E 16 A METEORIC WATER LINE FOR SRI LANKA

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There are naturally occurring stable isotopes of Hydrogen and Oxygen associated with the water molecule, known as Deuterium (H-2, D) and Oxygen-18 (O-18). Their natural variations among the various components of the Nature's Hydrologic Cycle are well documented and of great use in applied hydrology. These isotopes are ideal tracers for keeping track of diverse hydrological phenomena on a global scale. Some of the important information that can be obtained by the isotopes are origin of groundwater, mode of recharge to groundwater, interconnections between surface and groundwater, sea water intrusion, paleo-climatic information etc. Deuterium and Oxygen-18 contents in natural water samples are measured by using a mass spectrometer. The isotope ratics D/H and 180/160 are measured against a reference standard, known as SNOW (Standard Mean Ocean Water). The results are expressed as δ values, i.e.

$$\delta(\text{D or O-18}) = \frac{(R_{sample} - R_{std.})}{R_{std.}} \times 1000 \text{ in per mil}$$

Where, R_{sample} = D/'H or $^{18}O/^{16}O$ for sample,
$R_{std.}$ = D/'H or $^{18}O/^{16}O$ for standard

An important relationship has been found on a global scale for δ O-18 and δ D in monthly rain water samples. Craig (1961) put forward the following relationship:
δ D = 8 δO-18 + 10 and this was called the Global Meteoric Water Line.
The IAEA (International Atomic Energy Agency) established a similar relationship, based on a Global network of over 100 rain water collecting stations. The equation took the form, δD = 8.17 δ(O-18) + 10.56. This was for weighted averages of δO-18 and δD of all network stations.[2] In groundwater studies using stable isotope data, it was felt necessary to establish a local meteoric water line for Sri Lankan rain waters, the isotopic label of which has to be accurately determined. Since January 1983, seven meteorological stations in Sri Lanka have been collecting monthly rain water samples for this purpose. The water samples were sent to IAEA Laboratories in Vienna for Mass Spectrometric analysis. The data for water years 1983-84 are presented and the results were fitted to the following regression equation:
δ D=8.205 δ(O-18) + 12.029. Number of monthly data = 84. R^2 = 0.978.
This is known as the Meteoric Water Line for Sri Lanka.

References

1. Craig, A. (1961) Isotopic variations in meteoric waters Science 133 p 1702.
2. Stable isotope hydrology (1981) Technical reports Series No.210, IAEA, p 121.