1994

Jointing and fracturing of flat-lying rock masses, Illawarra Coal Measures, southeastern Sydney Basin New South Wales, Australia

Hossein Memarian
University of Wollongong

JOINTING AND FRACTURING OF FLAT-LYING ROCK MASSES, ILLAWARRA COAL MEASURES, SOUTHEASTERN SYDNEY BASIN, NEW SOUTH WALES, AUSTRALIA.

A thesis submitted in fulfilment of the
requirement for award of the degree of

DOCTOR OF PHILOSOPHY

from

THE UNIVERSITY OF WOLLONGONG

by

HOSSEIN MEMARIAN

(M.Sc. University of Waterloo, Canada)

Department of Geology

1994

The content of this thesis are the result of original research by the author and material contained herein has not been submitted to any other university or similar institution for a higher degree.

H. Memarian
Please see print copy for image.

This thesis is dedicated to my wife.

ABSTRACT

Fracture mapping of the Late Permian Illawarra Coal Measures, between Coalcliff and Wollongong, shows that joints developed originally in extension (mode I) and were faulted in subsequent events. Conjugate joint sets are a consequence of two separate fracturing events. Extension joints developed in joint units of different size and shape, with boundaries at changes in mechanical properties. The fracture pattern of extension joints in a joint unit is related to the mechanical properties of the rock mass and loading history. Joints with regional distribution fall into two, early and late formed, groups. Group I regional joints strike N-NNE, NE and SE. These joints propagated horizontally and never interfered with each other. All the existing interactions are the result of succeeding events.

Group I regional joints were recracked subsequently. Recracking commenced with jointing and continued with lateral slip. All the faulted joints are classified as hybrid fractures. Faulted joints grew horizontally by the connection of recracked segments. En echelon arrays are the result of vertical propagation of faulted joints into intact rock. Recracking of rock also formed a set of secondary joints parallel to σ_1. The sense of movement along conjugate faulted joints and orientation of sets of secondary joints, are related to 3 compressional stress fields namely: NNE-SSW, E-W and SSE-NNW. The intensity of recracking and the amount of lateral slip is mostly related to the strength of infilling materials, the angle between the fracture and the maximum compression direction, and the number of compressional events imposed on the fracture.

In the southeastern Sydney Basin, some of the northwesterly trending normal faults were active during Late Permian deposition. Slip along these listric faults formed northwesterly trending gentle folds. A quasi-extensional regime, related to the forebulge of the Sydney Basin, reactivated appropriately oriented basement faults, which in turn, generated grabens in the cover. Group I regional joints formed after lithification and are classified as burial joints. Normal faults and dykes also developed during the Mesozoic. It is considered that the later part this episode was related to rifting that predated the opening of the Tasman Sea and its subsequent extensional history. The youngest deformational events were compressional. Group II regional joints and reactivation of pre-existing fractures occurred during these post-Early Tertiary events. Anticlockwise motion of the Australian crust, relative to the rest of the enclosing plate,

caused by the collision between the Indo-Australian and Pacific Plates, may have been responsible for the NNE-SSW compression in the eastern part of the Southern Coalfield. The E-W compression most probably postdated the NNE-SSW event.

Rock fracturing controlled the present configuration of the coastal platforms. Fractures in bedrock also governed the location of many landslips in talus along the Illawarra Escarpment. A method is presented for predicting the presence of dykes in underground coal mines, using adjacent joints.

CONTENTS

LIST OF FIGURES

LIST OF TABLES