

Isotopic and Chemical Characteristics of Khewra George Rocks



by

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Abstract

Khewra Gorge is present in the Eastern Salt Range. It is located about a distance of 1km from the Khewra town, after this town it is named as Khewra Gorge. “Khewra Gorge is known as the Museum of Geology.” In this Gorge, Salt range formation which is of Pre-Cambrian age, Jehlum group rocks which are of Cambrian age, it includes Khewra Sandstone, Kussak formation, Jutana formation and Baghanwala formation.

Ten rock samples collected from Khewra George were analysed for major ion, metal and stable carbon and oxygen isotope with the objective to; (i) to determine major cation in Khewra rock, (ii) to determine and to find correlation among selectee metals in the rocks of the area and (iii) to find stable carbon and isotope composition of rocks in the area. Major cations analyzed were Ca, Mg, K Na, while metals analyzed were Al, B, Cd, Co Cr, Cu Fe, Li, Mn, Ni, Sr and Zn. Stable isotope analyzed were C-13 and O-18.

Calcium, Potassium, Magnesium, and Sodium in Khewra rock samples were in the range of 19752.0 μ g/g to 319322.5 μ g/g, 95.8 μ g/g to 47774.4 μ g/g, 121.1 μ g/g to 63117.7 μ g/g, and 211.2 μ g/g to 42982 μ g/g. respectively.

Al concentration in these samples varied from 17.4 μ g/g to 108843.5 μ g/g with a mean value of 18962 μ g/g. Sample of marl at gypsiferrous bed was very rich in Al with almost 10% Aluminum contents. Boron contents of Khewra george rocks ranges from 8.7 μ g/g to 157.1 μ g/g with a mean value of 50.37 μ g/g. Maximum concentration is found in samples of Khewra George Marl which is 157.1 μ g/g. Cadmium of Khewra george rocks ranges from 1.3 μ g/g to 108 μ g/g with a mean value of 33.78 μ g/g. Co was found in narrow range of 1.2 μ g/g to 10 μ g/g with a mean value of 3.8 μ g/g. Cr is found in narrow range 6.9 μ g/g to 55.6 μ g/g with a mean value of 21.47 μ g/g. Cu was also found in narrow range of 2.8 μ g/g to 9.4 μ g/g with a mean value of 5.2 μ g/g. Whereas Iron concentration in Khewra george rocks varied considerably, from 30.9 μ g/g to 26620.7 μ g/g with mean value of 7091.11 μ g/g. Lithium concentration in Khewra George Rocks is not widely distributed, it ranged from 2.9 μ g/g to 69.6 μ g/g with a mean value of 22.8 μ g/g. Mn concentration was widely distributed, it ranged from 3.1 μ g/g to 806.9 μ g/g with a mean value of 228.07 μ g/g. Sr has a range of 38.2 μ g/g to 574.5 μ g/g and mean concentration in rock samples is 329.4 μ g/g. while Zn concentration in Khewra

George Rocks showed a narrow range of 1.2 $\mu\text{g/g}$ to 47.9 $\mu\text{g/g}$ with a mean value of 15.2822.8 $\mu\text{g/g}$.

Metals analysis revealed that Al was not significantly correlated with other metals but it was positively correlated with B, Cu, and Fe and negatively correlated with Cd, Co and Zn. B is significantly correlated with Li and Zn and while negative with Cd and Co. Cd is significantly correlated with Co and Sr, however its significant negative correlation exist with Zn. Co is correlated positively with Cr, Cu, Fe, Ni and Zn whereas negative correlation exist between Co, Sr and Zn. Positive correlation exist between Cr and Cu, Li, Mn, Ni and Zn. Fe exhibits positive correlation with Li, Mn, Ni, Zn and negative correlation is seen with Sr. Significant correlation is observed between Li and Zn. High negative correlation is seen between Ni and Sr and Sr and Zn. Significant negative correlation between Mn and Sr indicate replacement of Sr with Mn. .

$\delta^{13}\text{C}$ values of rock sample in this study ranged from -5.27 to 0.77 ‰ VPD. Sample from red marl at gypsiferous bed showed highly enriched values (0.77‰ VPD) followed by fossiliferous hard limestone) which has the values of 0.66‰ VPD.. Very low values correlate with diagenetic alteration close to deposits of the meteoric realm. The values of $\delta^{18}\text{O}$ range from - 5.56 to 1.4 ‰. As with $\delta^{13}\text{C}$, there are mostly trends towards higher values as a consequence of diagenesis.

No covariance exists between $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ in case of Khewra George Rocks; this indicates that the circulating meteoric fluid volume was insufficient to re-equilibrate and alter the carbon isotopic composition to any significant extent owing to the fact that the carbon system is rock buffered whereas the oxygen system is water-dominated.

LIST OF ABBREVIATIONS

ppm	Parts per million
ppb	Parts per billion
SMOW	Standard Mean Ocean Water
RDA	Recommended daily allowance
VPDB	Vienna Pee Dee Belemnite
DIC	Dissolved inorganic carbon
TDIC	Total dissolved inorganic carbon
mg/L	milligram per liter
DO	Dissolved Oxygen
TDS	Total dissolved solids
EC	Electrical conductivity
HMDE	Hanging mercury dropping electrode
DME	Dropping mercury electrode
m.eq	milli equivalent
ICP-OES	Inductively coupled plasma optical emission spectrometry
ICP-MS	Inductively coupled plasma mass spectrometry
RSD	Relative standard deviation
QIP	Quenched Index Parameter
AES	Automatic external standardization
tSIE	Transformed spectral index of external standard

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