Final PhD Seminar
Claudio Moya
School of Earth, Environmental & Biological Sciences
Queensland University of Technology

HYDROSTRATIGRAPHIC AND HYDROCHEMICAL CHARACTERISATION OF AQUIFERS, AQUITARDS AND COAL SEAMS IN THE GALILEE AND EROMANGA BASINS, CENTRAL QUEENSLAND, AUSTRALIA

Monday 17 November, 2014, 11.00 am, Block C, Room C406, QUT Gardens Point

ABSTRACT

The Galilee and Eromanga sedimentary basins in central-western Queensland are sub-basins of the Great Artesian Basin (GAB). Ongoing coal seam gas (CSG) exploration is been carried out in the Permian units of the Galilee Basin which underlie the aquifer sequences of the GAB. Because of this it is essential to understand whether there is potential for hydraulic connection between the Permian coal seams and the overlying aquifers if CSG production is to be developed. To achieve these aims, the current project developed a 3D geological/hydrogeological model with which was integrated new hydrochemical and isotopic characterisations of groundwater systems.

Very limited subsurface data was available as input, however, drillhole and seismic data could be used to produce the geological model, from which a 3D hydrogeological conceptual model was generated. Using these models, assessments of the relation between regional faults and groundwater flow was possible. Hydrochemical data was generated and evaluated with a Multivariate Statistical Analysis approach, particularly by the use of Hierarchical Cluster Analysis (HAC), Principal Component Analysis (PCA) and Factor Analysis (FA). HCA allowed the recognition of four different water types in the area, of which three characterise GAB groundwaters and the fourth the Galilee Basin recharge area (outside the GAB limits). Factor Analysis enabled identification of the hydrochemical processes controlling water chemistry, and with the 3D geological model allowed understanding of groundwater evolution along its flowpath. The use of PCA allowed separation of GAB into three sequences based in their hydrochemical character.

In addition, gas (largely CO_2) was also recognised in GAB groundwaters, and degassing at lower atmospheric pressure is shown to be an important process. Isotopic data helped to confirm hydrochemical processes and to understand how aquifer mineralogy controls water-rock interaction and influences water chemistry in certain areas. Groundwater age was calculated for selected bores, which is in general agreement with previous studies, showing a trend of increasing age along groundwater flowpath.

The study showed the hydrological relationship between the Eromanga Basin of the GAB and the underlying Galilee Basin. The methods used enabled the hydrochemical characterisation of groundwaters and the understanding of potential inter-aquifer mixing in deep sedimentary basin environments.