Using the Multi-Source Induced Polarization System for Gold Exploration in Azerbaijan

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Abstract

The multi-source system offers a unique approach for resistivity and IP surveys for targets as deep as several hundred meters. The system consists of small, battery powered transceivers each connected to three electrodes. Each transceiver has an internal 375 watt transmitter with a maximum current flow of 2.5 ampere. By having multiple units transmit simultaneously, the system can produce signal levels at depth that are comparable to those from a single large transmitter. For example, eight units transmitting 1.5 amps simultaneously will produces signal levels comparable to a single 12 amp source. In addition, distributing the source over a broader area can be shown to reduce the impact of near surface anomalies on the overall response.

In 2017, 20 units were deployed at Goydagh project, located in the Julfa district of Nakhchivan Autonomous Republic (Azerbaijan). The area is covered by volcanogenic-sedimentary rocks of Upper Eocene, andesites of early Oligocene, dacite and quartz-syenite intrusions with diorites of Oligocene-Lower Miocene. Gold mineralization of the area is consists of by quartz-sulphide veins, ore-bearing alteration zones and large metasomatites.

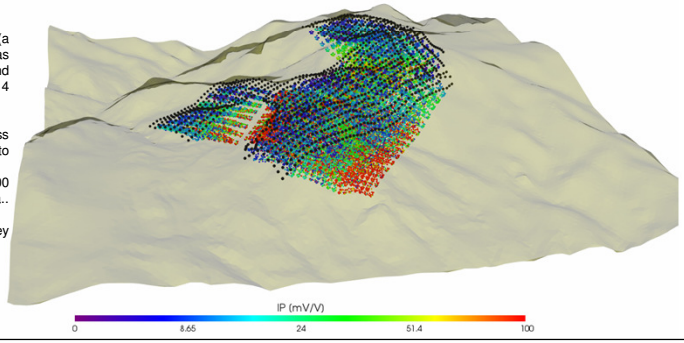
Despite the rugged terrain of the region, high quality resistivity and TDIP data were collected at the site and inverted to provide 3D images to depths of more than 300 m.

Survey

The survey used 25 and 50 m dipoles (a denser grid was used in the "gold zone" as previously identified by geochemistry) and combined acquisitions with 1, 2 and 4 simultaneous transmitters.

Equatorial dipoles were collected across adjacent lines to add 3D information and to increase the penetration.
The terrain is extremely rugged with over 500 m of elevation change within the survey area..

The figure to the right shows the survey layout and pseudo-sections.



Geological Overview of Goydagh Area

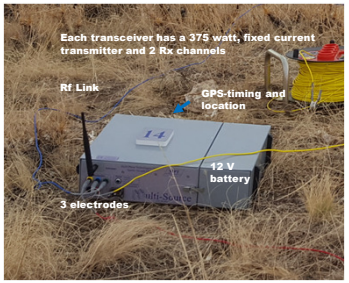
The investigation area, called as Goydagh, is located in Julfa district of Nakhchivan Autonomous Republic (Azerbaijan). The Goydagh area is a fragment of the southern part of the Lesser Caucasus, complex mountain-fold structure that is the central segment of the Mediterranean zone. Sedimentary rocks of Middle and Upper Eocene, and volcanogenic and sub-volcanic occurrences of Eocene, Oligocene and Neogene take part in the geological structure of the area. Upper Eocene rocks are exposed in the watershed of Mountain Gylynjyurd. Oligocene is represented by lavas, lava breccias of andesite-basalts, and their tuffs and tuff-conglomerates.

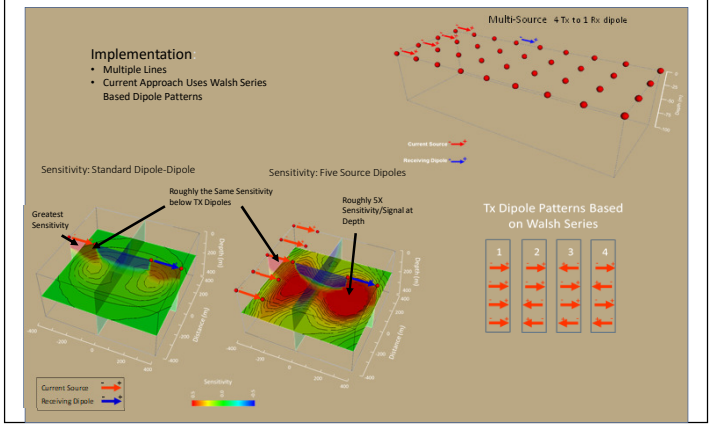
Intrusives at Goydagh make up the peaks of Mountain Goydagh and its slopes, and they appear as a window-like syenite-diorite with quartz composition. Contacts of the intrusives have large development of metasomatic replacements (silicification, epidotization, chloritization, pyritization) with the widths of 50-250 m. Local Quartz syenite-diorites were subjected to intense veinlet-disseminated copper mineralization (malachite, chalcopyrite).

Gold mineralization of the area is represented by gold-containing sediments along the river Bashkendchay, quartz veins, ore-bearing alteration zones and large metasomatites. The Ortakend gold-bearing ore body is situated at the intersection of Yarpagly-Ortakend-Beyrakdagh fault with Bashkend deep fault. The area is covered by volcanogenic-sedimentary rocks of Upper Eocene, andesites of Early Oligocene, dacite and quartz-syenite intrusions with diorites of Oligocene-Lower Miocene. All of them are strongly silicified, kaolinized, serisitized and cut by different orientation quartz-sulfide veins. The thickness of alteration zones ranges from 50-100 meters on the same strike with Bashkend-chay fault (NE40-50°), and the length of them from 200 to 2500 meters.

Multi-Source Overview

- An electrical impedance tomography system with the capability to transmit electric current on multiple dipoles simultaneously.
- The multi-source system uses a series of wireless transceivers.
- The system is designed to work difficult terrain and around obstacles where running cables would be difficult.
- Geared towards 3D surveys with grid-type layouts
- Using simultaneous dipoles can improve signal levels for large-scale surveys
- Using multiple dipole also allows us to manipulate the subsurface sensitivity distributions
- Commonly we us Walsh series to create orthogonal source series





Results

Currently drilling is underway to determine the correlation between resistivity/IP responses and the ore bodies. The primary approach has been to use normalized chargeability = (Chargeability / Resistivity). Most of the ore zones do not correspond to the highest values of either chargeability or conductivity but intermediate values typically resistivities of around 100 to 200 Ohm-m and chargeabilities of 20 to 35. Borehole #14, on top of the mountain ridge, found oxidized diorite in the top 80-100 m, where normalized chargeability is rather low. Borehole #18 (midway between the mountain peaks and the "placer" valley) found oxidized andesitic/dacitic rocks to 100 meters depth and then porphyritic diorite with interesting mineralization to 200 m depth => horizon with resistivity around 30-40 Ohm-m and chargeabilities ranging from 40 to 80 mV/V.