CHAPTER ONE

GENERAL INTRODUCTION
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The principles of soil mechanics have been understood for a considerable time. Many renowned engineers were associated with their formulation. Internal friction between the grains of the material predominates in the calculations, but cohesion between the grains is considered slight. The principles of soil mechanics provide the best means of anticipating the behaviour of unconsolidated deposits, and Terzaghi has used them to good effect in designing structures at or near the surface. However, to use such concepts in the design of structures and of mine layouts at great depths in consolidated deposits is to use them out of context.

For construction in hard rock, recourse has been made to the theories of elasticity and to the theories of structures. Openings are designed in such a way as to keep the surrounding rock within its failure limits. Should failure occur in very hard rock, the disintegration of the rock is explosive in character, a fact which gives rise to the phenomenon of rock bumps and/or bursts.

Neither the laws of soil mechanics nor the theories of elasticity explain completely the behaviour of the relatively soft rocks of the Coal Measures. The many hundreds of years of coalmining have seen the evolution of basic rules which do not harmonise entirely with the patterns of these disciplines. Isolated coal pillars, for example, are stable if their width is of the order of one tenth of their depth below the surface, while the support requirements of longwall faces are independent of their depth below the surface. Depth, however, does have an influence on the support and closure of drivages.
These considerations led the author to study the phenomena which occur in soft rocks at depth and to develop hypotheses which explain them. In turn this led to his approximating methods by which to calculate both the stability of openings and the degree and type of support required to maintain them. This aspect of the author's work is particularly relevant to the excavation of wider openings at greater depths. Such a study, it is suggested, constitutes an entity in its own right, the name 'Soft Rock Mechanics' being proffered as a means of distinguishing it from the related disciplines of Soil Mechanics and Hard Rock Mechanics.

In carrying out this study, the author has drawn on his experience of twenty-five years participation in rock mechanics research. This research, into the development of instrumentation [1] [2], the support of longwall faces [3] [4], pillar stability [5], and measurement of strain in shaft and inset linings [6], has been complemented by attendance at a large number of conferences and by visits to research institutes. Frequent discussions with others engaged in associated research work both in the United Kingdom and abroad have also been held. The author has had access to much unpublished material gathered by the National Coal Board's Mining Research Establishment at Isleworth, Middlesex, and by its successor, the Mining Research and Development Establishment, at Stanhope Bretby, near Burton-on-Trent. The development of the ideas which follow has been influenced by the many individuals whose views have been considered and due acknowledgement is made to all who, knowingly or unknowingly, have helped.
Many of the ideas outlined in this thesis must be considered hypothetical, insofar as they are put forward as a basis for reasoning and not as indisputable theories. The requirement to obtain answers to fit the facts and to aid in practical decision-making was the overriding consideration. Assumptions have been freely made and constants deduced, but some still require years of further investigation before they can be verified beyond doubt. This time constraint is a facet of industrial research.

During the course of the study some of the work contained in this thesis has been published [7] [8] [9] [10], but in the final writing up the author has availed himself of the opportunity to update, to enlarge and to critically review his ideas.