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Geophysical Investigations in the Caucasus (1925 - 2012): Initial, Basic and Modern Stages

L.V. Eppelbaum

Tel Aviv University, Faculty of Exact Sciences, Dept. of Geophysical, Atmospheric and Planetary Sciences, Tel Aviv, Israel (levap@post.tau.ac.il, +9723 6409282)

The Caucasian Mountains occupy an area of about 440,000 km^2. A number of important mineral resources are concentrated there. Geophysical data on the geological structure of Caucasus can shed light on the basic principles of evolution of the Earth, the distribution of minerals and seismic activity. However, geophysical surveys under complex conditions are generally riddled by poor accessibility to certain mountainous regions, the unevenness of observation surfaces, as well as by a great variety and frequent changes of tectonic structures and geological bodies with variable physical properties. These factors either restrict geophysical surveys in difficult environments or confine the scope of useful information drawn from the results obtained. This has led to the development of special techniques in geophysical surveys, data processing and interpretation that draws heavily on the experience accumulated in the specific conditions of these mountainous regions.

First applied geophysical observations in the Caucasus region – thermal measurements in boreholes – were carried out by Bazevich (1881) in the Absheron Peninsula. At the same time, start of the initial stage is usually referred to as the mid 20-s of the XX century, when the rare, but systematic geophysical observations (mainly gravity and magnetic) were begun in some Caucasian areas. Somewhat later began to apply the resistivity method. Mid 30-s is characterized by the beginning of application of borehole geophysics and seismic prospecting. The marine seismics firstly in the former Soviet Union was tested in the Caspian Sea. In general, the initial stage is characterized by slow, but steady rise (except during World War II) lasted until 1960.

A basic stage (1960-1991) is characterized by very intensive employment of geophysical methods (apparently, any possible geophysical methods were tested in this region). At this time the Caucasus region is considered in the former Soviet Union as a geophysical polygon for testing different geophysical methods and methodologies in complicated environments. Airborne magnetic and gravity surveys covered all the Caucasus, regional seismic and magnetotelluric studies were used as reference profiles for deep structure investigation. Numerous effective applications of geophysical methods for searching ore, oil&gas deposits, building raw, fresh water localization, solving engineering, etc. was demonstrated. Seismological investigations (including different methods) were widely applied throughout the entire Caucasian region. Satellite geophysical examinations were successfully combined with other methods.

Finally, destruction of the former Soviet Union in 1991 (beginning of the modern stage) caused a sharp common decreasing of the geophysical activity in this region. Only foreign oil-&gas companies (mainly American and England) demonstrated some industrial geophysical activity basically in the Caspian Sea. In the last few years the situation began to straighten out, especially in the field of seismology.

This presentation is based of the author's experience (e.g., Eppelbaum, 1989, 1991, 2009; Eppelbaum et al., 1987; Eppelbaum and Finkelstein, 1998; Eppelbaum and Khesin, 1988, 1992, 2002, 2004, 2011, 2012; Eppelbaum and Mishne, 2011; Eppelbaum et al., 2003, 2004; Khesin et al., 1988, 1993a, 1993b, 1996, 1997; Khesin and Eppelbaum, 1986, 1994, 1997, 2007; Pilchin and Eppelbaum, 1997, 2011) and corresponding publications and reviews of other authors.

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