

Assessment of recharge and flowpaths in Lushnja aquifer system using environmental isotope tracers

¹Iris Bakiri, ²Arben Pambuku ³Eduard Andoni

1. Institute of Applied Nuclear Physics, University of Tirana; 2. Albanian Geological Survey; 3. Faculty of Natural Sciences, University of Tirana.

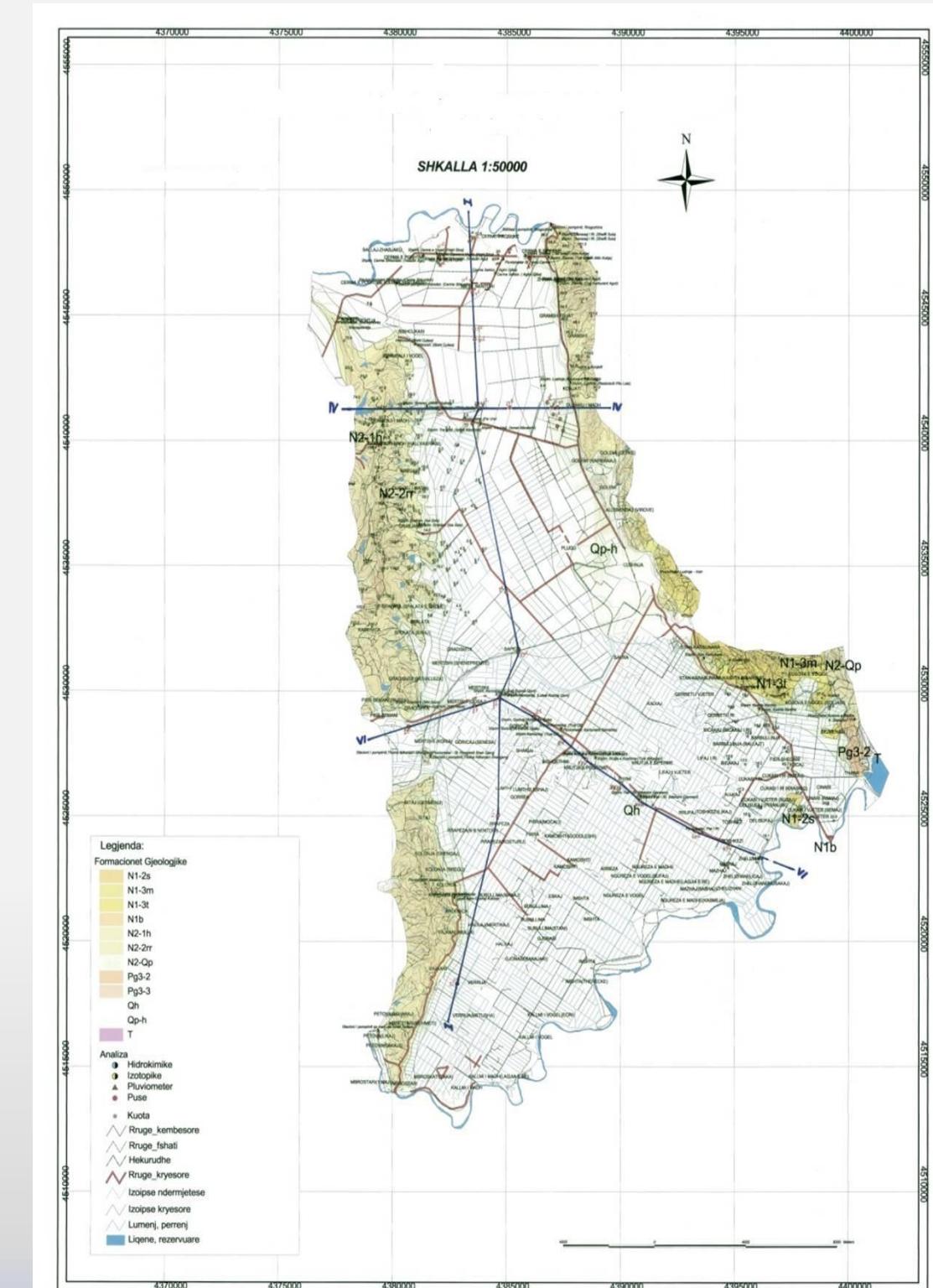
Introduction

In this paper we will discuss an assessment of the Lushnja aquifer by the measurements of the environmental isotopes, oxygen-18 and deuterium. The isotopic ratios of oxygen and hydrogen in water are unique and often considered as "fingerprints", thus due to different proportions of oxygen and hydrogen isotopes that constitutes water.

The stable isotopes ratios ^2H and ^{18}O in water samples are reported in permil (‰) relative to VSMOW2.

Area of Investigation

The study area is situated in west Albania and includes the city of Lushnja and its surroundings, covering an area of 256 km². The area is bounded in north by Shkumbin River, east from the hills of Thanasaj - Lushnjë - Karbunarë – Kosovë e Madhe; south from Seman River and west from the Divjakë-Ardenicë hills



Materials & Methods

• During a sampling campaign in 2009 were collected 50 water samples for isotopic ratios of deuterium and oxygen-18 measurements. The samples were collected from rain water and deep groundwater at various depth and location. The samples were collected and stored in 50 ml polyethylene bottles, double capped and no chemicals were added to them.

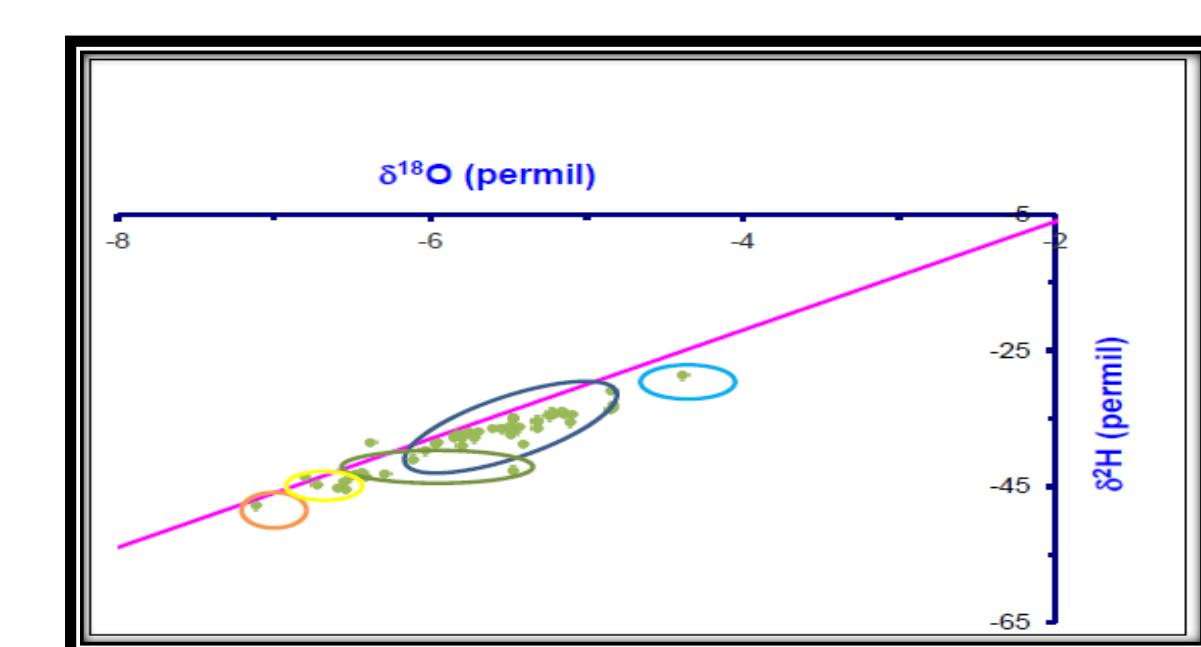
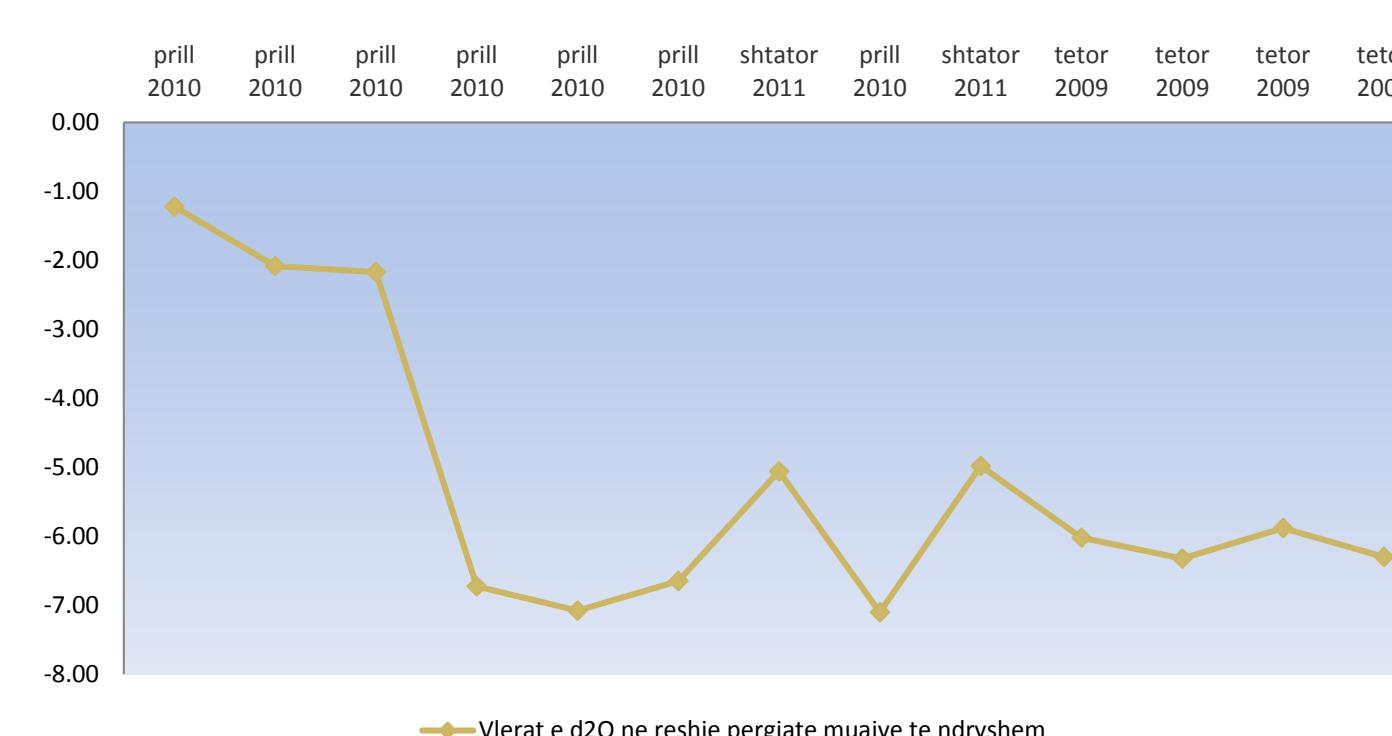
- The 55 water samples were analyzed for $\delta^{18}\text{O}$ and $\delta^2\text{H}$ at the laboratory of stable isotopes at the Institute of Applied Nuclear Physics in Tirana by an water analyzer LWIA, model DLT-100 upgraded version.
- Determinations of both hydrogen and oxygen isotope ratios are measured on the same bottle of water.



Results & Discussion

The measured stable isotopes ratios range from -7.11‰ to -4.37‰ for $\delta^{18}\text{O}$ and for $\delta^2\text{H}$ vary from -48.00‰ to -28.79‰.

	$\delta^2\text{H}(\text{\textperthousand})$	$\delta^{18}\text{O}(\text{\textperthousand})$
Minimal Values	-48.00	-7.11
Maximal Values	-28.79	-4.37



Isotopic composition of the sample values vs. the Global Meteoric Water Line

Conclusions

The aquifer of Lushnja is a complex coastal aquifer. Studying the isotopic composition of its groundwater sample, it is possible to detect four different recharge sources: fresh water from rain falls, fresh water from the two boundary rivers (Shkumbin and Seman) (mixing waters), it is possible seawater intrusion from the Adriatic Sea and also, it is noticeable the presence of palaeewater which might be originated from the ancient riverbed of Seman river.

Acknowledgements

The study of aquifer in the area of Lushnja could not be accomplished without the help of many colleagues. A special thanks goes to the colleagues of the Albanian Geological Survey who collected the samples.

Literature

- Aggarwal P. K., Ahmad T. Groening M., Gupta M., Owano T., Baer D. (2007): Laser Spectroscopic Analysis of Stable Isotopes in Natural Waters - A low-cost, robust technique for the use of environmental isotopes in hydrological and climate studies, Water and Environmental News, No 23, 2-5.
- Coplen T. B. Reporting stable hydrogen, carbon and oxygen isotopic abundances. Pure Applied Chemistry 66, 273-276 (1994).
- Craig H. (1961): Isotopic variations in meteoric waters. Science 3465, 1702-1703.
- Dansgaard W. (1964): Stable isotopes in precipitations; Tellus 16, 436-468.
- Gonfiantini R: Advisory group meeting on stable isotope reference samples for geochemical and hydrological investigations, IAEA-1984.
- IAEA (2009): International Atomic Energy Agency: Laser Spectroscopy Analysis of Liquid Water Samples for Stable Hydrogen and Oxygen Isotopes. Performance testing and procedures for installing and operating the LGR DT-100 Liquid Water Isotope Analyser, IAEA, Vienna.
- Jouzel J., Foelich K., Schotterer U. (1997): Deuterium and oxygen-18 in present day precipitation: data and modelling; Hydrological Sciences Journal des Sciences Hydrologiques, 42(5).
- Lis G., Wassenaar I., Hendry M. J. (2008): High Precision Laser Spectroscopy D/H and $^{18}\text{O}/^{16}\text{O}$ Measurements of Microliter Natural Water Samples; Anal. Chem., 80, 287-293.
- Sturm P., Knoll A. (2010): Water vapor $\delta^2\text{H}$ and $\delta^{18}\text{O}$ measurements using off-axis integrated cavity output spectroscopy. Atmospheric Measurements Techniques 3, 67-77.
- Tanweer A, Groening M, Van Duren M, Jaklitsch M, Polstenstein L: Stable isotope internal laboratory water standards- Preparation, Calibration and Storage. Vienna 2009.