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# Integrated chemostratigraphic studies of the Khuff and Palaeozoic section in Kuwait

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## Abstract

Integration of new inorganic geochemical data with biostratigraphy has resulted in a robust, detailed chemostratigraphic correlation scheme for the Khuff and pre-Khuff Palaeozoic section in Kuwait In much of the section, biostratigraphic data are limited, with prevalent non-marine or marginal marine facies precluding the consistent recovery required for biostratigraphic zonation.

Where biostratigraphic recovery is poor, chemostratigraphic interpretation can be advantageous as it is not dependent on the presence or preservation condition of microfossils or palynomorphs. In this study the compositions of 47 major, trace and rare-earth elements were determined by a combination of Inductively-Coupled Plasma – Optical Emission Spectrometry and Mass Spectrometry (ICP-OES and ICP-MS) in ditch cuttings samples from both the carbonate Permo-Triassic Khuff and clastic pre-Khuff Palaeozoic section. Inorganic geochemical data were subjected to multivariate statistical treatment to identify the chemical 'fingerprints' of individual subunits, and consequently to establish zonation and correlation schemes in the studied wells. In addition to stratigraphic zonation and correlation, this chemostratigraphic analysis has provided information on facies mineralogy, and the depositional environment. Changing facies mineralogy can be distinguished by clear changes in lithology with depth documented by eg. Ca/Al, Si/Al ratios and total immobiles (Ti + Hf + Nb + Y + Zr), in both the carbonate/dolomite Khuff Formation and the clastic Palaeozoic section. High levels of V/Cr, U/Th, U and Mo indicate organic matter preservation in sediments often deposited in a reducing environment through both carbonate and clastic facies. Changes in provenance of the formations can be seen in changing rare earth element ratios in clastic sequences (eg. LREE/HREE and Ce/Y). This study has demonstrated the applicability of the chemostratigraphic technique to both carbonate and clastic sequences, of ages varying from Precambrian to Triassic.