Spectacular Mud Bubbles, at the Active Mud Volcano Crater of Napak, Iran, photo by A. Amrikazemi

Large Mud Hill of Deposits of Napak Mud Volcano, Iran. photo by A. Amrikazemi

resulted in a 25-meter-high hill. Apart from the major crater on the hill, there are other craters around it some of which are active. Mud flowing from top of the hill downward is spectacular. Such mud contain a lot of granroy.

Reference:

Atlas of Geopark & Geotourism Resources of Iran, Alireza Amrikazemi, 2010

Sedimentary Phenomena of Iran

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Sedimentary phenomena are the most frequently seen geological phenomena of Iran with vast varieties.

Caves are amongst the phenomena initially formed through Karst erosion, and then the various cave deposits have been formed inside them. Hence they have had a transition from erosion to sedimentary processes. As the beauty and attractions of caves are mostly due to the cave deposits and their various beautiful forms, the cave are studied under the title of sedimentary phenomena. Accordingly there are a good number of caves in Iran.

Iran's mud volcanoes in the south-east region near the Oman Sea and north-east region near the Caspian Sea, are among the those phenomena which are attributed to have igneous, tectonic, or orogenic origins. Yet what is seen on the surface and draws attentions of visitors are bubbles and sediments.

Travertine deposits in various shapes are considered as other sedimentary phenomena; the mineral springs which leave such sediments behind are also interesting phenomena that attract tourists.

Sediments deposited in dry areas and deserts create various magnificent forms. Salt polygons, various desert and kavir textures, vast spread of net crack in mud and various forms of jypse and salt crystals are among the eye-catching phenomena which attract visitors.

Deserts in Iran include perfect types of the structures related to Aeolian sand, such as Seefs, borkhans, sand dunes, nebkas, and rebduse. Some of these phenomena like sand dunes and nebkas due to being large and vast are matchless in the world.

Napak Mud Volcano

Napak mud volcano (locally known as the earth center) is the most famous mud volcano of Sistan and Baluchistan Province as it is very active and large. Marl sediments discharge from its crater has

sediments; however those located in the vicinity of the ophiolite rocks are darker. Shallow depth of these lakes and lack of paleo lake terraces make it impossible to determine its formation date; however, Krinsley (1970) believes that it dates back to late Pleistocene (same time as glacial period of worms). This period is consistent with orogenic movements of Alpine's last cycle which was along with uplifts.

The Tar and Havir Lakes – Mazandaran Province

The Tectonic lakes of Tar and Havir are two of mountainous fresh water lakes, located at the altitude of 2900 meters above sea level. These lakes are 500 meters away from one another, and together they are nearly 0.7 square kilometers. Geological evidences around them has caused geologists to believe that the function of Mosha-Fasham thrust fault(Abiek, Firouz Kooh, Shahrood) and relatively large drift of Zarin Kooh (mountain ranges at the south of the lakes) have played essential roles in their formation.

The Jazmoorian Lake – Sistan and Baluchistan Province

Jazmoorian is a young tectonic subsidence system of 350 meters altitude above open sea level. It is 3300 square kilometers in rainy seasons, and due to its special climate, a large part of this lake turns into salty and clay bed throughout the most of the year.

This lake is located in the center of a young tectonic subsidence system between Jabal Barez mountain range (north) and Bashagerd mountain range (south). Stöcklin (1970) and Krinsley (1970) relate the depression phenomena to the Neogene-Quaternary events and Pleistocene respectively.

The Parishan (Famoor) Lake – Fars Province

Parishan Lake with 43 square kilometers is located in a shallow subsidence system which is about 820 meters higher than sea level. It is surrounded by elevated outcrops of Zagros lithostratigraphic units of late Cretaceous to Quaternary. Tectonically and geologically, the Famoor Lake is located in the folded Zagros Zone.

The Hoz-e Soltan Lake – Qom Province

An asymmetric depression of 330 square kilometers, Hoz-e Soltan is located in the northeast of the Namak Lake. This lake has two separate depressions, known as Hoz-e Soltan and Hoz-e Mareh, which connect to each other with a narrow waterway.

According to Motamed et al., (1977), sediments of Hoz-e Soltan are mainly gypsium, salt, marl and clay. Seismic analyses and drilling also have proved that there exist salt up to 46 meters of depth. This salt is comprised of 5 individual layers of totally 20 meters thickness, each separated through brown to gray clays.

The Zarivar Lake – Kurdistan Province

The Zarivar Lake is a mountainous fresh water lake located at the altitude of 818 meters above the sea level. This lake is 8.5 square kilometers, located at a local rather narrow subsidence system in the Sanandaj-Sirjan Zone. In the east and west, Zarivar is limited to the longitudinal faults of northwest-southeast. It is most probable that these two faults have affected the formation of the Zarivar Lake.

The Gavkhooni Swamp – Esfahan Province

Gavkhooni Swamp with an area of 280 square kilometers is a lake which located 1470 meters above the sea level. This swamp is a part of discontinuous tectonically subsidence system which starts from Lake Van in Turkey, passing through Lake Urmia and Tozgol Lake in Arak, it reaches to Gavkhooni Swamp and continues to the southwest up to Jazmoorian depression and even Mashkel depression in Pakistan. These depressions are in fact forearc depressions in whose formation slope faults have been very effective.

Other Lakes of Iran

Other Lakes of Iran include the Salt Lake in Qom Province, Gahar in Lorestan Province, Maharloo in Fars Province, and Hamoon in Sistan and Baluchistan Province. In addition, there a number of rather small unknown lakes such as Siran Gol, Ghori Gol, Bazangan, Shoorabil, Ardebiloo, etc.

Reference:

Geology of Iran, by Ali AghaNabati, GSI, 2004.

Geographical Distribution of Major Lakes of Iran

Lakes of Iran (part VII)

Iran is a part of semi-arid and arid lands of Asia with relatively little precipitation. Therefore, its local lakes are often not too much, and mostly located in the young tectonic depression. Nevertheless, some lakes such as Tar and Gahar are located over the high lands.

The seas and lakes of Iran have not been studied in details, that is why their geological information is not pretty much available, although their mechanism and impacts over the geology and policy of Iran is pretty considerable.

Permanent lakes of Iran are mostly limited to high rainfall areas of the north-west and southwest. Lakes in dry and desert lands are seasonal and endorheic type, filled with salty water.

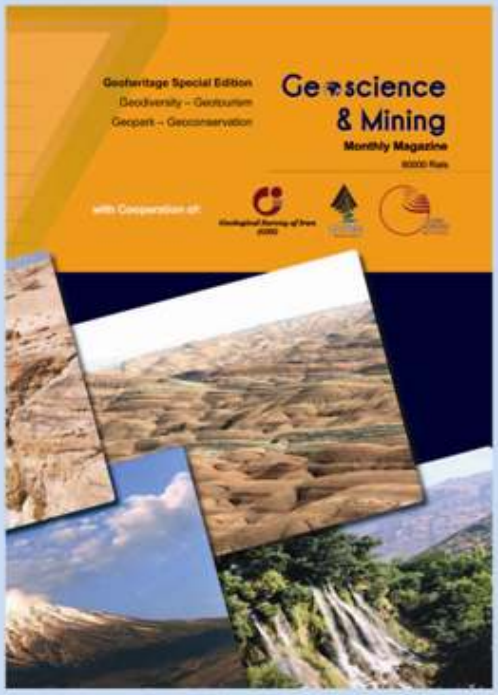
In the following, several lakes of Iran have been discussed in brief.

The Lake Urmia in the Western Azerbaijan

Lake Urmia is the largest and saltiest permanent lake of Iran, and one of the most salt-oversaturated lakes of the world, similar to America's Great Salt Lake. Lake Urmia is located in a shallow expansive subsidence system with average depth of 6 meters. However, its deepest part with 13 meters depth is in its northwest corner.. Its surface is 1300 meters higher in comparison to open sea levels. There are more than 102 islands in this lake whose sizes and figures are proportional to the annual precipitation. Geologically viewing, this basin is the result of compressional fault systems such as Tabriz and Zarineh Rood faults which has impacted on its watering system.

The Bakhtegan and Tashk Lakes– Fars Province

The Bakhtegan and Tashk lakes are two inter-mountain subsidence systems whose altitude above open sea is about 1558 meters. These lakes majorly originate from Rood Kor. Bakhtegan's seashore is covered with white evaporated



The main strategies of the GSI may be summarized as follow:

- Precise and comprehensive identification of Iran's related capabilities, as well as national and international introduction of the phenomena in order to motivate the society to preserve these phenomena
- Encouragement and collaborations with provinces to organize valuable geosites, and introducing geoparks of inside and outside of Iran
- Providing proper scientific-informative base for geotourism development
- Contribution to the economical-cultural sustainable development through promoting cooperation, as well as involving the local society in economical, educational, and protective activities

GSI has listed several significant steps for achieving the mentioned goals, some of which has already been accomplished while the others are to be taken in the near future:

- Enact regulations of the geoparks in the Cabinet
- Form Heritage Evaluation Group within the organizational framework
- Prepare and utilize surveying standards of geological phenomena along with geological map preparation
- Hold training workshops in different provinces, organizations and centers

The Special Edition is the result of intensive and persistent attempt of the GSI experts, with the cooperation of connoisseurs, pioneers, and experts of geoheritage in and out of Iran. Geoheritage principles and concepts including geological and geomorphological phenomena, geoparks, geotourism, and geoconservation are the topics covered in it, as well as several interviews with some of related experts, introducing their experiences and ideas. This Special Edition aims to extend related concepts and expressions, and to prevent improper beliefs and methods of utilizing geoheritage.

Please refer to the Geoheritage Groupe of the Geological Survey of Iran in order to purchase a Geoheritage Special Edition.

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Introduction to the Publication of Geoheritage Especial Edition

Geoheritage is a science, brought into attention of geologists, geographers, tourists, archeologists, etc. in recent decades. It's a generic but descriptive term compatible with human relish. Geotourism, geoparks, archgeology, etc. are all branches which can be considered as subclasses of geoheritage science.

Accordingly, Iran has always been touristically well-known for its history and culture. Natural features and biodiversity places Iran near the top of touring list. Other natural attractions of it include geological and geomorphological phenomena and reliefs which recently have been taken into consideration. It is known that Iran has a high global rank in terms of geology, and is highly capable in geodiversity.

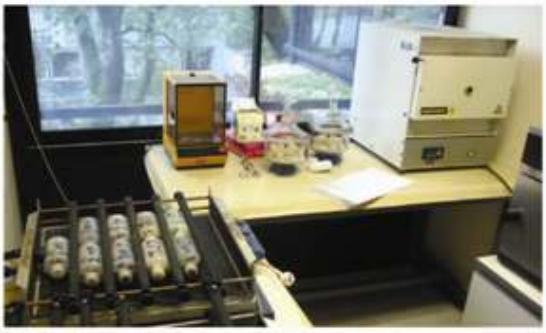
Iran has 10 years of experience in geoheritage and especially geotourism technical studies. As a governmental organization which produces fundamental geological information and performs technical mineral exploration investigations, the GSI started to conduct studies in 2000, aiming to define and introduce unique geological phenomena and their sites. With the development of such works as well as the needs to introduce such geoheritage, these activities have been carried out more systematically and consistently since 2007.

The GSI has begun to discover and define such phenomena for a decade, and it has documented and publicized them through publishing books, papers, films and images. The importance and value of "geoheritage" is now revealed to many experts and even to the society. It is obvious that introduction and public presentation of these phenomena will attract more and more people to enjoy and preserve them.

earthquake studies and researches since 2007.

"Cooperation of the Seismotectonic and Seismology Department of the GSI and Applied Geology Research Center of the GSI lead into official launch of laboratory of 10Be dating. Iran is the first country in the Middle East and Central Asia which has such technologies and considering high risk of earthquake in the region, this laboratory is ready to offer research services to the countries of the region. " said Oveisi.

It is noted that GSI has presently planned for ^{23}Al cosmogenic radionuclide technology, and its geologists will present better standards for geological studies of



active faults through geo-database of earthquake and geodynamics of Iran.

Exploration of Vast Mineral Areas of Bauxite in the North and South of Iran

Vast Mineral Areas of Bauxite in the North and South of Iran was explored by the experts of the Geological Survey of Iran.

Deputy of Exploration of the GSI announced reconnaissance and exploration of Bauxite in Iran and stated:

GSI has planned to explore and produce Bauxite for the purpose of producing alumina for factories which produce aluminum.

"Hopefully we could conduct some investigations on Buaxite reserve of Mazandaran, Gilan, Qazvin, Tehran, Alborz, Kohkilooyeh and Boir Ahmad provinces, and reconnoiter such reserves for the first time. More complete exploration is required to ascertain the proved reserve." Said Borna.

"Soochelma in Neka Township has been explored and about 1.6 million tons of Bauxite was accosted to reconnaissance reserve phase, and we await to receive exploration license from the Ministry of Industry, Mine, and Trade."

Borna added that exploration in the 1:100000 sheets of Javaherdeh and Jirandeh has been performed in an area of 5000 square kilometers, and said "we could detect more than 700 thousand tons of Bauxite which may not be considered as proved reserves."

Deputy of Exploration of the GSI said that outcrops of Zardkooh lariteh, Shegel in Sangrood, Abbasak and Arsheh Kooh have totally 700 thousands of Bauxite, and GSI is determined to develop exploration in such areas. Also Golchehreh outcrop is located in a ski piste, which is why its exploration has been impossible.

He mentioned that in Dehdasht in Kohkilooyeh and Boir Ahmad province, four exploration areas have been fully reconnoitered, and their results have been sent to the Province authorities to be assigned to private sectors in order to be exploited.

Borna mentioned Bauxite as the priorities of the GSI and said "fortunately we were able to explore three million tons of Bauxite reserves in the territory."

Deputy of Exploration of the GSI considered Aliabad Katool as another mineral region for exploration and said " this area is coved with forest and has environmental problem to be explored ; therefore its exploration is subject to the consent of the Ministry, Iran Department of Environment and also Forest, Range and Watershed Management Organization of Iran."

"There are mineral potentials of Bauxite in Yazd and Northern Khorasan provinces as well as Miandooab, Mahabad, Saghez and Samirom in Chaharmahal and Bakhtiari."

Borna mentioned that Bauxite, as the element required to produce aluminum, is found less in the northern hemisphere, as it needs special conditions of mineralization, climate and precipitation.

Referring to the slight capacity of Iran for Bauxite production, Borna declared that it is economic to convert Bauxite to aluminum, while aluminum is a precious metal which has high position in different industries."

In The Name of God

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Launch of the First Modern ^{10}Be Dating Laboratory

Aiming to Produce Information to Reduce Earthquake Hazard, by the GSI Scientists

By the effort of the geoscientists of the GSI, application of ^{10}Be dating method, as one of the state of the art technologies in studying active seismic regions and producing information in order to reduce earthquake hazards, became operational in Iran.

According to the report of the Public Relations of the GSI, Dr. Behnam Oveisi, Director of Seismotectonic and Seismology Department of the GSI, said that there are various methods of short term, intermediate, and long term, to study the seismic behavior of a region and estimate faults activities. "In short term methods Global Positioning System (GPS) and radar data are used, while the geomorphological studies (which are considered long term) are highly significant for achieving basic information of faults activities in order to estimate earthquake hazards." said Oveisi.

Considering accurate information on faults activities as an essential requirement for earthquake estimation, Oveisi added: "Scientists, especially seismo-geologists, play important roles to produce such information, for which 10Be dating is a modern method."

According to Oveisi, in this method, seismo-geologists attempt to count the limited number of radionuclide atoms in rock samples collected from active faults at depths of 1 to 2 meters in the field in order to estimate speed and activity of faults movement.

He mentioned the high potential of earthquake in Iran and said the GSI has attempted to localize