deposits resulting from Tertiary extension and magmatism that produced a series of lakes in the ancestral Cascade arc. Nevada is the second leading producer of diatomite in the U.S. Similarly, enclosed basins and ephemeral lakes associated with Tertiary extension/transtension and rhyolitic volcanism have generated lithium-rich clays and brines, endowing Nevada with more lithium resources than any other state. Clayton Valley in west-central Nevada, where subsurface brines are evaporated on a playa, is currently the only producer of lithium in the U.S. Nevada is also the leading producer of barite, which is generally derived from hydrothermal alteration of Paleozoic passive margin carbonates. Nevada is also a leader in the production of several other industrial minerals, including gypsum and magnesite. The total value of industrial minerals produced in Nevada in 2020 was at least $416M. Aggregate (sand, gravel, and crushed stone) had the greatest value at ~$197M. Aggregate is associated with a variety of geologic settings, including Paleozoic passive margin limestones, Mesozoic and Tertiary granitic intrusions, and Neogene sediments filling grabens. Thanks to its mineral wealth and increasing demand for raw materials, Nevada will likely continue to produce large amounts of industrial minerals in the foreseeable future.

GREAT SALT LAKE: A CRITICAL MINERAL RESOURCE WORTH PRESERVING

Andrew Rupke, PG | Industrial Minerals Geologist, Utah Geological Survey

Great Salt Lake (GSL) is one of the largest saline lakes in the world and represents an important critical mineral resource in the United States. Salt has long been a product of GSL, but the lake also serves as a source of two critical minerals, as designated by the U.S. Department of the Interior. The lake is the only productive domestic source of magnesium metal and one of only two productive domestic sources of lithium. Potash, deemed a critical mineral until recently, is also a product of the lake in its high-value form of potassium sulfate, and GSL is the only potassium sulfate source in the country. Finally, magnesium metal production is linked to nearby processing of an additional critical mineral: titanium. Although GSL's mineral significance is readily apparent, the lake currently faces its lowest historical levels due to drought and upstream consumptive water uses. Currently, local and state agencies are actively seeking solutions to preserve and protect GSL, a unique and significant mineral resource.

DIATOMACEOUS EARTH AS A POSSIBLE STRENGTH ENHANCER IN CONCRETE

Jack Sackrider, PG | Project Geologist at Westward Environmental

Fly ash and silica flume have long been the ‘go to’ materials for improving concrete strength, workability, and other physical properties. However, with reduced coal production and processing in recent years, a suitable replacement has yet to be proven. One potential substitute in certain applications may be diatomaceous earth (DE).

DE is comprised of the fossilized remains of single celled aquatic algae. DE possesses a high silica content and is plentiful in various locations in the US. Additionally, it has a very low density, is chemically inert and has a high porosity. Although the silica content in DE is very high, there may be other potential issues such as void space, impurities and even moisture content. Given the recently passed trillion-dollar infrastructure bill, perhaps this is a time to revisit the use of DE in concrete.

THE ROLE OF INDUSTRIAL MINERALS IN THE LOW-CARBON ENERGY FUTURE

J. Richard Kyle, PhD, PG | Bureau of Economic Geology, University of Texas at Austin

Various projections of increased global consumption of Earth resources in the transition of a low-carbon energy future tend to focus on critical minerals for which adequate supply may be uncertain for the near future. Those include battery minerals such as lithium, but also include other industrial minerals such as graphite and rare earth elements. These demand scenarios are based on current technologies, whereas new technology developments might markedly change supply-demand relationships for some materials. Construction materials are required extensively in all infrastructure developments, including wind and solar farms and required electrical grid and storage developments. Therefore, those construction materials, including cement, will also be in increased demand. The consequences of rising sea levels also suggest the need for hardening of coast lines in many settings. Novel energy storage means such as pumped hydro, compressed air, and hydrogen also require considerable infrastructure development.

Peripheral energy transition aspects include the challenges of adequate supplies of all needed resources for a growing global population. Therefore, recognition that efficient land use, including adaptive reuse of former extraction sites, might encourage local communities to appreciate industrial mineral extraction within the context of holistic long-term planning. For example, some former extraction sites might serve as a solar farm with integrated surface water storage and/or aquifer recharge site. Such integrated developments would allow preservation of other tracts for agriculture or other uses.