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**CONTROLS ON POROSITY IN THE PAB SANDSTONE,  
KIRTHAR BASIN, PAKISTAN**

by

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## **CONFIDENTIALITY**

The author has accepted a confidentiality clause with BHP Petroleum Pty Ltd (Melbourne) concerning this study. The sponsors have requested that this thesis be unavailable for public release until the 31<sup>st</sup> day of December 1998.

## **STATEMENT OF AUTHENTICITY**

To the best of my knowledge, and belief, this thesis contains no material which has been accepted for the award of any degree, or diploma in any University, nor does it contain any material previously published or written by another person, except where due reference is made in the text.

Travis Enman, B.Sc.

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## EXECUTIVE SUMMARY

The Pab Sandstone is a gas producing reservoir in the Middle Indus Basin, Pakistan at the Pirkoh, Dhodak and Loti fields, but as yet is not a recognised hydrocarbon producing reservoir in the adjacent Kirthar Basin. This study attempts to examine the controls on porosity development and destruction in the Pab-Sandstone in the Kirthar Basin.

As part of the Honours program at the National Centre for Petroleum Geology and Geophysics (Adelaide), BHP Petroleum Pty Ltd (Melbourne) supplied a project integrating lithostratigraphy, sequence stratigraphy, petrography, seismic interpretation and wireline log analyses in the Kirthar Basin of Pakistan, with particular reference to the BHP Petroleum permits in the Sindh Province.

The main objective of the study was to map porosity trends in the Pab Sandstone and to predict reservoir quality in the vicinity of a proposed exploration well in Pakistan. The prediction of play fairways was included in this study.

The objectives of the study have been met by initially compiling a regional data base on the Pab Sandstone. Identification of the unit in both wells and outcrop on the basis of litho- and bio-stratigraphy allowed regional correlation of the unit. Porosity evaluations were carried out where data permitted and the possible controls on porosity quality and distribution, such as depth of burial, diagenesis, depositional environment, texture, and temperature were examined.

Empirical relationships and analogies were investigated incorporating outcrop analysis and burial histories. Porosity versus depth relationships were investigated and explained, incorporating depositional and sequence stratigraphic interpretations.

Sand distribution and quality maps including regional isopach, net sand, percentage sandstone and palaeofacies variations were compiled in order to more precisely define play fairways.

The Pab Sandstone is a medium to coarse grained, occasionally fine to very coarse grained, generally massive to thick bedded, cross bedded, occasionally conglomeratic, quartz arenite of Maastrichtian age with intercalations of shale, claystone, mudstone, marl, and limestone beds and is characteristic of a transitional marine environment.

The Pab Sandstone is interpreted to be present in the West Phulji, Dadu and Nawabshah permits. The shelf margin systems tract palaeofacies is interpreted as having good to very good reservoir quality and is interpreted to be present in the Phulji area.

The Pab Sandstone is most commonly carbonate and silica cemented, occasionally dolomite and siderite cemented. Diagenetic clays generally develop microporosity at the expense of macroporosity and diagenetic enhancement has resulted in at least adequate porosity. Despite the loss of original primary porosity, subsequent diagenetic events have led to the development of secondary porosity in the Pab Sandstone.

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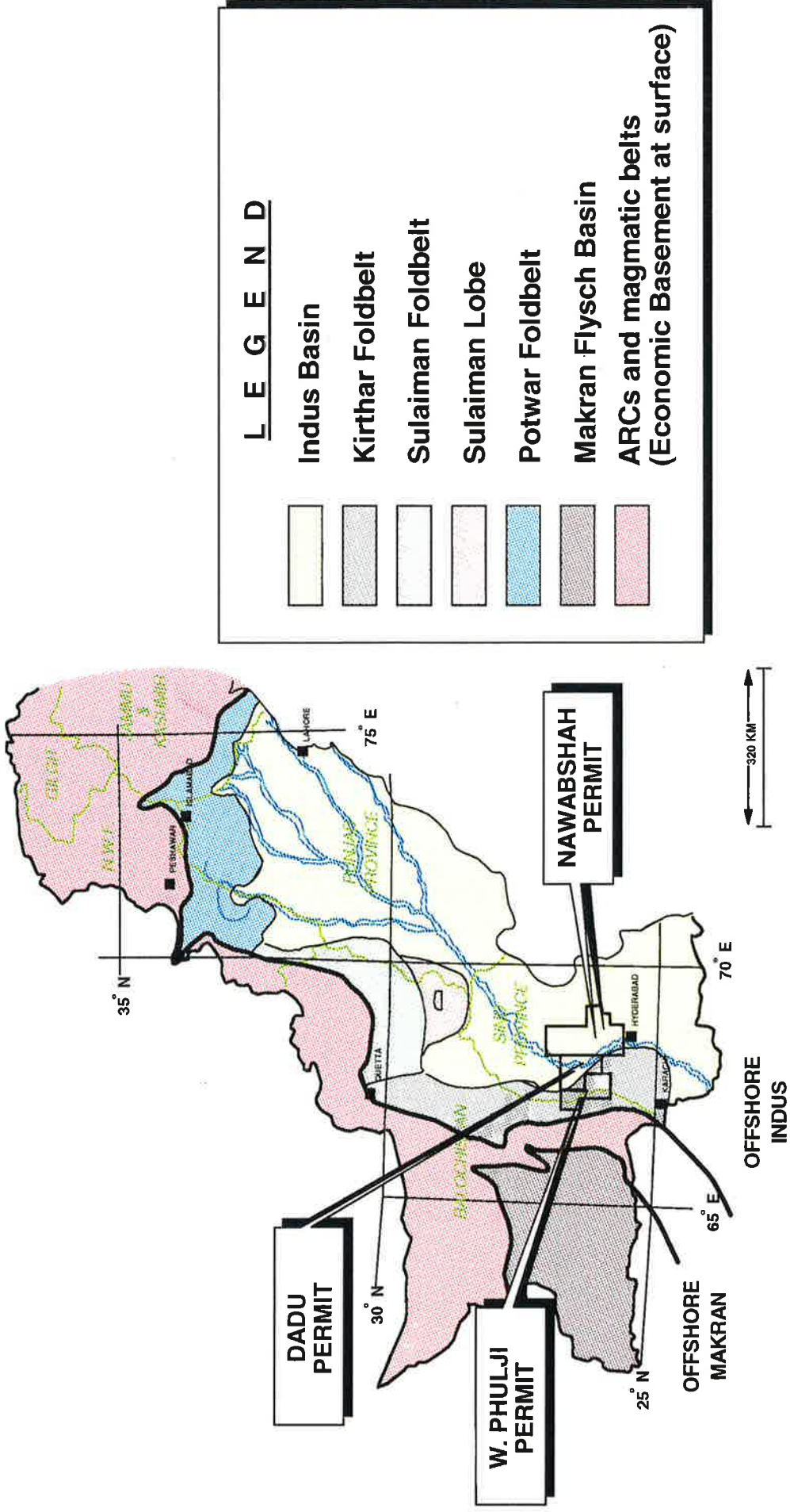
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**Disclaimer:** All photomicrographs used in this study are reproductions of slides prepared and analysed by Robertson Research (1996). I accept no responsibility for errors associated in the identification and labelling of the slides and I have accepted in good faith that the photomicrographs are a fair representation of the samples analysed.

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# DADU AND NAWABSHAH PERMITS PAB STUDY : Location Map





## **1.2: RESEARCH AIMS AND OBJECTIVES**

The principal aim of this study is to determine the controls on porosity development and destruction within the Pab Sandstone in the Kirthar Basin. Ultimately, this is with the view to the prediction of porosity in the Pab Sandstone and specifically the prediction of reservoir quality in a proposed exploration well in the region. The information should also constrain play fairways in the vicinity of the BHPP permits.