

Application of multivariate analysis to regional groundwater quality assessment

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ABSTRACT

Investigations of regional groundwater quality conditions provide information addressing a range of questions, including the overall quality of groundwater. However, the notion of water quality is very fluid, as it describes its suitability for use. Various users have different water quality requirements, and good groundwater quality for some may be poor groundwater quality for other users. Therefore, groundwater management decisions tend to rely upon single parameter/variable values established through system control methodologies or toxicity tests, from water samples that are usually unrelated to management area activities. However, single variables do not provide sufficient information about the influence of the complex phenomena in a system of numerous and simultaneous chemical reactions.

Recent approaches favor supplementing traditional geochemical characterization with joint multivariate approaches to distinguish rare and spatially limited phenomena from regional geochemical processes representative of rock-water interactions. This helps to identify and delineate zones of impaired groundwater quality versus zones of natural groundwater quality, while also establishing a causal relationship between groundwater quality and some human activities. A case study using the multivariate approach is presented. The case study is based on publically available groundwater chemistry data from Alberta Health and hydrostratigraphic units defined by the Alberta Geological Survey within the Calgary-Lethbridge Corridor.