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Distribution of Magnesium Fractions in the Nilgiris Soil Profiles. IV. Distribution Pattern in typic Haplumrepts and Fluventic Haplumrepts

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The Soils of Typic Haplumrepts were least weathered as indicated by higher amounts of mineral Mg and acid-soluble Mg. Organic cycle was active. The group average of top soil and surface soil indicated that unless the released magnesium is injected in the organic cycle it moves down. Existence of immature profiles with the presence of organic cycle was the main feature in the sub-group Fluventic Haplumbrepts. The interconversion of one form of Mg to another was seen in these sub groups and the reserve pond of magnesium was enriched from organic sources.

Distribution of magnesium fractions in the profiles were used as a measure to assess the stage of development, processes of soil weathering, leaching, presence or absence of organic cycle, accumulation of magnesium in various depths (Metson and Brooks, 1975). work on the pedogenic processes of the Nilgiris soils is very much negligible. Therefore with a view to assess the distribution of various forms of magnesium in the profiles of Nilgiris and to relate the data to certain aspects of soil development processes, the present investigation is taken up. In this paper soil profiles pertaining to the sub-groups typic Haplumrepts and Fluventic haplumrepts alone are discussed.

MATERIAL AND METHODS

The details of the location and the method of investigation were furnished in Part I of the series. In this investigation profiles in localities Kadanad, Doddabetta (top), Balakola, Kengarai, Naduvattam, Emerald and Titukkal were studied in detail for the various forms of magnesium as per the method described by Mukwunye & Melsted (1972). (Table 1). Samples from horizons upto 35 cm depth were regarded as 'top soil' and the samples below this as sub-soil. Instead of individual profiles, group averages of the sub-groups were calculated (Table-3).

RESULTS AND DISCUSSION

Typic Haplumrepts :

Kadanad, Doddabetta (Top), Balakola, Kengarai and Naduvattam profiles constituted the sub-group.

Appreciably higher proportion of non-exchangeable fractions (69.1 to 92.0 per cent) of magnesium (mineral Mg - Mg^m plus reserve form - Mg_r) constituted the total inorganic magnesium in the profiles. This indicated the immature nature of weathering. Frotz and Riecken (1968) stated that soils with high amounts of non-exchangeable

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Mg would be least developed. Medium to high exchangeable Mg (Mg_e) associated with medium amounts of organic form of Mg (Mg_{oc}) throughout the profile was suggestive of an active organic cycle in the Kadanad profile (9)*. But an abrupt reduction in all the inorganic magnesium fractions in the profile needs further study. Doddabetta (peak) profile (13) contained low Mg^r and Mg^e and medium Mg^m, Mg^{oc} and Mg^t in the surface layers. There was no appreciable variation with respect to Mg^m and Mg^{oc}. Medium to high Mg^r in the lower depths indicated that the profiles were well supplied with reserve magnesium and that the occurrence of basaltic parent material was possible. Accumulation of Mg^e at the lowest depths with the corresponding increase in Mg^t at this layer suggested a leaching regime. This was confirmed by a decrease in Ca/Mg ratio and an increase in Mg saturation per cent with depth. It is of interest to note here that the soil as such was immature as indicated by morphological characters confirmed by physico-chemical analysis and also by the fact that the clay content gradually decreased with depth. Here leaching had played an important role in the pattern of magnesium distribution. Presumably this might be due to the fact that this profile was situated at the highest point on the Nilgiris (2637 m) with very steep slope.

Balakola profile (18) contained medium Mg^m constituting 36.8 to 54.4 per cent of Mg_t and 48.3 to 81.6 per cent of the total inorganic magnesium. Medium Mg^r was consistent throughout the profile upto 125 cm beyond which it suddently decreased. Low Mg^e in the surface soil tended to increase with depth to medium level upto the above mentioned depth of 125 cm, beyond which this fraction also decreased markedly. Medium Mg^{oc} was consistent throughout the profile. This type of distribution might indicate a fairly weathered soil lying over a very weakly weathered parent material. Kengarai profile (22) was similar to Doddabetta (top) profile (13) except for a clay pan horizon at the depth of 5-25 cm. Clay content at this depth shifted from 34.4 to 44.4 per cent and in subsequent layers it decreased again to less than 34.5 per cent. Higher CEC (13.8 me/100 g soil) was also recorded at this depth.

Characteristic feature of Naduvattam profile (28) was the presence of very high amounts of Mg^e throughout the depth of 72 cm below which the charnackite parent rock was struck. This fraction constituted 46.4 to 53.0 per cent of Mg^t and 50.0 to 67.0 per cent of total inorganic magnesium. Thus the soils had a very shallow depth. Neither the Mg_t nor Mg^{oc} content changed appreciably with depth.

Fluventic Haplumrepts.

This sub group was represented by soils from Emerald and Titukkal. Umbric epipedon containing less than 49.2 per cent base saturation within 35 cm depth was observed.

Emerald profile (2) contained high amounts of Mg_{oc} in the surface layers increasing with depth. All other frac-

* These indicate profile numbers.

tions were medium in the surface horizon, and decreased with depths Except the first horizon, the major proportion of total inorganic magnesium consisted of the non-exchangeable magnesium (Mg_m plus Mg_r). This revealed the very weakly weathered nature of the horizons while the plough layer alone was well weathered. Immature profile was indicated by higher amounts of clay of 38.5 per cent in the top decreasing slowly with the depths to 14.2 per cent. The profile was observed to be influenced by organic cycle.

Titukkal profile (6) contained medium amounts of all fractions of magnesium and Mg_t. A slow decrease of Mg_r with depth upto 200 cm and an abrupt decrease thereafter was observed. The presence of clay pan was seen at the depth of 70-145 cm. as indicated by accumulation of Mg^e, Mg and clay content (45. 0 per cent associated) with the highest CEC of the profile (15.3me/100g soil). Kaila (1974) reported that Mg_t content was always higher in heavy clay soils.

In typic Haplumrepts, higher amounts of Mg^m, Mg_r and Mg^t were found in the sub-soils than in the surface soils. This revealed that any magnesium released by weathering was moved down to the sub-soil layer if it was not absorbed by the vegetation and injected into organic cycle. This was in line with the observations of Metson and Brooks (1975). Soils from the sub-group Fluventic Haplumrepts were adequately supplied with reserve magnesium. Very slight difference in the Mg_m between top soil and subsoil indicated that release and fixation of magnesium in the minerals were of some order. Higher amounts of Mg_t in the top soils suggested addition of Mg through organic source-since all the samples were from virgin soils. But a lower content of Mg_{oc} in the top soil suggested the mineralisation of this fraction into Mg_r and Mg_e. This was confirmed by considerable higher Mg^r and moderately Mg^e in the top soils. In this case contribution to the reserve proof should have been mainly from one form to another as observed by Metson and Brooks (1974).

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Table 1 Mean Distribution of Magnesium Fractions in top and subsoils of each of the soil Taxonomical subgroup.

(i) Typic Haplumbrepts (6)

Magnesium	Topsoil	Subsoil	Mean
(a) Content (me/100g soil)			
Mineral	2.1	2.4	2.3
Acid soluble	1.4	1.7	1.6
Exchangeable	1.6	1.5	1.6
Organic complexed	1.1	1.2	1.2
Total	6 4	6.8	6.6
(b) Clay content (%)	42.8	39.3	

(ii) Fluventic Haplumbrepts (2)

(a) Magnesium content (me/100 g. soil)			
Mineral	1.6	1.4	1.5
Acid soluble	2.1	0.8	1.5
Exchangeable	1.0	0.8	0.9
Organic complexed	2.0	2.3	2.2
Total	6.3	5.3	5.8
(b) Clay content (%)	47.5	27 6	

Figures in brackets indicate number of profile (average)