

## **History of isotope geochemistry in Iran water resources studies (from the initial steps to the final achievements)**

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The application of stable isotopes ( $^{18}\text{O}$  and  $^2\text{H}$ ) in water resources studies was commenced by Harmon Craig in 1961 [1] and numerous studies have been done regarding isotope hydrology across the world since that time. In Iran, the application of stable isotopes ( $^{18}\text{O}$  and  $^2\text{H}$ ) in water resources studies has been classified to three stages (pioneer and initial studies, stable isotopes studies in the reports of institutes, modern and advanced studies in universities).

The application of stable isotopes in Iran water resources started by Zak and Gat in 1975 [2]. They have studied the saline waters in Shiraz-Sarvistan, south central Iran. In the second stage during 1976 till 2000, although stable isotopes techniques have been conducted in many parts of Iran as internal reports by Iran ministry of energy, Iran regional water authorities, and Iran national karst institute, the application of stable isotopes in water resources was still unknown for many scientists across Iran. This is maybe due to several reasons including the lack of equipments' to analyze stable isotopes in Iran, difficulty to send samples to foreign laboratories, and the high prices of stable isotopes analyses.

Since 2000, the application of stable isotopes techniques in water resources has been dominantly increased. Numerous meteoric water lines have been developed for Mashhad, Tehran, Shiraz, Rafsanjan, Sirjan, Isfahan, Shahroud, Bojnourd, and other regions across Iran. The first attempts also have been done to develop Iran meteoric water line/lines during this period. Furthermore, for the first time in Middle East, the role of precipitation moisture sources on the stable isotopes ( $^{18}\text{O}$  and  $^2\text{H}$ ) signatures of precipitation has been studied in Iran.

Although the application of stable isotopes in water resources studies have dominantly increased during the last two decades, but there are still some short comings such as the lack of permanent network of precipitation sampling for stable isotopes analyzes across Iran.

### References

[1] Craig H. Isotopic Variations in Meteoric Waters. (1961), Science 133, 1702–1703.

[2] Zak I, Gat JR. Saline waters and residual brines in the Shiraz-Sarvistan basin, Iran. (1975), Chem Geol 16, 179–188.