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No 19, Zenober Building 1, Derakhti Street, Mehrvilla Quartier, Karaj, IR Iran.
(0098) 26 33 55 47 31 | (0098) 26 33 55 46 69

Factory Address: Garnet Mines of Sirjan under Zenober Iranian Company, Islam-Abad Tanbour village, Gas Office Road, 15 km on Sirjan-Baft Road, Sirjan, Kerman, IR Iran

www.irzenober.com | Info@irzenober.com

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SUMMARY OF COMPANY PROFILE

- Zenober Iranian Company has been considered as a pioneer company in mining projects, and has played pivot role in many exploration, extracting and mineral processing projects throughout Iran. Company's footprints are traceable in many provinces of Iran such as Kerman, East & West Azerbaijan, Isfahan, Sistan Balouchestan, Hormozgan, and Ardabil for Several years and it is well-known as a reputable mining company and regarding to its prominent background in construction projects, has been known as a unique and trusted company since 1975 as well.

- Zenober Iranian Company always aimed to provide services and products at the international standard levels by relying on its educated experienced experts and using the highly new and modern technology. The company has planned to be among the best international mining companies by training experienced experts and knowledge management in all mining categories and procedures.

This company is proud of its success in achieving International Certificates in Integrated Management System (ISO 9001,14001,45001) from DQS German CB Company and Global Conformance Mark in product quality and credited brand as well.

National honors:

- Certificate of honor for the best entrepreneur of 2017 in Kerman province
- Certificate of honor of the best entrepreneur of 2017 Sirjan city
- Social responsibility statue from BALOUT festival in 2019 as an honored top unit
- Contractor qualification certificate (grade 1 in exploration)
- Contractor qualification certificate (grade 3 from the Ministry of Industries and Mines) -

The award of the best industrial and mining company in Kerman province in 2020

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The first phase of the factory implementation Production of industrial garnet and mica of Zenober Iranian

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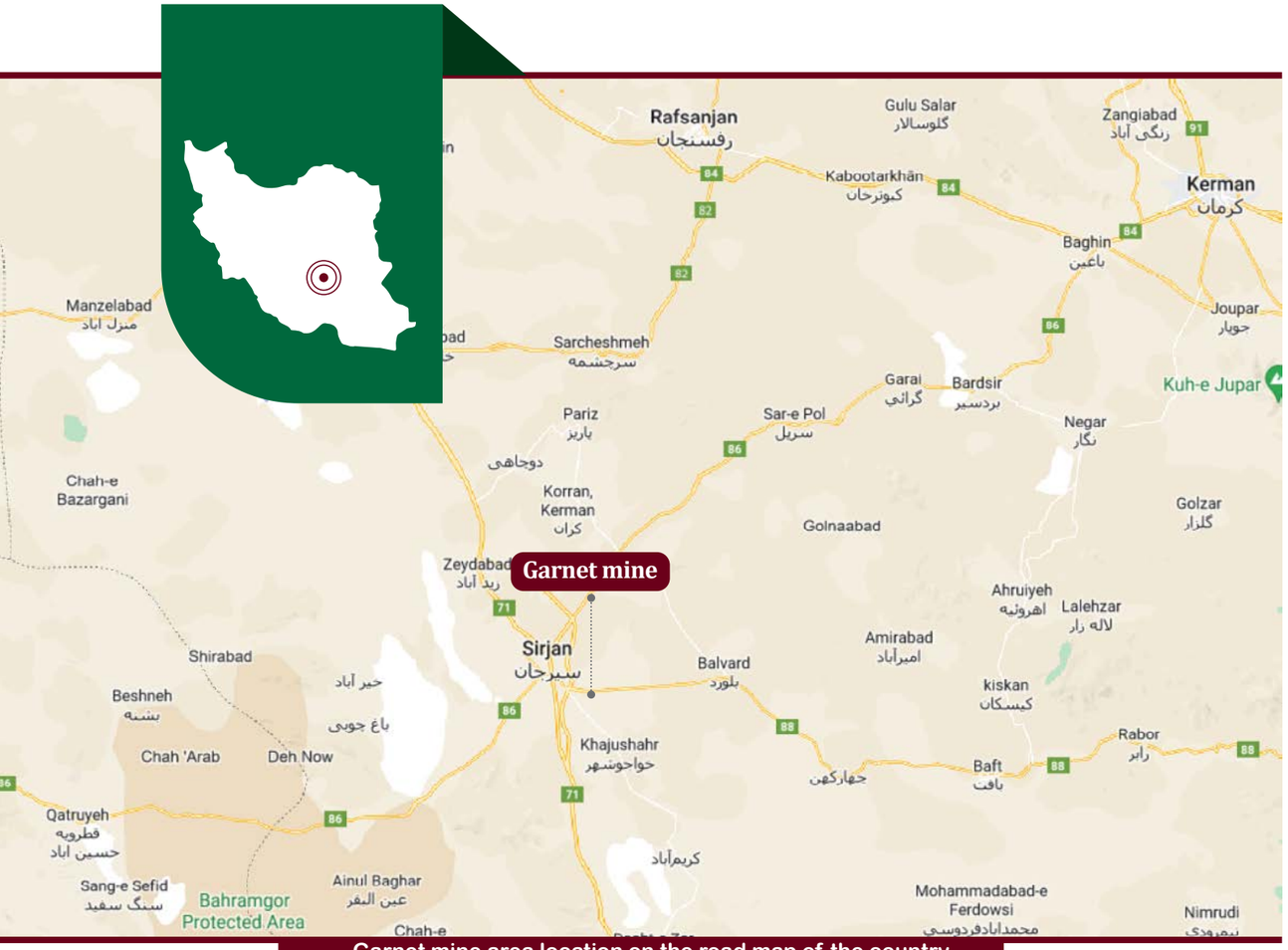
Garnet mine

of Zenober Iranian Company

Garnet mine of Zenober Iranian Company

Geographical location

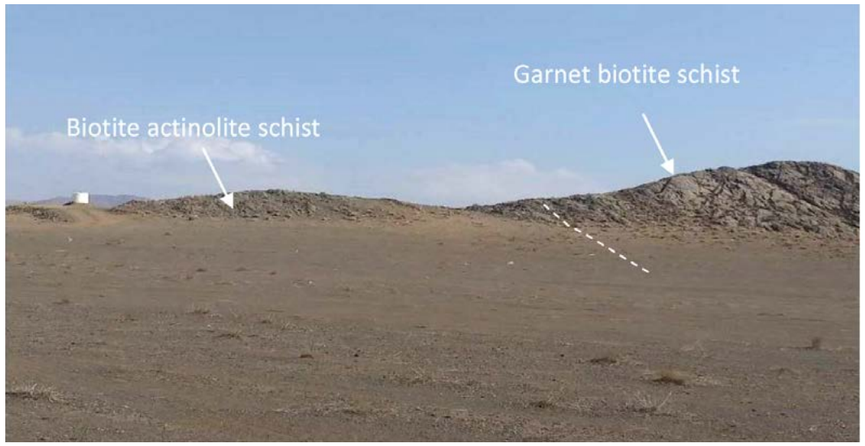
The garnet mine of Zenober Iranian Company is located in Kerman province, 15 km from east of Sirjan city. Its communication route is from the Sirjan-Baft asphalt road, 15 kilometers long after Najaf Shahr city, and after one kilometer of the asphalt road, we reach the garnet mine area of Zenober Iranian Company.

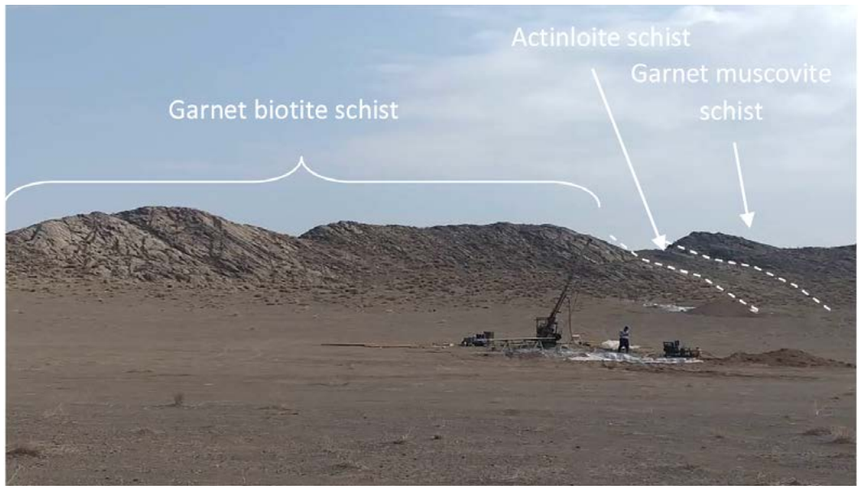


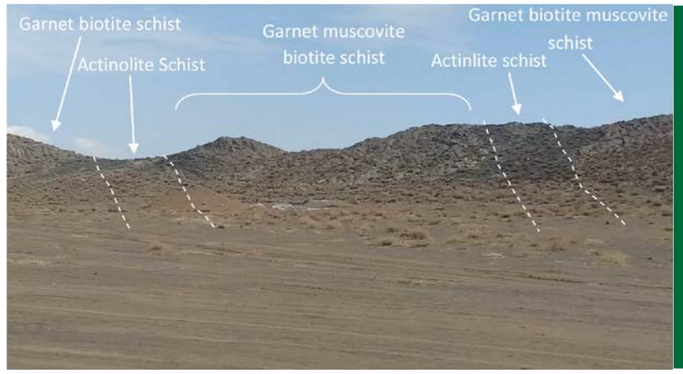
Garnet mine area location on the road map of the country and its distance from the city of Sirjan and Baft

Geological studies

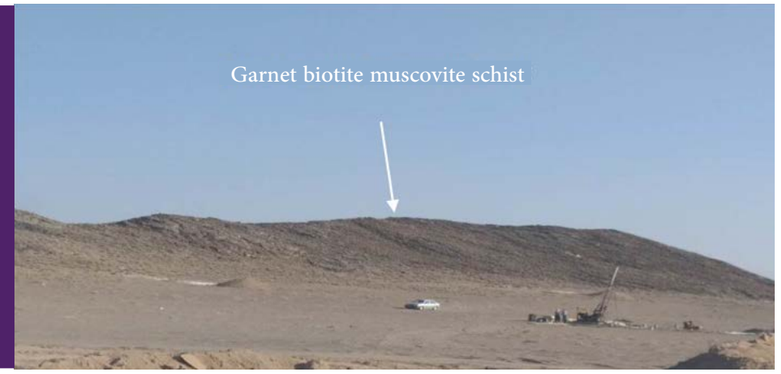
Garnet mine of Zenober Iranian Company includes stone outcrops in the form of a moorland. This mine is located in the southeastern part of the Sanandaj-Sirjan depth zone. Rock outcrops include types of schist rocks that include sedimentary and volcanic protoliths that have metamorphosed from the green schist facies to the early amphibolite facies. Based on the prepared 1:500 geological map, the amount of garnet, varies from 5 to 40% in different parts.

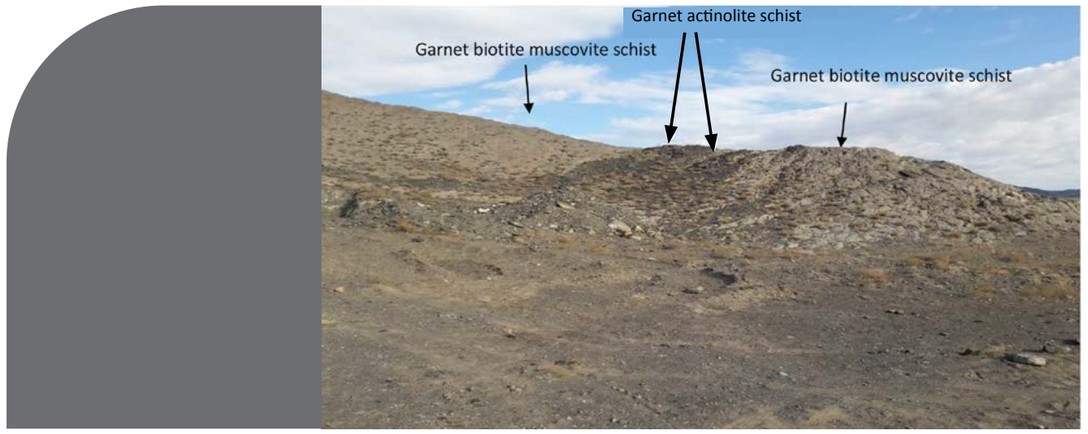




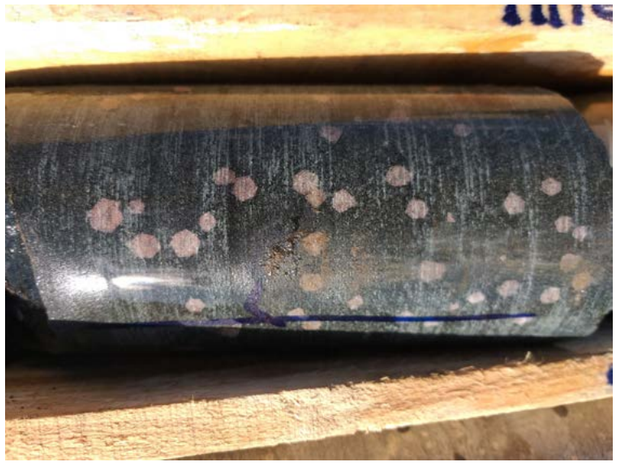

Garnet biotite schist
Actinolite Schist
Garnet muscovite biotite schist
Actinlite schist
Garnet biotite muscovite schist


Biotite actinolite schist
Garnet biotite schist


Garnet biotite muscovite schist

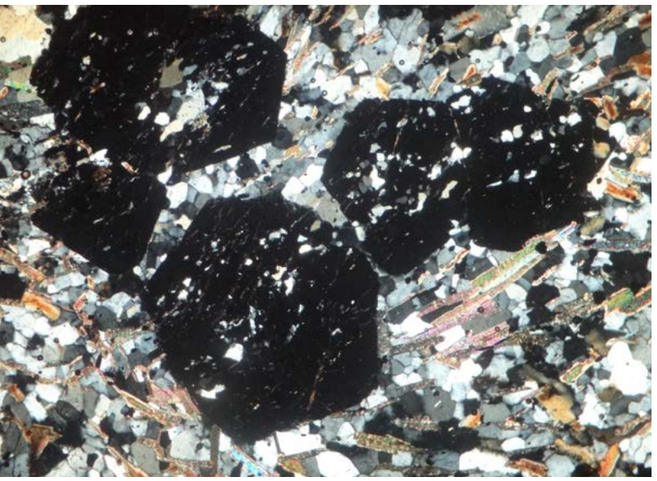

Garnet actinolite schist
Garnet biotite muscovite schist
Garnet biotite muscovite schist

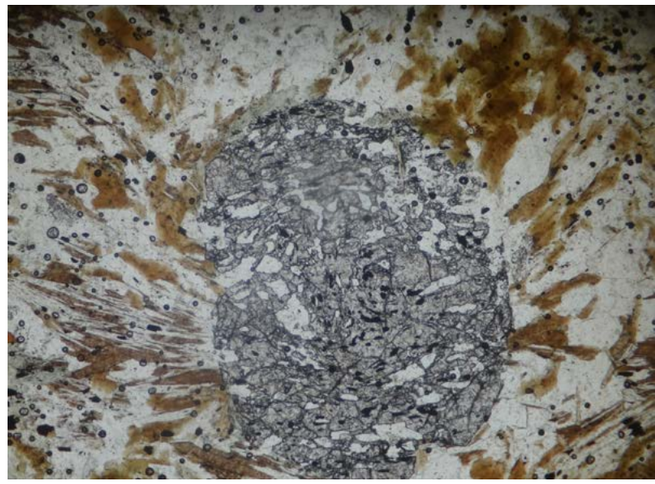

Zenobar iranian

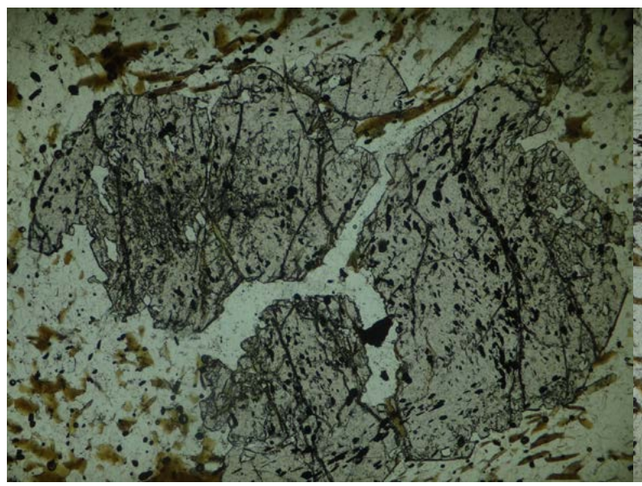


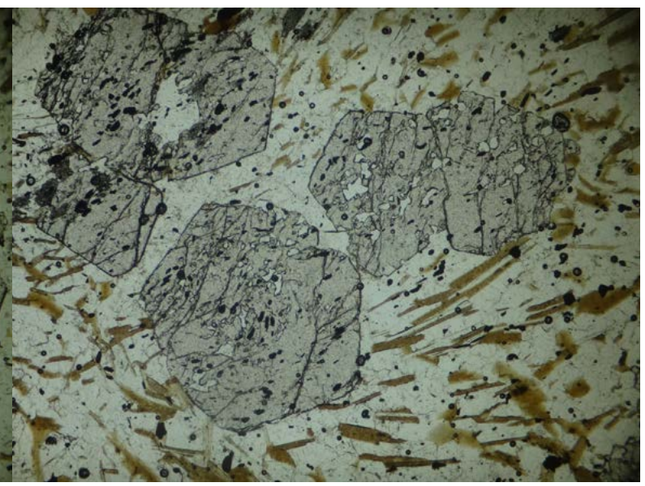
Mineralogical studies

Based on microscopic studies and the results of XRD studies, the main mineralogy of the mine includes garnet of almandine type and mica of muscovite type with a small amount of biotite, which are accompanied by amphibole, chlorite and epidote minerals along with feldspar and quartz.









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Chemical compositions of Garnet

Ore Estimation

The amount of deÞnite reserve calculated for this mine is 34.5 million tons of deÞnite reserve of garnet schist ore with an average weight percentage of 14.45% of garnet and mica with an average weight percentage of 27.6.

General & Mineralogical specifications of Garnet

Garnet belongs to a group of silicate minerals that crystallize in the cubic system and include a series of twelve-sided (two-decahedral) to forty-eight-sided (hexa-octahedron) crystal forms. The general formula of Garnet is $A_3B_2(Sio_4)_3$.
The range of high density changes (3.6 to 4.3), high hardness (7.5-6.5), variable fracture coefÞcient (1.71 in Pyrope to 1.89 in Andradite) and variable color (white color in Grossular to black in Melanite) are considered among the properties of Garnet.

Chemical compositions of Garnet

Minerals	SiO_2	Al_2O_3	CaO	FeO	Fe_2O_3	Cr_2O_3	MgO	MnO
(Pyrope)	44/8	25/4	-	-	-	-	29/8	-
(Almandine)	36/2	20/5	-	43/3	-	-	-	-
(Spesstarine)	36/4	20/6	-	-	-	-	-	43/0
(Grossularite)	40/0	22/7	37/3	-	-	-	-	-
(Andradite)	36/50	-	33/0	-	31/5	-	-	-
(Uvarovite)	35/9	-	33/5	-	-	30/5	-	-

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Applications and consuming of Garnet

The common applications and consumptions of Garnet in the industries are brieby described as following:

Sand-blasting

Common uses of Garnet for sandblasting:

- Construction of ships, maintenance of ships
- Construction and maintenance of steel structures (oil rigs, power plants, storage warehouses, bridges, boilers, rails, wagons, etc.)
- Construction of airplanes and Þnishing the components (turbine blades, etc.)
- Construction and maintenance of steel pipelines - cleaning boxes
- Engraving and making scratch on glass.

Waterjet

In waterjet technique, the abrasives are ejected from the nozzle head in an aqueous solution with a pressure of about 55000 Psi (38.7 m.kg/m2). The size of the nozzle head depends on the materials used for cutting and the cutting conditions, but usually the opening diameter is from 0.23 mm to 2.8 mm.
Its Þrst feature is that it does not generate sparks and provides safety in environments where there is a potential for explosion. The second feature is that it works almost without dust. The ßexibility and accuracy of the advanced automatic waterjet system makes it possible to use it in a large number of industrial factories and cut various types of materials, including steel, aluminum, plastic, wood, composite materials, glass, stone, cement, ceramic and cardboard. The global market of this industry, needs 220,000 tons of Garnet per year.

Coated abrasives

Coated abrasives are composed of graded abrasive grains that are glued on sheets of paper or fabric and are used to polish and smooth the surface of various artifacts. The main abrasives for this application are: aluminum, silicon carbide, silica, garnet. The type and size of abrasives are determined by their Þnal use.
These days, the use of garnet as a coated abrasive is limited to the woodworking industry, which has a market consumption of about 5000 tons per year in the United States of America.
Papers and fabrics with garnet coating are mainly used for wood wear and also for polishing leather, hard rubber, plastic, glass and softer metals.

Finishing and polishing

Precious abrasive powders have made great progress compared to coated abrasives and are used for precise and uniform polishing of electronic parts, special glasses and other precision products. Abrasive materials that compete with this material include diamond pieces, silicon carbide, aluminum slag and silica powder.
Also, cleaning by Garnet reduced the polishing time. Garnet creates a suitable surface and is cheaper than many other abrasive materials. The weak points of using garnet are the slow work speed and the relatively high consumption of materials. If the grains are too small, it will cause scratches on the surface and if they are too soft, it will waste the garnet.

Almandine:

The type of garnet mined by Zenober Iranian company is almandine type, which is a non-metallic and non-toxic abrasive, environment & Eco friendly, suitable for sandblasting all kinds of metals such as: steel, aluminum, carbon steel and etc.
The main consumptions and applications of garnet are in the manufacturing of abrasive materials, polishing, sandblasting, sand-paper, surface preparation in the wharfs, marine platforms, rusted tanks and reservoirs, metal structures, bridges, oil and gas pipes, petrochemical facilities and oil platforms.

Some of the advantages of Garnet in comparing other abrasives are:

- Use of the garnet, half of other abrasives
- Sandblast speed, 2 times
- Recycling times 3 to 6 times
- No increase effect and damage on the sandblast surface
- High resistance of garnet seeds
- Sandblast without pollution

Garnet is free from toxic substances such as heavy metals, especially free silica, and has the necessary standards for human health and the environment.
With low consumption, high speed, non-pollution and frequent recycling, garnet is the best alternative to silica sand and copper slag in the sandblasting industry and is widely used all over the world.
The garnet is produced by this company, is of the Almandine type, which is produced in different sizes for sandblasting and waterjet operations.

Advantages of Almandine-type Garnet in sandblasting:

- No risk of silicosis
- No pollution from cut pieces and its chips
- Fast cutting in the nozzle with low pressure for rust removal with little damage in the area of cleaning and higher efÞciency with less noise and less dust generation
- Using The smaller size grain can increase the density and reduce the surface damage Providing a quick Þled of view for the operator

The better recycling and recovery for reuse in sandblastin
No free silica
High hardness (7-5.8 on the Mohs scale) and density (2/4-9/3) with low brittleness.

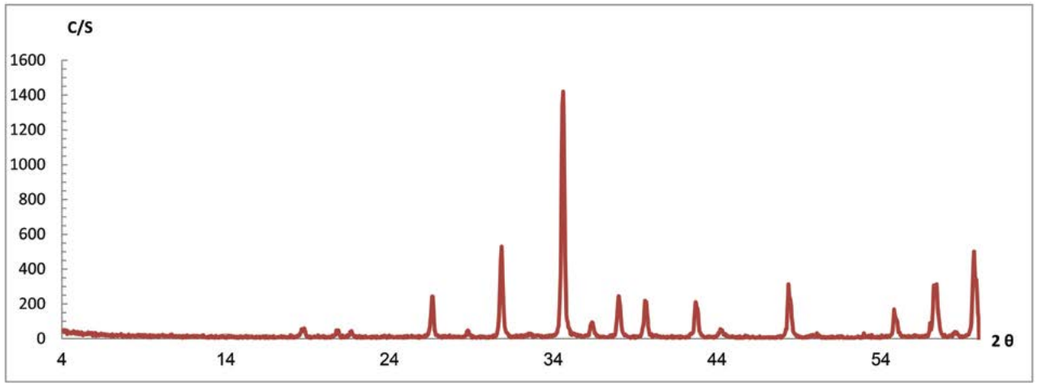
Physical characteristics (typical)	
Bulk Density	2.1 ton/m^3
Hardness(Moh)	7.50-8.0
Melting point	1250^{0}c
Shape of natural grains Sub-angular	

Garnet - Technical Data Sheet

sample	SiO2	Al2O3	Fe2O3	CaO	Na2O	K2O	MgO	TiO2
	%	%	%	%	%	%	%	%
30/60	37.55	17.81	34.04	4.77	0.15	0.22	2.41	1.479

sample	MnO	P2O5	LOi	S	Cl	Ba	Sr	Zn
	%	%	%	ppm	ppm	ppm	ppm	ppm
30/60	1.334	0.047	0.06	187	58	104	7	118

Results of The Analysis Report: Semi-Quantitative Analysis Using XRD



Sample:	Phase(s)
ZENOBER GARNET	Almandine manganoan(33-0658)=91% (Fe,Mn)3Al2(SiO4)3
Az: 874-2	
Date: 04/09/2022	Quartz (33-1161)= 4% SiO_2
kV= 40	llmenite (29-0733)= 2% $FeTiO_3$
mA= 30	
Ka= Cu	
Fil.= Ni	

Global resources and reserves of Garnet

The main countries with garnet reserves are: America, Australia, China and India, whose reserves and base reserves in 2016 have been estimated in the form of a table.

Garnet reserves in major supplying countries in 2020

Country	Deposits	Annual production
United State	5,000,000	110,000
Australia	Much	360,000
China	Much	310,000
India	19,000,000	120,000
South Africa	Uncertain	140,000
Other Counrties	6,500,000	60,000

Garnets of Iran

Iran's garnet reserves are mainly found in metamorphic rocks and skarn, and "Andradite" is the dominant mine among all the other types of garnet minerals. Iran's garnet reserves are mainly located in the three provinces of Hamedan, Khorasan and Kerman, which the reserves of Kerman province are richer than other provinces in terms of amount and grade.
It's mentioned that the main garnet reserves in Kerman Province are in the two regions of Sirjan (Zenober Iranian Garnet Mine) and Kuh-e Gabri (Rafsanjan). The last is of the andradite type.

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Mica

Mica

Mica is a general term that refers to a group of phyllosilicate minerals. These minerals have a sheet silicate structure and are composed of different physical and chemical compounds. Muscovite, Biotite, Phlogopite, Vermiculite, and Lepidolite are the famous mica group minerals.
Muscovite (White-Silver mica) is the famous and abundant sheeted mineral. Sheeted muscovite can be found in the pegmatites and the ßaky type reported from granites, schists, and pegmatites as well. Biotite (black mica) is common in many metamorphic and igneous rocks. Phlogopite is a magnesium rich black mica that can be found as veins and massive bodies in the pyroxenites and magnesian skarns. Lepidolite is lithium bearing mica that form in the lithium rich pegmatites.
Black mica (biotite) is less useful in applications where the color of the Þnal product is important due to its dark color compared to muscovite mica, but as a Þller and enhancer of mechanical and thermal properties, up to %50 by weight is added to polymers such as polyethylene and composites. White mica (phlogopite) has high chemical, electrical and thermal resistance and is resistant to ßame and has high toughness.

Mica mineral applications

The types of mica minerals have different uses, especially in the industry, which is presented in the following table, a summary of the mica's usage in different areas and the characteristic of the relevant index.

Usage area	Usage type	Indicator features
Ceramic	Manufacture of machinable ceramic glass, tiles and bricks	Glass melt viscosity, melting temperature, raw and beaten strength, shrinkage after pressing
Electricity	Construction of capacitor and electrical conductor insulation, as a flux in the coating of welding electrodes	Amount of iron and sodium elements, breakdown voltage
Oil	In drilling cement composition	Width to thickness ratio of mica grain
Building and concrete	Bonding mortar, gypsum wall covering, asphalt roof covering	Width to thickness ratio of mica grain, flexibility
Fuel cell	Fuel cell insulation, in the form of mica paper composite	Purity, thickness, width, opacity
Wastewater treatment	Lead purification	Grain size, ion exchange property
Coloring	As a filler in paint	Grain size, ratio width to thickness of mica grains, amount of iron and magnesium elements, white color
Composite	As a bulking agent and filler in the plastic components of the car, as a lightweight insulator to reduce sound and vibration	Grain size, ratio of width to thickness of mica grain, amount of iron and magnesium elements, hydrophobicity and polymer, preparation of mica grain surface, flexibility
Catalyst base	Inactivation of lipase enzyme	Special surface, grain size, lamination, thickness
Cosmetic	Blush, eyeliner and eye shadow, sunscreen cream, lipstick, body shine, hair and lips, mascara, moisturizing lotions and nail polish	Grain size, purity, whiteness luster, separation degree of mica sheets

Mica mines in Iran

The most important mica mines in Iran are reported in metamorphic, igneous and pegmatitic rocks, and the most obvious of these mines are in skarn zones in the contact of intrusive bodies. Among these mines can be pointed out to Masuleh, Amlash, Ghara-Bagh, Khoy, Zaman Abad-Hamadan and important mica mine in Sirjan- Kuhe Tanbor of zenober iranian company.

Mica consumptions in Iran

The types of mica consumed in the country are in the form of sheets, mica shreds and mica ßakes from all types of mica, and mica shreds are obtained in the form of blocks and thin sheets that are made in a mold and used to make paper. The main uses of mica in Iran are as insulation in the manufacture of all kinds of electronic components and appliances, insulation and protection in induction furnaces, oil, steel, aerospace, construction industries, production of sanitary materials, for construction purposes, creating cellulose coatings, decorative applications. (candle making, sculpture making, etc.), it is the basis of cosmetics, pad making, rubber making and paint making industries.

Mica manufacturing countries

England, Ireland, Sweden, Russia, India, America, Canada, South Korea, China and Madagascar are among the most important mica producers in the world. Mica production in the world in 1994 was about 240,000 tons, of which %60 was the share of the United States, %17 was the share of Russia, %13 was the share of India, and %4 was the share of South Korea. The amount of mica production in the world has increased to 1,000,000 ton in 2022. that the share of Zenober Iranian company in the coming years will be 10 to 15 percent of the total world production.

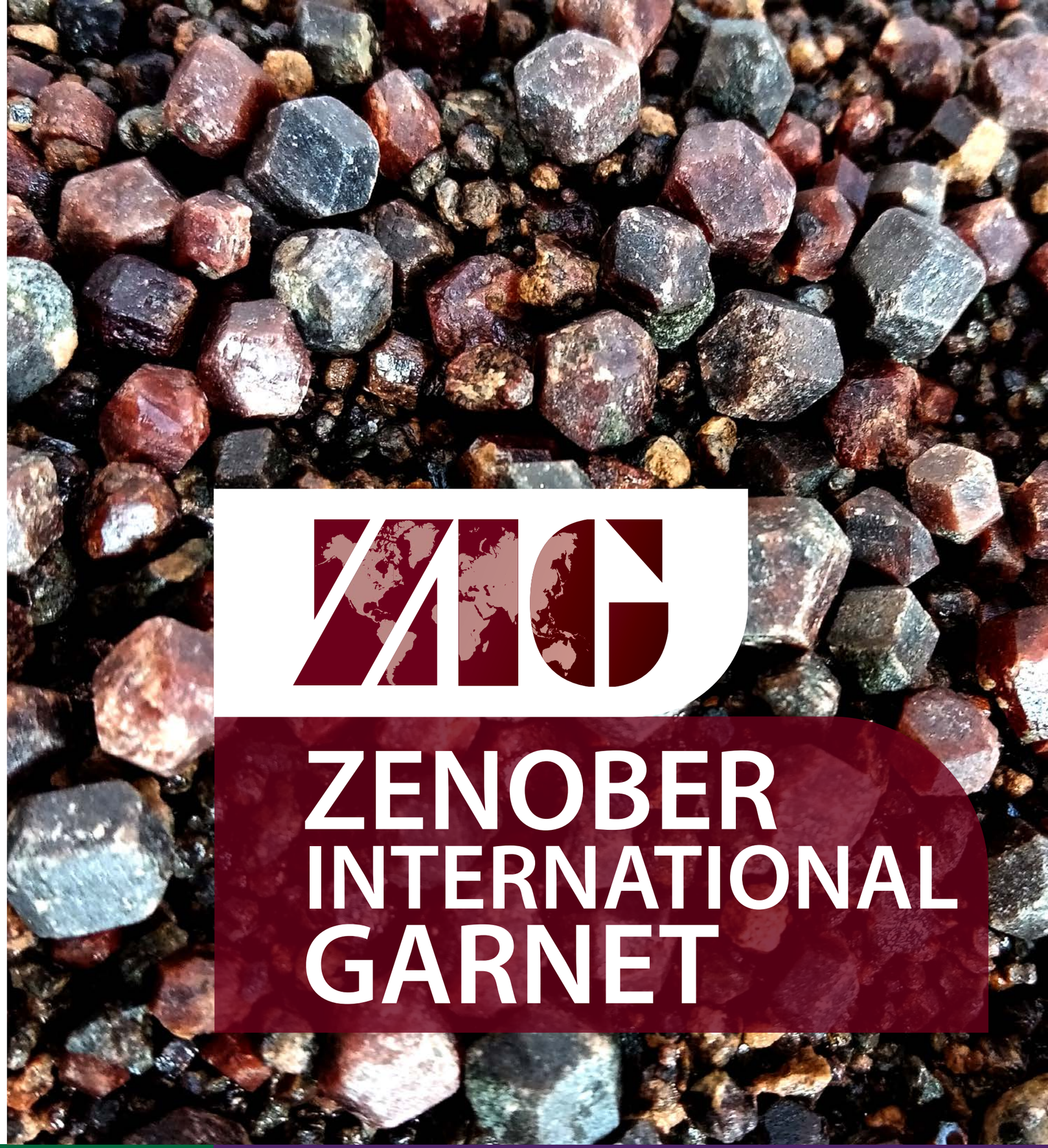
Commodity	Net import reliance as a percentage of apparent consumption	Major import sources (2017–20)[2]
ARSENIC, all forms	100	China, Morocco, Belgium
ASBESTOS	100	Brazil, Russia
CESIUM	100	Germany, China
FLUORSPAR	100	Mexico, Vietnam, South Africa, Canada
GALLIUM	100	China, United Kingdom, Germany, Ukraine
GRAPHITE (NATURAL)	100	China, Mexico, Canada, India
INDIUM	100	China, Canada, Republic of Korea, France
MANGANESE	100	Gabon, South Africa, Australia, Georgia
MICA (NATURAL), sheet	100	China, Brazil, Belgium, India
NEPHELINE SYENITE	100	Canada
NIOBIUM (COLUMBIUM)	100	Brazil, Canada
RUBIDIUM	100	Germany
SCANDIUM	100	Europe, China, Japan, Russia
STRONTIUM	100	Mexico, Germany, China
TANTALUM	100	China, Germany, Australia, Indonesia
VANADIUM	100	Canada, China, Brazil, South Africa
YTTRIUM	100	China, Republic of Korea, Japan
GEMSTONES	99	India, Israel, Belgium, South Africa
TELLURIUM	>95	Canada, Germany, China, Philippines
POTASH	93	Canada, Russia, Belarus
IRON OXIDE PIGMENTS, natural and synthetic	91	China, Germany, Brazil
RARE EARTHS,[3] compounds and metals	>90	China, Estonia, Malaysia, Japan
TITANIUM, sponge	>90	Japan, Kazakhstan, Ukraine
BISMUTH	90	China, Republic of Korea, Mexico, Belgium
TITANIUM MINERAL CONCENTRATES	90	South Africa, Australia, Madagascar, Mozambique
ANTIMONY, metal and oxide	84	China, Belgium, India
STONE (DIMENSION)	84	China, Brazil, Italy, India
CHROMIUM	80	South Africa, Kazakhstan, Russia, Mexico
PEAT	80	Canada
SILVER	79	Mexico, Canada, Chile, Poland
TIN, refined	78	Indonesia, Peru, Malaysia, Bolivia
COBALT	76	Norway, Canada, Japan, Finland
DIAMOND (INDUSTRIAL), stones	76	South Africa, India, Congo (Kinshasa), Botswana
ZINC, refined	76	Canada, Mexico, Peru, Spain
ABRASIVES, crude fused aluminum oxide	>75	China, France, Bahrain, Russia
BARITE	>75	China, India, Morocco, Mexico
BAUXITE	>75	Jamaica, Brazil, Guyana, Australia
SELENIUM	>75	Philippines, China, Mexico, Germany
RHENIUM	72	Chile, Canada, Kazakhstan, Japan
PLATINUM	70	South Africa, Germany, Switzerland, Italy
ALUMINA	58	Brazil, Australia, Jamaica, Canada
GARNET (INDUSTRIAL)	56	South Africa, China, India, Australia
MAGNESIUM COMPOUNDS	55	China, Brazil, Israel, Canada
ABRASIVES, crude silicon carbide	>50	China, Netherlands, South Africa
GERMANIUM	>50	China, Belgium, Germany, Russia
IODINE	>50	Chile, Japan
TUNGSTEN	>50	China, Bolivia, Germany, Canada
CADMIUM	<50	Australia, China, Germany, Peru
MAGNESIUM METAL	<50	Canada, Israel, Mexico
NICKEL	48	Canada, Norway, Finland, Australia
COPPER, refined	45	Chile, Canada, Mexico
ALUMINUM	44	Canada, United Arab Emirates, Russia, China
DIAMOND (INDUSTRIAL), bort, grit, dust, and powder	41	China, Ireland, Republic of Korea, Russia
LEAD, refined	38	Canada, Mexico, Republic of Korea, India
PALLADIUM	37	Russia, South Africa, Germany
FELDSPAR	32	Turkey
SILICON, metal and ferrosilicon	32	Russia, Brazil, Canada, Norway
SALT	29	Chile, Canada, Mexico, Egypt
MICA (NATURAL), scrap and flake	28	Canada, China, India
LITHIUM	>25	Argentina, Chile, China, Russia
BROMINE	<25	Israel, Jordan, China
ZIRCONIUM, ores and concentrates	<25	South Africa, Senegal, Australia, Russia
PERLITE	23	Greece, China, Mexico, Turkey
VERMICULITE	20	South Africa, Brazil

The mica mine of Zenober Iranian Company is located in Sirjan. This mine has 28 million tons of reserves with 7.5 million tons of muscovite mica content, Zenober Iranian company is able to produce and export 150 thousand tons of mica per year by completing the processing line. The analysis of the produced medium mica is presented in the table below.

Element	SiO_2	Al_2O_3	BaO	CaO	Fe_2O_3	K_2O	MgO
Unit	%	%	%	%	%	%	%
zenober- mica	47.22	29.07	0.11	0.36	5.00	7.06	2.85
Element	**MnO**	**Na_2O**	**P_2O_5**	**SO_3**	**TiO2**	**Cr_2O_3**	**LOI**
Unit	**%**	**%**	**%**	**%**	**%**	**%**	**%**
zenober- mica	**0.07**	**1.70**	**0.15**	**0.06**	**0.78**	**<**	**4.97**

Strategic Plan for Garnet and Mica Mine of Zenober Iranian Company

Given the high reserves and potential of the Zenober Iranian Company›s garnet mine, as well as based on studies and investments made, extraction from the reserves of this mine has been planned in two phases - medium-term and long-term, for the two minerals: garnet and mica.
According to the performance and approach of Zenober Iranian Company in relation to the garnet mine, in the Þrst phase, has been constructed a factory with an annual capacity of 80,000 tons of garnet production. The factory will be expanded to produce garnet with a capacity of 140,000 tons. The mica processing plant with a capacity of 120,000 tons per year will be constructed the medium-term phase.
It is worth mentioning that the Zenober Iranian Company›s garnet mine in Sirjan not only aims to meet the country›s domestic needs and achieve self-sufÞciency in importing garnets required by the sandblasting, waterjet, and mica industries, but it will account for 10 to 15 percent of the world›s garnet and mica production in the long term.



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