

Analytical Services Guide

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Zarazma Mineral Studies Company

Zarazma Mineral Studies Company (Zarazma) commenced operations in 2007. It is an Iran-based organisation that utilises state-of-the-art technology, combining Iranian and international expertise. Our large laboratory facility at Parand, near Tehran, offers sample preparation, gold analysis by fire assay, multi-element analysis by ICP spectrometry, whole-rock analysis and wet-chemistry techniques. Through our agency for LabWest, Zarazma is also able to provide an extensive range of supplementary analytical services, including ICP-Mass Spectrometry.

Over the past 5 years, Zarazma has demonstrated its ability to provide world-class minerals analysis to the mining and minerals exploration industries in Iran and surrounding countries, at competitive prices and with short turnaround times.

Zarazma has an ongoing development programme, and new services are regularly being brought into production to meet the needs of the minerals exploration industry.

Zarazma, as part of the Zar Group of Companies, can assist with geochemical interpretation, geological consultancy and related professional services.

Whether your analysis requirement is for 50 samples or 5,000, contact Zarazma, where you will be sure of receiving professional, expert services.

Lotfollah Shakoorian
Managing Director

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Quality Assurance

Zarazma is fully committed to demonstrable, international standard quality control in all aspects of its sample handling and analysis systems.

ISO/IEC Certified Systems

We recognize that it is important for our clients to be assured that the data produced by Zarazma is reliable, and has been produced according to current best practices.

Zarazma's systems are accredited to ISO/IEC 9001-2008. This demonstrates that all management and operating systems are documented and audited to ensure compliance with accepted practices.

Our analytical facility is further accredited to ISO/IEC 17025. This international standard for analytical laboratories certifies the technical suitability for the techniques utilized by the laboratory.

NIST-traceable Calibration Standards

The solution standards used to calibrate our instruments are all certified against NIST (National Institute of Standards and Technology) traceable standards.

Certified Reference Materials

All batches of samples analysed at Zarazma contain certified reference materials (CRMs) appropriate to the sample type and main elements of interest to the client. The data generated by the laboratory is compared to the certified values, yielding measures of accuracy and precision.

Blanks

Barren samples are analysed with each batch of samples to monitor and detect any traces of contamination.

Duplicates and Repeats

At various points in the sample analysis process, from coarse crushing and splitting, through to weighing for digestion, duplicate splits are analysed in parallel to determine precision of analysis.

External Checks/Round-robins

Zarazma participates major international inter-laboratory round-robin programmes which compare our analytical performance to a large number of other laboratories. Examples includes the programmes run out of Australia by Ore Research and Geostats. Our focus on quality ensures consistently high performance in these programmes.



Sample Preparation

Zarazma's rigorous sample preparation techniques are designed to optimize sampling characteristics and eliminate potential for cross-contamination.

Attention to detail at every step...

The sample preparation procedures utilised at Zarazma have been designed to follow an optimum size-reduction and sampling protocol, whilst minimising cross contamination. Samples are dried upon receipt, then jaw-crushed if necessary, before splitting to 500g for pulverisation in ring-and-puck mills to a nominal minus 75µm grind-size.

Pulveriser bowls are routinely cleaned with a charge of barren abrasive material between all samples. Two portions of the pulverised material are taken and placed into paper sample packets. One is used for analysis, and the other kept for future reference if required.

Sorting: Where samples are submitted in a random manner and significant effort is required to sort them, a sorting charge may be applied on an hourly basis.

Drying: Large samples that are particularly wet and require extensive drying times will have an additional drying charge levied.

Oversize Samples: samples in excess of 5kg will require extra splitting before being pulverised.

Jaw Crushing: Rock chip, diamond core or other samples of large particle size will require jaw crushing to nominal 6mm before pulverising.

PREP-01	Samples less than 5kg: Samples are sorted, oven-dried at 80 ° C, crushed to <6mm, split then pulverised to <75µm.
PREP-02	Samples more than 5kg: Samples are sorted, oven-dried at 80 ° C, crushed to <6mm, split then pulverised to <75µm.

Sample Storage

Bulk sample rejects can be either disposed-of or returned to the client after completion of preparation. We will store your prepared samples free-of-charge for three months after completion of analysis, after which they can be returned to you, disposed-of or stored at our facility.



Gold and Precious Metals

Determining gold by fire assay ensures maximum gold recovery and minimizes interferences.

PPB-level Detection for Exploration Samples

Zarazma analyses mineral samples for Au, Pt and Pd by fire-assay. This well-proven technique involves fusion of the samples at high temperature (1,100°C), during which precious metals are separated from gangue materials and collected in molten lead. Lead is then removed by cupellation, again at high temperature, resulting in a prill of silver, gold and precious metals. The prill is dissolved in acids before the metal values are determined by ICP-OES or AAS.

Fire-assay is essentially a total-recovery technique., and is generally used as the reference technique when calculating ore reserves.

Very high base metal concentrations can interfere with the technique, and require particular care. Zarazma's proprietary assay flux mix is designed to provide optimum recoveries from the widest range of rock types possible.

The highest quality assay consumables (flux, crucibles and cupels) are sourced from around the world, to ensure that assay integrity is guaranteed.

Zarazma's standard assay charge is 25g.

FA3-01	Exploration samples: Lead-collection fire-assay analysis of a 25g sample portion, with high-sensitivity ICP finish. Au (1ppb) Pt (5ppb) Pd (5ppb)
FA3-02	Ore grade samples: Lead-collection fire-assay analysis of a 25g sample portion, with high ICP or AAS finish. Au (0.01 ppm)



Multielement Analysis

Acid-digestion and ICP-OES analysis for a range of multielement applications.

Multi-element analyses are primarily for geochemical exploration by acid digest followed by elemental determination by ICP-OES.

Aqua-regia Digestion

Aqua-regia digestion of samples (using hydrochloric and nitric acids) is suitable for many exploration applications, and offers a cost-effective multielement analysis solution for most base-metals explorers. Where high recovery of refractory elements such as Ti, Sn, Zr, W is required, the HF/multiacid digestion is used.

Zarazma Scheme ME-01 Elements and Detection Limits (in ppm):

Ag (0.1)	Al (100)	As (0.5)	Ca (100)	Cd (0.1)	Ce (1)	Co (1)
Cr (1)	Cu (1)	Fe (100)	La (1)	Li (1)	Mg (100)	Mn (5)
Mo (0.5)	Ni (1)	P (5)	Pb (1)	S (50)	Sb (0.5)	Sc (0.5)
Th (0.5)	V (1)	Y (0.5)	Yb (0.2)	Zn (1)		

HF/Multi-acid

Where more refractory mineral species are targeted, a multi-acid digest involving hydrofluoric, perchloric, nitric and hydrochloric acids is performed. Hydrofluoric acid dissolves the silicate matrix of the sample, making metallic elements available for dissolution.

Zarazma Scheme ME-02 Elements and Detection Limits (in ppm):

Ag (0.1)	Al (100)	As (0.5)	Ba (1)	Be (0.2)	Bi (0.2)	Ca (100)	Cd (0.2)
Ce (1)	Co (1)	Cr (1)	Cu (1)	Fe (100)	K (100)	La (1)	Li (1)
Mg (100)	Mn (5)	Mo (0.5)	Na (100)	Nb (1)	Ni (1)	P (10)	Pb (1)
Rb (1)	S (50)	Sb (0.5)	Sc (0.5)	Sr (1)	Th (0.5)	Ti (10)	U (0.5)
V (1)	W (0.5)	Y (1)	Yb (0.5)	Zn (1)	Zr (5)		

Rare-Earth Elements

Rare-earth elements (REE) are relatively refractory, and require intensive extraction techniques. Samples for REE analysis are analysed at LabWest, using microwave-assisted multiacid digestion, and ICP-MS determination.

Zarazma Scheme ME-10 Elements and Detection Limits (in ppm):

Ce (0.05)	Dy (0.02)	Er (0.05)	Eu (0.02)	Gd (0.05)	Ho (0.02)	La (0.05)
Lu (0.02)	Nd (0.02)	Pr (0.05)	Sm (0.05)	Tb (0.02)	Tm (0.02)	Yb (0.05)

Ore Grade Analysis

Specialised analytical techniques for highly mineralised materials and near-mine ore samples .

Ore-Grade Mineral Samples

Ore-grade samples require higher acid volumes and greater dilution ratios in order to be analysed effectively. Zarazma's ore-grade digest involves a variation on the aqua-regia digest, and is a high-precision technique, able to handle high sulphide levels and suitable for ore reserve calculations.

Zarazma Scheme ME-03:

Element	DL (ppm)	UL (%)	Element	DL (ppm)	UL (%)	Element	DL (ppm)	UL (%)
Ag	2	1	Ni	50	10	Co	20	5
As	50	40	Pb	50	50	Cr	20	2
Cd	10	1	S	50	75	V	20	2
Cu	50	75	Sb	50	5	Mo	20	1
Fe	50	75	Zn	50	75	P	50	2

Oxide Copper

Where speciation of copper between oxide- and sulphide- minerals is required, copper ox-

Element	DL (ppm)	UL (%)
CuO	10	5



Whole Rock Analysis

Alkaline fusion of mineral samples to yield complete recoveries of major oxide forming metals.

Lithium Borate Fusion

Alkaline fusion with borate flux decomposes most refractory mineral types, enabling analysis of major oxides. When combined with Loss on Ignition (LOI) determination, an approximation of the whole rock matrix composition can be made.

Zarazma Scheme AF-01 elements and detection limits (in %).

SiO ₂ (0.01)	Al ₂ O ₃ (0.01)	Fe ₂ O ₃ (0.01)	CaO (0.01)	K ₂ O (0.01)
Na ₂ O (0.01)	MgO (0.01)	TiO ₂ (0.01)	P ₂ O ₅ (0.01)	SO ₃ (0.01)

Base metals and some traces may also be determined by ICP-OES from the fusion solution.

Zarazma Scheme AF-02 elements and detection limits (in ppm).

Mn (100)	As (50)	Ba (20)	Be (20)	Co (20)	Cr (20)
Cu (20)	Mo (20)	Ni (20)	Pb (20)	Sn (50)	Sr (20)
Ta (50)	V (20)	W (100)	Y (20)	Zn (20)	Zr (20)

Sodium Peroxide Fusion

This highly oxidizing, low temperature fusion is required for sulphide minerals and complete recovery of base-metal oxides.

Zarazma Scheme AF-03 elements and detection limits (in %).

SiO ₂ (0.01)	Fe ₂ O ₃ (0.01)	CaO (0.01)	K ₂ O (0.01)	MgO (0.01)
TiO ₂ (0.01)	P ₂ O ₅ (0.01)	SO ₃ (0.01)		

Zarazma Scheme AF-04 elements and detection limits (in ppm).

Mn (100)	As (50)	Ba (20)	Be (20)	Co (20)	Cr (20)
Cu (20)	Mo (20)	Ni (20)	Pb (20)	Sn (50)	Sr (20)
Ta (50)	V (20)	W (100)	Y (20)	Zn (20)	Zr (20)



Wet Chemistry Analysis

Classical analysis using digestions and titrimetric techniques

Ferrous Iron

Ferrous iron is selectively dissolved from the sample and determined by titrimetry.

Scheme	Element	DL (%)	UL (%)
WET-03	FeO	0.01	5

Sulphur

The sample is digested in acid and sulphur concentration determined by precipitation/gravimetry.

Scheme	Element	DL (%)	UL (%)
WET-04	SO ₃	0.01	5

Chloride

Chloride is eluted from the sample and determined by spectrophotometry or titrimetry.

Scheme	Element	DL (ppm)	UL (%)
WET-05	Cl	1	5

Moisture

Moisture is determined gravimetrically after drying at 110°C.

Scheme	Element	DL (%)	UL (%)
WET-06	H ₂ O	0.01	100

Specific Gravity

Determination of Specific Gravity (on pulp samples) and Bulk Density (on bulk and core samples) is performed gravimetrically by water displacement.

Scheme	Element
SG-01	Specific Gravity
SG-02	Bulk Density

Petrography and Mineralogy

Petrographic analysis by leading mineralogists.

Petrography—Thin Section

Sample slides are prepared for transmitted light analysis under plane- or cross-polarized light. photographed and analysed by experienced mineralogists.

Scheme	Description
PET-01a	Preparation of thin section
PET-01	Thin section study, photography and report

Petrography—Polished Section

Sample slides are prepared for reflected light analysis under plane- or cross-polarized light. photographed and analysed by experienced mineralogists.

Scheme	Description
PET-02a	Preparation of polished section
PET-02	Polished section study, photography and report

XRD

Samples are analysed by XRD for mineral content, either qualitatively or quantitatively.

Scheme	Description
XRD-01	Qualitative XRD Analysis
XRD-02	Quantitative XRD Analysis

Heavy Mineral Analysis

Heavy minerals are concentrated by panning, then undergo heavy liquid separation. The final concentrate is examined by experienced mineralogists for speciation of minerals present.

Scheme	Description
HM-01	Heavy mineral analysis

Environmental Analysis

Low-detection ICP-MS analysis of soil, water and vegetation samples is provided by Zarazma's affiliated laboratory, LabWest Minerals Analysis, for trace elements and rare-earths.

Soil Samples

Samples are digested in a mixture of acids using microwave digestion apparatus. Elemental determinations are performed by ICP-MS and ICP-OES. Contact Zarazma for a full list of elements analysed.

Scheme	Description
ME-07	Soil samples: Multi-elements by ICP-MS

Water Samples

Water samples are analysed for most metallic elements by ICP-MS. Contact Zarazma for a full list of elements analysed.

Plant Samples

Plant sample material is digested in a mixture of acids using sealed-vessel microwave digestion apparatus. Elemental determinations are performed by ICP-MS and ICP-OES. Contact Zarazma for a full list of elements analysed.

Scheme	Description
ME-09	Plant samples: Multi-elements by ICP-MS



Sample Submission

Contact Zarazma at the address below for assistance with pricing, analytical queries, or submitting your samples.

Submission Advice

Zarazma's Sample Submission Advice is available for download from our website, www.zarazma.com, or we will e-mail it to you on request.

The Sample Submission Advice ensures that all of your requirements are correctly detailed and that we have the information needed to treat your samples appropriately.

Contact Details:

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