ABSTRACT

The thesis consists of two parts covering theoretical studies on response surface models and application of numerical methods to specific geologic situations. Part I is presented in the form of five papers, three of which are already published, and the other two are under publication.

In the first part, the structure of response surface generating functions have been critically examined to study the relationship between polynomial coefficients and the response surface characteristics. As a further development, the use of principal components (eigen values) of the quadratic equation for the comparison of the response surfaces is shown to be possible. In a further attempt to study the response surface models, five models are simulated adding a stochastic noise component. The basic patterns of the simulated models are analysed by the trend surface technique, with a view to study the limitations of the method for applying to heuristic situations.

A comparative study of the filtering techniques and their utility in the interpretation of geochemical anomalies, using the available copper assay values in the vicinity of Surda, Singhbhum district, Bihar is given. As a continuation of these studies, the validity of using residual maps for the study of anomalies is critically assessed. Since the trend computations are based on certain assumptions,

and in residual interpretation these restraints are not considered, it is suggested, in the fifth paper, that anomaly interpretation may be done using moment measures, which do not inherently possess any restraint.

The second part consists of the application of numerical methods to the study of magnetite deposits of Nausahi,Orissa. Numerical methods have been used as a corroborative evidence to the main conclusions reached by field and laboratory studies. Numerical methods have been used to study the three following specific aspects which have a bearing on the magmatic intrusion, and magnetite mineralisation.

1. Analysis of topography, using moving average method, spectral analysis method, and rolling gradient analysis, to study the possible states of pre-weathering and post-weathering topographic expressions on the basis of certain valid assumptions.
2. Study of granitic activity, using response surface concepts.
3. Study of textural variation of rocks in the proximity of magnetite mineralisation, using spectral density functions.

The work was supported by x-ray diffraction work, thin section studies, ore microscopic studies, and chemical studies of ores and minerals.

The aspects detailed above are the original contributions of the author, parts of which are already published. The computer programs for performing various calculations are developed under the supervision of Dr. S.V.L.N.Rao, and the programs and the resultant output are separately filed in the department. This thesis includes only the relevant data.