CHAPTER X
SUMMARY

The object of the present investigation was to study the characteristics and genesis of red lateritic soils of Birbhum, Bankura and Burdwan districts. Seven different upland soil profiles have been selected for this purpose and are named as Rashpuri series (profile I), Jhinjharpur series (profile II), Sankarpur series (profile III), Maldihi series (profile IV) all in Birbhum district; Bankura Agricultural Farm (profile V), Gangadharpur series (profile VI) in Bankura district; and Bistupur series (profile VII) in Burdwan district. For this investigation morphological, physical and physicochemical properties of soils along with electrochemical, electroviscous, dta, x-ray studies of H-clays, petrological analysis of sand fractions of soils and morphological and chemical analysis of concretions were carried out.

The soil is related to elements of landscape. Drainage condition, differential transport of eroded material, leaching, translocation and redeposition of mobile soil constituents influence the genesis of the soil. Profiles are moderately deep to deep, and the morphological features reflect the well drained condition of the soils. Soils are dark in colour at the surface and changes to lighter colour at the lower depths. Hard and soft ferruginous concretions are present in most of the horizons, the amount of which increases with depth and finally forms a hard murrum layer.
mixed with soil matrix. The clay fraction increases with depth in most of the soil profiles. Therefore, the presence of argillic horizon due to illuviation of fine mechanical fraction is evident. Sand fraction, both coarse and fine together, correspondingly decreases with depth. All the soils are light in texture ranging from sandy to loamy sand and loam at the surface and changing to sandy loam, loam and sandy clay loam at the lower layers.

Values of volume expansion, water holding capacity, pore space, apparent density and specific gravity of the soils in each horizon of the profiles are well compatible with increase in clay content down the profile.

The soils are acidic excepting the profile V, which is almost neutral at the surface. The acidity increases with depth in some cases and the reverse is true for others. The electrical conductivity is low in all the soils reflecting the presence of negligible amount of free salt. Organic carbon content is low in most of the soils and their value decreases with depth in all the soil profiles. The cation exchange capacity values are low and they always keep parallel relation with clay content. Calcium and to a certain extent magnesium, are the dominant exchangeable metallic cations. Exchangeable sodium and potassium are very low. Small amount of exchangeable manganese and iron are also present. The degree of base saturation increases with increase in pH values of the soils.

From the chemical composition of the soils it is revealed that the SiO₂ content ranges from 64.37 to 88.19 per cent and the value
generally decreases with depth. Sesquioxides, that is $\text{Fe}_2\text{O}_3$ and $\text{Al}_2\text{O}_3$ together increase down the profile in most of the cases. Manganese content is low and $\text{TiO}_2$ is present in traces in most of the soil profiles. Bases like $\text{CaO}$, $\text{MgO}$, $\text{K}_2\text{O}$ are very low and their combined contribution never exceeds 9.9 per cent in any case. The $\text{SiO}_2:R_2\text{O}_3$ molar ratio generally decreases with depth reflecting the progress of laterisation. Some important ratios i.e. silt per cent:clay per cent, clay $\text{CEC}$:clay content, exchangeable $\text{Ca}$: exchangeable $\text{Mg}$, indicate that the soils are fairly mature. Both oxalate and dithionite extractable free iron increase with depth in most of the profiles. The amount of silicate iron also increases downwards in almost of the profiles.

For identifying the nature of clay minerals in the soil profiles, it is necessary to take into account all the results of the chemical composition of H-clays, their potentiometric and conductometric curves, nature of electroviscous curves, cation exchange capacity, the differential thermal analysis and the x-ray diffraction analysis.

All the results together reveal that the clays in the different profiles are mixtures of illite and kaolinite, their proportion being slightly variable from soil to soil. X-ray analysis, however, suggest that a minor amount of chlorite is additionally present in profile IV.

From the petrological analysis of sand fractions of the soils of seven profiles it is realised that the heavy minerals like limonite, ilmenite, haematite, magnetite, zircon, tourmaline,
biotite, staurolite, garnet, kyanite which have been evolved through weathering of rocks are present in lateritic and red soils. Among the light fraction the mineral quartz counts most. The next mineral is feldspar. It is thus expected that the clay minerals that are present in the soil profiles have been formed in situ and originated from the soil forming minerals.

Concretions are present in most of the horizons of the soil profiles and their amount increases with depth. They are mostly rounded to subrounded in shape, and of varying diameters, size 2 mm to 5 mm is the most predominant. The colour is red to reddish brown and yellowish red on the outer surface and on breaking the inside colour is reddish brown to dark reddish brown.

Chemical analysis of concretions showed that the residue left as insoluble by 6M HCl extraction was between 38.10 to 65.50 per cent. In the soluble part, iron is the dominant. The next is manganese. Both the minerals increase with depth. For each size, Fe/Mn ratio, however, shows that the proportion of iron deposited in the lower horizon is more than manganese. This ratio also increased with decreasing concretion size, which indicates that more of iron has been deposited in the smaller sizes than manganese. Other constituents like CaO, MgO, K₂O, Na₂O are however present in small amount and TiO₂ present in traces.

The fusion analysis of residues that were left after acid extraction revealed that the main component is SiO₂, ranges from 66.16 to 84.04 per cent. Fe₂O₃ is very low and sesquioxides consist mostly of Al₂O₃ in all cases. It is evident therefore
that the core over which iron and manganese have been deposited to form concretions consists of particles of quartz, parent rock and/or clay.

With no evidence of reduced condition in any part of the profile, it is suggested that the concretions have formed by leaching down of soluble iron and manganese and their deposition over soil and parent material particles where conditions are favourable for such process.

Seven different soil profiles of three districts were classified according to the comprehensive system of soil classification (USDA, 1970). Examining the morphology of soil profiles, soil colour, base saturation and other physical and physicochemical properties of soils and also considering the moisture regime of the soils, mean summer and mean winter temperatures, the soils, have been grouped under orders Ultisol and Alfisol, and have been further classified as below:

Profile I, II and IV Typic ochrustult
Profile III, V, VI Typic ochrustalf
and VII