3.1 INTRODUCTION

It is appropriate to follow the treatment in Chapter 2 of the implications of the 'ordered' arrangement of the different layers of adsorbate(s) at a solid surface with a discussion of the effects of possible lateral heterogeneities of such surfaces. In soil there are several reasons for the presence of such heterogeneities. These include the diversity of the materials of the soil solid phase, the presence of different faces on the
crystalline constituents of the solid phase, and the heterogeneity which is associated with small scale disorder in crystal lattices. Uneven faces of crystals are included in this small scale disorder. The latter heterogeneities will, no doubt, be associated with the manner in which the formation of the crystals took place, and in particular with the presence of impurities.

It seems certain that in 'soil' no information would be available with regard to the pattern of small scale heterogeneities of the surfaces. Accordingly, surface heterogeneity of the soil solid phase tends to be treated as a stochastic variable.

It is clear, as was evident in Chapter 2, that also here a satisfactory but not excessive degree of detailing is necessary when developing models to cover this aspect of the behavior of the soil solid phase. In particular, it is important to seek an appropriate balance between details considered within the present context and those covered before in Chapter 2. Again, it is intended to consider first in some detail the effect which can be expected from surface heterogeneity, so that a responsible choice for simplification can be made.

The basic concepts for adsorption on heterogeneous surfaces were developed initially for gas adsorption. Langmuir (1918) was already aware of the complications inherent in describing adsorption on heterogeneous surfaces. Since then, there has been a considerable amount of work in this field. For recent reviews on the subject see Jaroniec (1983) and House (1983). This chapter is concerned with the adsorption onto charged heterogeneous surfaces of ions from aqueous solutions, a topic that has not been given much attention previously.

The treatment which follows consists of three parts. The first is concerned with general aspects of the extension of existing theory to charged surfaces. This part centres around the necessary translation of the activity of the adsorbed species in terms of its bulk concentration, plus a Boltzmann term reflecting the effect of the local electric potential on the adsorption. The latter is treated separately, because of an additional difficulty encountered when applying the theory to polycomponent adsorption. A second part is concerned with the difficulty of deriving the actual energy distribution curve from experimental information. Numerical analysis is found to be cumbersome and of low accuracy. Accordingly it is advisable either to fit experimental data to a chosen type of adsorption-energy distribution -as reflected in a particular type of isotherm function involving one fitting parameter- or else to use an approximative analysis of the observed isotherm. Both aspects are discussed with regard to their merits and possibilities. In a third part, the implications of the foregoing are demonstrated through comparison between a number of adsorption isotherms constructed numerically following assumptions as specified.

3.2 GENERAL CONCEPTS

3.2.1 Monocomponent Adsorption

The above term is used to distinguish between multicomponent adsorption systems and the prototype arising when only a single adsorbate