Azimut Geology LLP was established on the basis of the branch of JSC AES in Karaganda - a diversified enterprise that is currently the only structure of this kind in Central Kazakhstan that successfully solves the full cycle of geological problems, ranging from prospecting and exploration of promising ore occurrences, their assessment and ending with volumetric modeling, reserves calculations and solving issues related to the subsequent development of mining facilities.
The first private exploration company in the CIS. Established in 1991 as GGAO "Azimuth". After a number of structural changes and owners of the enterprise since 2011, the company is owned by citizens of the Republic of Kazakhstan. Currently operating company name “Azimuth Geology”.

The main asset of the company is highly qualified Kazakhstani personnel (247 people, including ITR 114 people.) and constantly updated technological equipment.

**Types of Works and Services:**

- Topo-geodetic support of geophysical and geological exploration, center-binding works, topographic survey of various scales, tracing of linear structures.
- Comprehensive geophysical surveys (electrical, gravity, magnetic exploration) while searching and exploration of all types of solid minerals, engineering and geological surveys, as well as oil and gas;
- Geophysical surveys of wells (logging) for solid minerals and for solving hydrogeological problems;
- Engineering and geological surveys of all directions;
- Study of physical and mechanical properties of samples;
- Drilling work up to 2300m in depth at the stage of geological survey, prospection and exploration;
- Geological surveying and exploration
- Geocological research and environmental monitoring;
- Hydrogeological survey and research of all types, including water supply of industrial and social facilities;
- Accredited according to international standards chemical-analytical laboratory, performing work on the whole complex of solid and liquid minerals, including geo-environmental studies;
- Monitoring of operational oil and gas fields (the study of geodynamic processes, gravimetric measurements);
- Seismic exploration (engineering geology, the study of upper part of the geology section, 2D- 3D monitoring of deposits).

azimut@azimut-geology.kz

**Why choose us!**

turn-key geological surveys
Geological Surveys
- Geological Mapping in Scales 1 : 50 000 to 1 : 200 000 by Government Orders;
- Geological Mapping in Scales 1 : 10 000 to 1 : 25 000 for detail studies through private investments;
- Interpretation of aerial and space phototopographic images;
- Interpretation of data acquired in the course of advanced geophysical studies;
- Prospect Mapping Drilling;
- Sampling;
- Petrographic Studies

Mineral Prospecting Surveys
- Geological mapping of exploration sites;
- Lithochemical survey;
- Mining workings;
- Drilling operations;
- Sampling of mine openings and borehole cores;
- Interpretation of geophysical data;
- Petrographic studies;
- Development of Research Reports

Mineral Exploration Surveys
- Development of Mineral Exploration Work Programs;
- Exploration drilling;
- Borehole core description;
- Petrographic studies;
- Reserve assessment;
- Development of the Reports and Technical & Economic Assessment conditions
- Reserves substantiation at the State Reserves Committee

Paleontological and Biostratigraphic Researches
- Collection of fossil fauna and flora in the course of geological surveys;
- Fauna and flora definition;
- Development of conclusion on age of fossil confining sediments;
- Drawing of reference sections
Bore-Hole Drilling and Field Testing

The drilling of wells is carried out using a percussion cable up to 50 m and a core method.

**Equipment available:**
- URB-2A2 (yom 1988) – 2 rigs
- URB-3AM (yom 1985) – 1 rig
- UGB-50M (yom 1987) – 1 rig
- Christensen CS14 – 1 rig
- Boyles C8C– 1 rig
- Equipment for static soil sensing

**Laboratory Work**
- Determination of physical and mechanical properties of loamy, sandy, macrofragmental and rocky soils
- On the basis of the data acquired from soil-water extracts and chloride extracts, soil salinity, soil aggressivity towards concretes and soil corrosive activity towards metals are determined
- Chemical analysis of water

**Office Works**
Development of Complete Technical Reports with descriptive and graphic appendices in accordance with the Kazakhstan Standards

Software employed: CredoGEO, Auto CAD.
Bore-Hole Drilling

Main areas of activity:

Drilling of Exploration Wells

Drilling of Hydrogeological Wells

Drilling of Engineering Geological Wells

Technical Equipment:
- URB-2A2 - 2
- URB -2A2 - 2
- UGB-50M - 1
- UGB001-) - 1
- Christensen CS14 - 1
- Boyles C8 - 1
- Beretta T57 Geo - 1
- XY 360 - 1

Drilling of Exploration Wells
- Core drilling up to 2300 meter depth at the stage of geological survey, prospecting and exploration works
- Pneumatic impact drilling at the stage of prospecting works

Hydrogeological Drilling
- Drilling of prospecting hydrogeological wells
- Drilling of exploratory production hydrogeological wells;
- Drillign of hydrogeological observation wells;
- Performing pumping tests
Topographic survey:
- Tacheometric Survey in Scales 1:500 to 1:5000;
- GPS Survey with creating of digital terrain model;
- highways, railways, powerlines, fiber optic communication lines Survey.

Creating of Survey justification:
- by traditional methodologies (triangulation, notes, traverse moves, polygonometry);
- using GPS receiver (GPS network development);
- leveling course (with different accuracy depending on purpose).

Bench mark

As-built and lay out survey:
- profiles lay out survey;
- tracing line structures (roads, electric power lines, oil & gas pipe lines
- curves lay out survey;
- as-built of excavations, ditches, water conduits, pipelines and other constructions as-built.

«Certification» of roads by using GPS receivers Trimble 4400, 4600 ser.
Projects takeaway.
Justification of 3D and 2D seismic exploration.
Border demarcation.
Polygonometric network creation.
Special equipment:
High quality of works is also provided by the use of modern equipment. "Azimut Geology" LLP owns computational and multiplying equipment that allows to quickly and efficiently process large digital arrays and draw up reporting materials in accordance with modern requirements.
- Optical theodolites 3T2KA, 3T2KП,
- Electronic tachometers GTS-302 TOPCON. GTS 236N
- Optical levels H-0.5,3H3КЛ, 3H2КЛ
- Digital level DINI 03.
- GPS equipment:
  - Portable GPS Garmin
  - Receivers Trimble 4600 LS
  - Base and mobile station GPS Trimble 4400, 4600 XL
  - Base and mobile station GPS Ashtech Z-12
  - Base and mobile station GPS Leica SR530
- Modern software: Surfer, MapInfo, Autocad, Prizm, GPSurvey, GPSSeismik Trimble Geomatic Office, GPS CAAD Seismark, full software package CREDO.
Geophysical Studies

Main activities:

- Surveying and Prospecting Works of Various Scales - 1:200000 to 1:10000 and larger
- Various Integrated Geophysical Studies
- Geological Engineering Works
- Hydrogeological Studies
- Polymetallic Ores, Ferriferrous Manganese Ores, Gold, Rare-Earth Metals, Ground Waters, Radioactive Raw Materials, Hydrocarbon Material (Oil, Gas, Coal, Coalbed Methane), Construction Materials

Types of field geophysical research:

- High-precision gravity survey (profile and areal)
- High-precision magnetic survey (profile and areal)
- Electric profiling, including: Resistivity Mean Gradient Method and Induced Polarization Method (MG and MG-IP);
- Electric profiling with electrical probe systems of different configuration, including: Point Resistivity Sounding (PRS) and Point Induced Polarization Sounding (PIP), Vertical Electrical Resistivity Sounding (VES) and Vertical Induced Polarization Sounding (VES-IP), Dipole Axial Sounding (DAS) and Dipole Equatorial Sounding (DES), and Axial Sounding (AS);
- Excitation-at-the-Mass Method by Resistivity (EAM, EAMM) in bore-hole – day surface modification;
- Natural Electrical Field Method (NF);
- Inductive methods: Near-Field Time-Domain Electromagnetic Sounding (NFTDES), Time-Domain Electromagnetic Method (TDEM), Time-Domain Electromagnetic Sounding with Fixed Source (TDEM-FS);
- Seismic survey

Types of Well Logging Performed:

- Gamma ray logging
- Caliper logging
- Electrical logging
- Magnetic susceptibility logging
- Inclinometry
- Flowmeter survey
Geophysical equipment:
Single-channel EIN-209M
8-channel EIN-2000M
Generating station GER-1/1000
Generating station GER-5/1000
Cycle-7, GET-4
Protonic MiniMag
Scintrex CG-5 AutoGrav

Software:
All field data are promptly processed using specialized and original programs developed at Azimut Geology LLP. Among the software packages used for processing geophysical information, the most well-known and well-established in practice are:
- Surfer, Grapher (Golgen SoftWare)
- MapInfo + Discover for MapInfo (ENCOM)
- Micromine
- IMPULSE ABC, HORIZOW (G.M.Trigubovich, Novosibirsk, GFUP SRIGG&MR)
- ZondRes2D, ZongIP1D, ZondMag2D, ZondMag3D, ZondGM2D (SP, Kaminskiy A.)
- CYCLE: PROBA, PODBOR V.S.Mogilatov, Novosibirsk, Institute of Geophysics RAF
- WGRMG (S.V.Dolgov, Almaty, AES )
- auxiliary program AutoCad, CorelDraw etc.

A wide range of applied software allows for on-line pre-processing and visualization of the results obtained directly in the field, as well as semi-quantitative and quantitative calculations during the cameral period with obtaining the vertical distribution of the true parameters of the studied media (media model). In addition, currently, the most promising processing methods are various algorithms that use inversion methods (ZOND software package) and restore true environmental parameters across the entire array of field data, taking into account the actual terrain and location of receiving and feeding electrodes on it (2.5D interpretation). This type of field data processing allows to obtain the most accurate and close to the real sections of the environmental model.
Seismic exploration occupies a leading place among geophysical methods used in the search for oil and gas fields, as well as solid minerals.

The method is based on the study of the propagation in the earth's crust of elastic waves caused by an explosion or impact. Getting into the geological environment, the waves are reflected and refracted and partially return to the surface of the earth, where they are recorded by a seismic survey station. The time of wave propagation and the nature of their oscillations allows to judge the composition of the rock, the depth and the shape of the reflecting geological boundaries.

Azimuth Geology LLP, either independently or with its partners, is ready for 2D or 3D seismic exploration, providing for different conditions, combinations of sources and receivers, etc. Seismic work can be carried out in conjunction with other geophysical methods: magnetic prospecting, gravity prospecting, electrical exploration. Integration of seismic prospecting with other geophysical methods significantly increases the reliability of information and reduces the risk of drilling empty exploratory wells.

To perform seismic exploration, our company has in its presence a cable-free seismic system SCOUT (Russia, Saratov). A unique Russian seismic system designed to solve a wide range of exploration tasks:

- Engineering surveys (minimum quantization interval 0.25 ms);
- studying TPS;
- 2D and 3D projects;
- 4D projects (monitoring of fields, monitoring while drilling).

The company promotes 2D and 3D seismic surveys with an explosive source while searching for solid mineral deposits. According to the theory of seismic exploration, the work experience of world seismic companies, including our company, using explosive sources allows us to map thin and low-thickness ore-bearing formations due to the high-frequency spectrum of seismic vibrations, unlike vibrational systems that excite seismic impulses on the surface of the earth and due to loose rocks of the upper part significantly lose their high-frequency component.

Due to the absence of cables and the availability of wireless interfaces, SCOUT allows you to organize a flexible project execution scheme, save financial resources by reducing logistics costs, and increase the speed of work.

The company has all the necessary equipment and personnel to perform seismic exploration. All projects are carried out in compliance with all the requirements of the HSE, at the international level.
Types of Engineering-Environmental and Hydrogeological Studies Performed:
- study of the geological section of loose formations with the definition of the depth of the aquitard;
- the allocation in the context of aquifers and areas of increased endogenous and exogenous fracture;
- prospecting and exploration of drinking, mineral and industrial groundwater;
- calculation of reserves of groundwater deposits for various purposes and approval of operational reserves in the State Commission on Mineral Reserves;
- identification of promising areas with an assessment of operational capabilities;
- hydrogeological, complex hydrogeological and engineering-geological surveys with geo-ecological studies and mapping;
- monitoring of groundwater at local and regional levels;
- study of the conditions of watering of solid mineral deposits and mining and technical conditions of development;
- development of regional water supply programs using groundwater.

Ecological service performs the following work:
- integrated geo-ecological surveys of 1: 25000 and smaller scales;
- geoecological studies in the production of all types of surveys;
- environmental monitoring of facilities throughout Kazakhstan;
- sampling of soil, water, air, vegetation, etc.;
- instrumental measurements on emission sources;
- research on air pollution in industrial premises and work areas;
- sampling of sediments, therapeutic mud, brine lakes;
- environmental design - writing projects of EIA, MPE, MPD, DWGS, waste passports, inventory of emission sources using modern software.

Applied equipment:
- Physical and chemical analysis of the elemental composition of rocks, ores, products of their processing and microelement composition of samples of plant origin, natural surface, groundwater, groundwater, as well as waste and drinking water, soil, soil and bottom sediments
- Chemical analysis of soils, soil, bottom sediments to monitor the quality of soil in populated areas, on agricultural land during the design, placement, construction, reconstruction and in the process of operation of various facilities.
- Chemical analysis of water (natural - underground, surface; drinking; waste) for more than 30 indicators.
- Determination of the physicomechanical characteristics of clay, sandy, coarse and rocky soils.

**MAIN AREAS OF ACTIVITY**
- Complete Sample Preparation Cycle
- Physical-Chemical Analyses
- Spectral Analysis
- Physical and mechanical testing of soils

**OBJECTS OF LABORATORY RESEARCHES**
- water (natural - underground, surface; drinking; waste)
- soil, priming and bottom sediments
- samples of plant origin

**SPECTRAL ANALYSIS:**

*Atomic Absorption:*
- quantitative determination of gold, silver, copper, arsenic, platinum, palladium
- determination of mercury in the air, soil, water;

*Atomic emission analyses with ISP*
- drinking water analysis (for compliance with SN & R of RK), natural and waste water over 30 elements;
- Testing of water, soil, rocks, ores and derivatives for 31 chemical elements (As, Se, Sn, Sb, Be, Na, Si, Te, Co, Ni, Cr, Ar, Li, Mo, W, Bi, Pb, Ba, Ca, Zn, Al, Cd, Mg, B, Ti, V, Fe, Mn, Cu, Sr);
- semi-quantitative rapid analysis:
  - water, soil, rocks more than 40 elements (Al, Ag, B, Ba, Bi, Cd, Co, Cr, Cu, Fe, Li, Mn, Mo, Ni, Pb, Sb, Sr, Sn, Ti, V, W, Si, Zn, As, Be, Ca, K, Mg, Na, Se, Te, Hf, In, U, Sc, P, Zr, Ge, Ga, Au, Pt, Tl) in the range of contents from 10 -7% to percent units;
- determination of gold in rocks, ores, secondary raw materials with a detection limit of 0.05 g / t;

*Atomic emission analysis*
- Automated emission quantitative multicomponent spectral analysis of mineral raw materials (28 impurity elements - Ba, Be, Bi, W, Ga, Ge, In, Yb, Y, Cd, Co, Mn, Cu, Mo, As, Ni, Nb, Sn, Pb, Ag, Sc, Sb, Tl, Ta, Ti, Cr, Zn, Zr)

*X-ray spectral analysis:*
- X-ray spectrometer multichannel silicate analysis of ores and rocks-determination of rock-forming oxides MgO, CaO, Na2O, Fe2O3, TiO2, K2O, P2O5, SiO2, Al2O3, MnO2;
- Express analysis of soil, rocks, ores, processed raw materials and atypical samples for presence of more than 80 chemical elements (from Mg to U as listed in the Mendeleev periodic system)

**PHYSICAL-CHEMICAL ANALYSES:**
- determination of mineral forms of copper in ores and products of their processing by the method of chemical phase analysis
- determination of soil salinization;
- Organic substance in soil

-ECO, humus and gypsum in soil.
Complete set of hydrochemical analyses

- Organoleptic;
- Suspended matters;
- Reduced Chemical Analysis (RCA) of potable, natural and waste water (dermination of Cl-, SO$_4^{2-}$, NO$_3^-$, HCO$_3^-$, Ca$^{2+}$, Mg$^{2+}$, Fe$^{2+}$, Fe$^{3+}$, dried residue, CO$_2$, total hardness, pH);
- Complete Chemical Analysis of potable water, natural water and waste water (RCA + dermination of silicic acid and permanganate value);
- chemical oxygen consumption (COC), (BOD n) biochemical oxygen demand

**Laboratory Testing of Soil Samples for Engineering-Geological Researches**

- Determination of the physicomechanical characteristics of clay, sandy, coarse and rocky soils

**CHEMICAL ANALYTICAL LABORATORY EQUIPMENT**

- Jaw crusher DS-01M 150×100
- Jaw crusher DS 200×125
- Roller crusher DVG 200×125
- Mill (KIT-2 un.)
- Pre-compaction device, GT 1.2.5
- Standard seal device, PSU GT 1.4.1
- Universal ionomer EV-74
- Alpha beta radiometer, UMF-2000
- Photoelectric colorimeter, KFK-2
- X-ray multichannel spectrometer, SRM-25
- X-ray energy dispersive analyzer, BRA-18
- Optical emission spectrometer with inductively coupled plasma Leeman Lab Profile Plus
- Spectrophotometer "DFS - 462" based on an analyzer of photoelectric spectra "FEP-454"
- Atomic absorption spectrometer AANALYST 400
- Mercury analyzer, RA-915+, SPC «LUMEX»
- Fluid analyzer, Fluorat 02-5M
- Measuring and computing complex, MCC «ASIS»

*Chemical Analytical Laboratory of Azimut Geology LLP is accredited by the Analytical Accreditation System laboratories on independence and competence of June 9, 2014 with the right to use the laboratory combined ILAC MRA mark*
Azimut Geology LLP

Total Employment (Including administrative staff) – 247
ETP – 114
Workers - 133

<table>
<thead>
<tr>
<th>Facility</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office block (double-storey)</td>
<td>1700м²</td>
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<tr>
<td>Base</td>
<td>4330м²</td>
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<tr>
<td>Boiler-House</td>
<td>434м²</td>
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<tr>
<td>Storage facilities</td>
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<tr>
<td>Laboratory</td>
<td>311м²</td>
</tr>
<tr>
<td>Land Allotment Area</td>
<td>19 398м²</td>
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Experience

The success and effectiveness of Azimut Geology LLP is constantly emphasized by the specialists of the State Institution ID “Centr kaznedra” and the Committee of Geology and Subsoil Use of the Republic of Kazakhstan, and the results of the work have repeatedly received positive feedback from Customers, which has a positive effect on the image of the company as a whole.


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