NOTES

MAPS OF MINERAL RESOURCES IN ISRAEL: RAW MATERIALS FOR THE BUILDING INDUSTRY

This note attempts to summarise the salient aspects of the recently brought out maps by the Geological Survey of Israel (Report GSI/38/00, Dec.2000) on Raw Materials for the Building Industry on 1:250,000 scale (two sheets covering the northern and southern parts of Israel). The maps are accompanied by excellent explanatory notes authored by Amit Segev, Shimon Ilani and Moshe Shirav of the Survey.

The Geological Survey of Israel (GSI) carried out a very comprehensive national survey of raw materials required for the building and construction industries commissioned by the Israel Land Authority based on the previous GSI studies for raw materials updated by substantial sampling and analytical work. All these important deposits were systematically evaluated for their quality, reserves and environmental impact. The commissioned survey included full array of carbonate-rocks, sandstones, igneous rocks, clays, loose sediments and soil, exposed throughout Israel. To locate sandstone and clays at shallow depths within the unsaturated zone of coastal plains, a database comprising more than 4000 digitized drill holes was utilized. The delineated deposits were coded into GIS over a background of 1:50,000 topographic maps. The calculated geological reserves of the deposits and other relevant data are stored in Access database and published in detailed reports. In order to achieve an overall countrywide view, the 56 detailed maps were edited and reduced into two 1:250,000 scale maps which form the prime focus of this report. Based predominantly on geological criteria, hundreds of deposits for the building and construction industries were located and mapped. These have to undergo thorough examination for land availability, eliminating those parts or entire areas targeted for other uses, before they can be related to as national reserves, after detailed geological and critical environmental surveys. This laudable attempt by GSI is of immense societal value and other surveys all over the world may also adopt such techniques to create user-friendly maps and strong database.

The GSI is the repository for comprehensive geological database both for up-to-date geological map (all computerized) and for detailed information regarding natural resources of Israel. The present study is mainly based on the knowledge gained by earlier GSI regional reconnaissance surveys for potential raw materials for the building industry in Israel. This previous reconnaissance was the resource appraisal database for the first version of the national master plan for mining and quarrying, i.e., raw materials for building and construction industries submitted to Ministry of Interior in the early eighties.

A large group of scientists from Israel National Survey actively participated in the present study for raw materials and summarized their work in 26 reports and two accompanying reports (Segev et al. 1995 and Rosensaft et al. 1996) submitted to the Israel Land Authority in August 1996.

The raw material deposits were detailed on 56 maps which were finally edited and reduced to two maps on 1:250,000 scale.

The meticulous approach which resulted in the preparation of two maps entitled Northern Sheet and Southern Sheet include the following:

1. Collection of all available up-to-date topographical, geological map-data pertaining to previous prospecting activities for raw materials in the given area. This stage ended with a proposal of detailed work programme for each 1:50,000 sheets.
2. Completing all necessary sampling and updating the boundaries of each deposit.
3. Conducting physical/chemical tests for properties like bulk dry density, water absorption test, Los Angeles abrasive test and aggregate crushing value, chemical analysis (partial and complete major elements) and granulometric analysis of sandy material.
4. **Processing of data** – The deposits located were coded into a GIS based microstation on an Intergraph TD-30 workstation. Digitisation of mineral deposit as vector files was carried out on a raster type topographic background, provided by the Israel Mapping Centre. The raw data i.e., analysis and summary of each deposit were tabulated and computerized (Microsoft Access). Each of the deposit has its ID number (GIS code) on the original 1:50,000 scale map.
5. **Processing of Coastal Plain - Subsurface geological data** – more than 4000 drill hole data (Rosensaft, 1996a) were used (down to the groundwater level) to locate areas in which deposits of unconsolidated

sand, calcareous sand (Kurkar) and clays are found at shallow depth within the unsaturated zones of coastal plains where various types of soil form the upper cover.

6. **Interpretation and summarizing the results.** The calculated raw material reserves which were included in every marked polygon on the maps are defined as potential resources based on a preliminary geological reconnaissance. The complete data including maps and tables of each working unit is summarized in the GSI Report with relevant information on local geology and geography.
7. **Editing of 1:250,000 geological maps.** The original 1:50,000 maps were reduced to 1:250,000 scale. The symbol and colour were changed and several maps were combined to one sheet after adaptation of the deposits along the sheet boundaries. Twenty one colours have been selected for the various combinations of deposits and letter symbols. For lithology, capital letters and for its uses, small letters were used (*see* map legend). A generalized geographic map, prepared by GIS unit at Geological Survey forms the background.

   The identifying number (GIS Code) of the marked deposit were removed. Those wishing to get the database information (Identity No., Geological Information, Ore reserve etc.) should obtain the relevant regional reports using the list of sources in the legend of the maps and the full reference in the text.
8. **Results.** The distribution of the deposits in the present maps reflects the extent of the rock formation or groups quality-wise as raw material. The results are summarized using the common stratigraphical rock units in a simplified column.

While Precambrian basement, magmatics, metamorphics, volcanics are locally exposed only in the Elat, Timma area, most of Israel is covered by various sedimentary rocks, and in places by young volcanics of basaltic composition.

The sedimentary ensemble is schematically divided into three parts: (a) lower predominant clastic unit (mainly in the Negev) such as the sandstones of Yam-Suf, Ramon, Arad and Kurnub groups, (b) the middle, predominantly carbonates and shales of the Judea, Mount Scopus and Avedat groups and (c) the upper young, predominantly clastic sediments of the Saqiye and Dead Sea groups. The description of the main trends in distribution of raw materials for the building industry is described in pages 3-9.

The map of Mineral Resources in Israel Northern and Southern sheets summarise an important step in improving the quarrying industry for various raw materials in Israel. The data obtained by preparation of these maps ensures a controlled and efficient supply of raw materials for construction and building with minimum damage to the environment, though lot of work is still required to sort and select the various deposits within the framework of a national master plan for quarrying.

Hundreds of raw material deposits for the building and the construction sector were located and marked, mainly based on geological criteria. Since the deposits marked on maps represent maximum spread, without considering other land use targets, there is no significance at the present stage in totaling the reserves of the various raw materials. Once the deposits marked undergo a thorough examination of land availability, eliminating those parts targeted for other uses, the remaining deposits can be related to as a national reserve, selected parts of which can be put on the countrywide master plan, after detailed geological and environmental surveys. GSI also recommends similar reconnaissance surveys of other natural resources particularly phosphates and oil shales for industry and energy. Following comments summarise the quality aspects of the maps produced:

1. The work of Amit Segev et al. of Geological Survey of Israel has been given an excellent shape in the form of the map of mineral resources in Israel with special reference to raw material for the building industry.
2. The colour pattern and graphics of the map, density of data and the geological and geographical inputs are commendable.
3. The IDs/map symbols given for the various raw materials/rock types like – Da, Lb, Ldela, Sa, Kspb, Ksps, Kp, He, La, Ce, Le, Hmc, Ba, BLa, LDab, Dla, LdBa, HMe, Aap, Cacp and other superposed symbols (for e.g., superposed over Ce with blue dots i.e. southern boundary of northern sheet) are to be explained.

   Though the matching colours are given in the body of the map along with the raw material/rock type symbol, in the legend the symbols are absent.
4. For figure 4, an example of a 1:50,000 scale map of raw materials, the explanations for the various symbols are not given in English. They are in Hebrew.
5. Table 3 shows the rock group in Israel starting from Precambrian, Palaeozoic-Mesozoic-Cenozoic and the respective groups very clearly.

6. For quarrying any raw material for industry is there any Government guideline not to go beyond a particular depth? Since hundreds of industrial raw materials are spread over large area in the two maps, continued exploitation may lead to environmental problems, groundwater depletion/pollution etc.
7. GSI has brought out these maps with valuable database support for all the industrial raw materials.
8. Comparable situation of similar rock types used as industrial raw materials, in India are seen around, Rajkot, Veeraval, Porbandar, Mangrol, Diu areas in the west coast where miliolite limestones (early to late Pleistocene) are extensively exposed. These are used for chemical and cement industry.
9. Other geological surveys also should attempt in making such maps invariably accompanied by succinct explanatory notes/write-ups, which will be of immense societal value.

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NATIONAL SEMINAR ON ROLE OF INFORMATION TECHNOLOGY IN GEOSCIENCES, 19-20 FEBRUARY, 2002, BHUBANESWAR

Geological Survey of India (GSI) has been organizing symposia and seminars on various earth science related topics at different centers of the country to commemorate its 150 years of service to the nation. The National Seminar on the "Role of Information Technology in Geosciences" was organized by Operations Orissa, Eastern Region at Bhubaneswar on 19th and 20th February, 2002. This was preceded by a two day in-house workshop on Geoinformatics to assess the activities carried out by GSI in this regard.

The seminar was inaugurated by His Excellency the Governor of Orissa, Shri M.M. Rajendran. The abstracts volume of the seminar and the souvenir were released on this occasion. Shri Rajendran in his inaugural speech lauded the role played by GSI in exploration of various minerals which in turn contributed to the economic development of the country. He hoped that information technology could help GSI in dissemination of geoscientific information for upliftment of society including the rural segment through the huge earth science database and trained personnel.

Shri S.C. Tripathy, Additional Secretary, Ministry of Coal and Mines, who was the guest of honour, reiterated the role of GSI in providing vital inputs for industrial growth and urged the integration of geological, geophysical, geochemical and remote sensing data in a GIS format for exploration and management of natural resources, disaster mitigation and sustainable development. For the first time in the country the role and application of information technology in geoscientific studies were addressed by the experts in the field of IT and earth sciences in the seminar. The topic of the seminar generated overwhelming response among the earth scientists throughout the country. More than 80 papers were received, out of which 53 were accepted for oral and poster presentation.

The seminar was divided into four technical sessions, based on the following themes:

(i) General aspects of information technology in geoscientific studies.
(ii) Utilization of IT in geological, geophysical and geochemical database.
(iii) Exploration and management of natural resources.
(iv) Disaster management.

In the keynote address delivered by Shri K. Krishnanunni, Director General (Retd.), GSI, emphasis was laid upon the induction of new technology related to IT in a progress oriented organization like GSI. Shri E.V.R. Parthasaradhi, Director, GSI in his presentation deliberated upon National Spatial Data Infrastructure (NSDI) and the role GSI can play in this project. The technical sessions were followed by a panel discussion comprising Chairman and Co-Chairman of different sessions and moderated by Shri Debashish Chatterji, Sr. Dy. D.G., GSI. Proceeding of each session was summed up by respective Chairman of each technical session. The moderator invited feed-back and suggestions from distinguished guests and participants. The outcome of the deliberation in the seminar was summed up by the moderator as follows:

(i) Major thrust to be given on imparting training to geoscientists of the country on recent developments in information technology, so that the earth science related information could be better managed and utilized for integrated societal development.