



1 Using stable isotope analyses ($\delta^{18}\text{O}$) to characterise the regional hydrology of the Friuli Venezia Giulia plain, north-east Italy

F. Cucchi, O. Flora, **G. Franceschini**, L. Genoni, B. Stenni and L. Zini

Department of Geological, Environmental and Marine Sciences,

University of Trieste

Via E. Weiss 2, 34100 Trieste, Italy

(giuliana.franceschini@units.it / Tel.: +39 040 55822052; fax: +39 040 5582048)

The Friuli Venezia Giulia plain, located in the northeastern sector of Italy, support most of the agricultural and industrial activities of the region. From a geomorphological and hydrogeological prospective this plain is subdivided in two provinces which are separated by a resurgence line. The Upper Friuli Plain is mostly composed of calcareous and dolomitic gravels and host a well developed phreatic aquifer. The Lower Friuli Plain is characterized by multi-layered artesian aquifers that are composed of gravels and sand interbedded by clay and silty layers that become thicker in a southwards direction. The constant increase of water demand, has led the local authorities (ARPA FVG, Regional Environmental Protection Unit) to begun an evaluation at large scale of the hydrological fluxes and used of this plain creating a collaborative project with the GGACI group (Water and Geomorphological Research Unit) of the University of Trieste. This project focuses on the water chemistry and on stable isotope investigations ($\delta^{18}\text{O}$) from precipitation samples and groundwaters from the major aquifer types in the Region. Chemical analyses were done by ARPA FVG, whilst the stable isotopic composition of water samples has been measured by mass spectrometric techniques at the University of Trieste. The oxygen isotope composition ($\delta^{18}\text{O}$) was measured by

means of water-CO₂ equilibration technique at 25°C. The conventional δ notation is used and the values are reported as per mil deviations from the V-SMOW standard.

Thirteen pluviometers have been positioned in different areas of the region from September 2004 in order to characterize the oxygen stable signature of precipitations. Weighted mean $\delta^{18}\text{O}$ values of precipitation range from -7.7‰ , to -10.5‰ , (with a mean value of -9.1‰ ,) in the mountain areas and from -6.7‰ , to -7.6‰ , in the plain (with a mean value of -7.1‰ ,). The calculated vertical isotope gradient is 0.29‰ , in accord to the ones measured in other Italian regions and neighboring countries. Two hundred samples have been collected in autumn/winter and spring/summer from phreatic and multilayered artesian aquifers and measured for their oxygen isotope composition. The phreatic aquifer has $\delta^{18}\text{O}$ values that ranges between -6.3‰ , to -8.8‰ , (with a mean value of -7.8‰ ,), while the shallow artesian aquifers range between -6.8‰ , to -10.2‰ , (mean value of -8.2‰ ,). These values correspond to a mixing with the isotopic composition of the Region major river and with the composition of local precipitation.

The water samples collected from the deeper artesian aquifers (up to 200 m) indicate depleted values ranging from -8.3‰ , to -10.5‰ , (mean average value of -9.1‰ ,). These waters does not show significant $\delta^{18}\text{O}$ seasonal variations whereas the $\delta^{18}\text{O}$ values obtained from the samples collected in the phreatic and shallow artesian aquifers exhibit more marked changes during the year.

The result of this study has indicated that the phreatic as well the shallow artesian aquifers are fed by local infiltration and by streams waters. The deeper artesian aquifers maintain more passive hydrodynamic conditions where the presence of buried structure hinders totally or partially natural groundwater exchange.