Geophysical Research Abstracts
Vol. 14, EGU2012-1450, 2012
EGU General Assembly 2012

Mechanism of sinkhole formation along the Dead Sea shores -geophysical evidences

M. Ezersky (1), A. Al-Zoubi (2), L. Eppelbaum (3), S. Keydar (1), E. Akkawi (2), B. Medvedev (1), E. Levi (1), and A. Legchenko (4)

(1) Geophysical Institute of Israel, Engineering Geophysics, Lod, Israel (mikhail@gii.co.il, 972 8 920 8811), (2) Al-Balqa Applied University, Salt, 19117, Jordan, , (3) Tel-Aviv University, Tel Aviv, Israel, (4) IRD-LTHE, BP 53, 38041 Grenoble Cedex 09, France

Thousands of sinkholes have formed in narrow (50-100m width) strip along DS shoreline in Israel and at the south-east of northern DS basin in Jordan. It is accepted by the scientific community that the Dead Sea regression is directly related to the sinkhole development along its shoreline.
Seismic refraction surveys carried out by Israeli geophysicists has made possible the delineation of the buried salt layers in 12 sites of Israeli shore. Seismic refraction surveys carried out by Jordanian researchers allowed to detect high velocity zones of 3000m/s and over (interpreted as salt) in the Ghor Al-Haditha area. The pattern of the sinkhole development along the salt edge is repeated (with a small variations) in all studied sites in Israel. Correspondence between the salt edge line and sinkhole arrangement in Israel suggests that salt edge is a major factor of sinkhole formation. Similarly, salt presence at the depth of 30-50m in Ghor Al-Haditha detected by seismic refraction survey allows prolongation of sinkhole hazardous strip around the DS northern basin. This belt girding northern DS basin from the west, south and south east comprises all known cases of collapses and accidents including alarming catastrophe at the salt evaporation pond 19 of the Arab Potash Company in Jordan.
Indeed, the salt layer was formed along DS shore line in Earlier Holocene when warming of the climate caused intensive evaporation of sea water. Thus, 10-30m thick salt belt formed along the DS shores. There are no reasons that salt was formed along the western DS shore and is absent from south and east. Salt was deposited at places of superficial coastal backwaters where sea bottom was slopping (Israeli shore and south-eastern and north-eastern parts of the DS in Jordan). At places of steep shores salt was not deposited. Jordanian side is characterized by such steep shores in central part of the northern DS basin. Thin salt featheredge fitting to the shore morphology come out far from massive salt layers deposited in the backwaters. This conclusion presented at first at the EGU-2008 has been confirmed by new geophysical data. Interpretation of the salt edge will be considered during presentation. Other question is how fresh or unsaturated water comes to contact with salt edge. The faults it seems to bring unsaturated water to zones located close to the Judea Mountains where groundwater coming out from carbonate aquifers under pressure breaks aquiclude and ascend upward. Hydrogeologists have discovered such areas at the north of Dead Sea where strong distortion of the fresh/salt water interface was observed. Our preliminary data suggesting that Mineral Beach area is a such case. Sinkholes in this site are arranged along the salt edge of complicated shape. Faulting zone and damage of the reflector located at 50-80m deep was revealed by 3D seismic reflection study some west of sinkhole location. Groundwater with resistivity of 0.8 Ohm-m ($\sim$60g/l chloride) was discovered using TEM method at the same zone. Different situation is observed in other sites remote from marginal faults some hundred meters. In such sites groundwater comes into contact with salt edge by the underground flows.
Understanding of the sinkhole formation mechanism allows developing of different geophysical methodologies that take into account different aspects of sinkhole formation mechanism. Most of new methodologies developed during studying of DS sinkhole problem is planned to be presented at this section by participants. All these methodologies were applied to the Dead Sea (DS) sinkhole problem in Israel and Jordan. They have allowed determining the sinkhole formation mechanism and location of the sinkhole hazardous zones.

Acknowledgements
This publication was made possible through support provided by the U.S. Agency for International Development (USAID) and MERC Program under terms of Award No M27-050.