

Geological features and health problems

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Environmental geology is an integrated application of geology for the benefit of man and his living and inanimate world. Geological features greatly influence man and his activities and the environmental geology embraces the whole gamut of human use of the earth — the prediction, assessment and combating of natural hazards, and the application of technology and engineering for the development of society without destroying environment.

The chemical quality of surface and groundwater is influenced by the local geology. Reactions between rain water and the bed rocks over a period of days and months as infiltrations and percolation occurs and are responsible for mineral content of groundwater.

| Village | F | NO3 | SO4 | Na | Radon |
|-------------|-----|-----|------|-----|-------|
| Jajjal | 0.2 | 65 | 327 | 85 | 4.33 |
| Maur | 1.1 | 32 | 1070 | 710 | 7.57 |
| Kotshamir | 0.8 | 56 | 875 | 360 | 5.75 |
| Bucho Khurd | 5.1 | 56 | 810 | 350 | 4.40 |

(data in mg/l, but for f)

The extent to which reaction with host rock proceeds will be governed by the residence time of the water, which in turn may be influenced by the type of flow movement i.e. intergranular or fissure flow movement and the mineralogy of the aquifer. The concentration of carbon dioxide in the soil influences the degree of reaction of carbonates or silicates mineral in a rock. Deeper groundwater can undergo notable change in mineral composition increase of residence time.

In SW Punjab and the adjoining areas of Haryana, the basement rocks go down rapidly from Tusham to Bhatinda (Fig 2). East of Sirsa, rocks of Malani suite, granites and rhyolites and

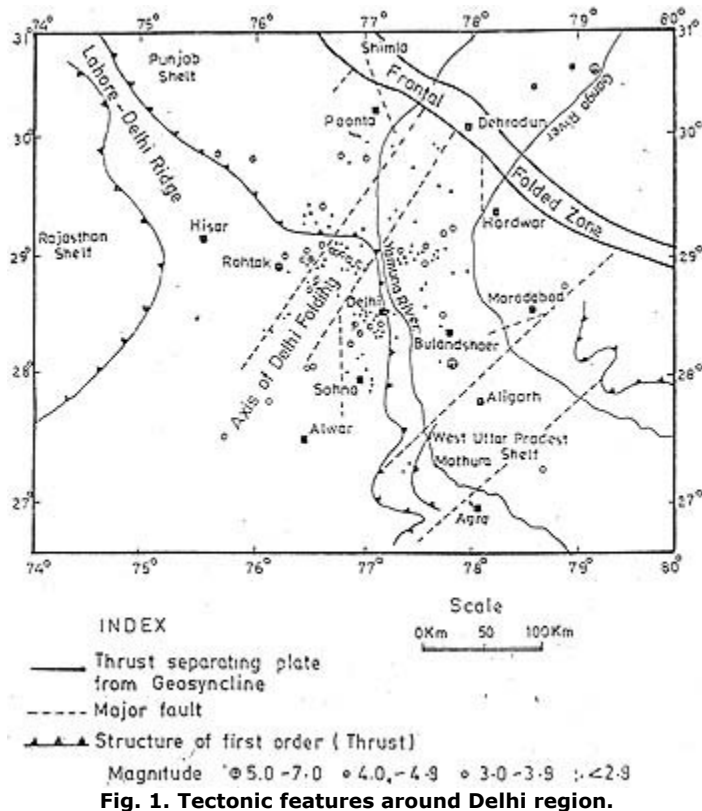


Fig. 1. Tectonic features around Delhi region.

Delhi quartzites are encountered below the Quaternary sediments. At Zira, near Ferozpur, granitic rocks are met at a depth of 700m below Siwalik sediments. At Adampur, the basement is encountered at a depth of 2500 m. The maximum depth to basement in Punjab plains is about 4 to 5 km and the depth increases to some extent under Siwaliks.

It is interesting to mention here that under a thick blanket of Quaternary sediments (305-350 m) in SW Punjab (Faridkot and Ferozpur dists.) Haryana (Sirsa district) a thick sequence of halite (NaCl) and associate evaporites (polyhalite, anhydrite, limestone and dolomite) occur. Four cycles of evaporites with a cumulative thickness of 130.77 m occur under Punjab plains, and three cycles of evaporites (cumulative thickness of 50 m) occur under Haryana plains. The dolomites/limestone are of foetid character-they give sulphurous smell when struck with hammer.

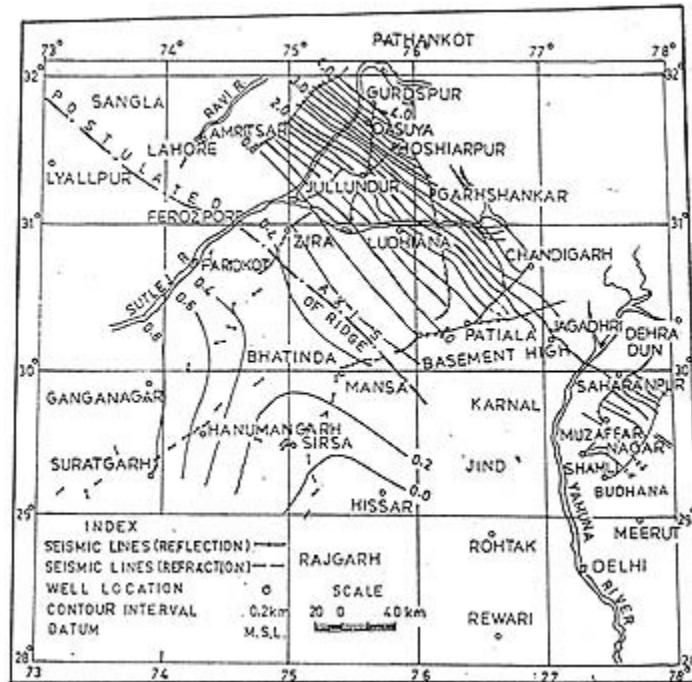


Fig. 2. Basement structure map of Punjab-Rajasthan plains, based on seismic data

The subsurface geology under Punjab and Haryana plains has controlled the chemical quality and radon content in groundwater.

Radon: Radon is a decay product of uranium and thorium. These elements are present in crust and granitic rocks.

Uranium decays to radium which in turn decays to radon. The radon gas is colorless, odourless and tasteless. It migrates through caves, ground fissures and buildings. The radon gas and its daughter products are known to cause cancer.

Survey of radon activity in groundwater done in collaboration with scientists of GND University, Amritsar, reveal that the values increase from Amritsar towards Bathinda and village in Haryana. This is mainly due to the interaction of groundwater with the soils formed from the weathering of Malani granites exposed at Tusham and also at the basement. These granites have high concentration of U and Th. The concentration of radon in water varies from 2.28 to 7.96 Bq/l which are below the safe limits (400 Bq/L, Internationally recommended value). At Zira the value is 6.53, at Maur it is 7.90 and at Jajjal (Talwandi Saboo the concentration is 3.27 to 4.33). It is interesting to mention here that maximum number of cancer patients are reported from here.

Higher than desirable values of F, SO_4 , NO_3 , Na and Mg have been reported for Jajjal, Kotshamir, Maur and Bhuchok Khurd villages in Bathinda dist.

As per newspapers report (most recent HT, Dec 1, 2003) Jajjal and Giana villages to Talwandi Saboo block of Bhatinda dist. record the maximum number of cancer patients in the region.

About 70-80 persons have died due to cancer of different body parts since the seventies.

People attribute cancer cases to the groundwater quality which is brackish and fluoride rich. There does not seem to be any correlation with quality of groundwater with the cancer, as many adjoining villages record higher concentration of these elements such as Maur Mandi, Nahinwala etc.

The high concentration of these elements can be attributed to the subsurface geology i.e. granitic rocks and the presence of evaporites including limestone and dolomite which could contribute F, Ca, Mg, SO_4 etc.

It is interesting to mention here that the area falls within the cotton belt of Punjab and there is a widespread use of pesticides. Since there is no industry in Bhatinda dist. the carcinogenic elements such as cadmium, nickel, chromium, asbestos could not have contributed to the problem. PGIMER, Chandigarh is carrying out survey in the area.

Medical Geology: Medical geology is the science dealing with relationship between natural geological features and health problems in humans and animals.

It is a broad and complex subject which requires interdisciplinary contributions from different scientific fields.

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