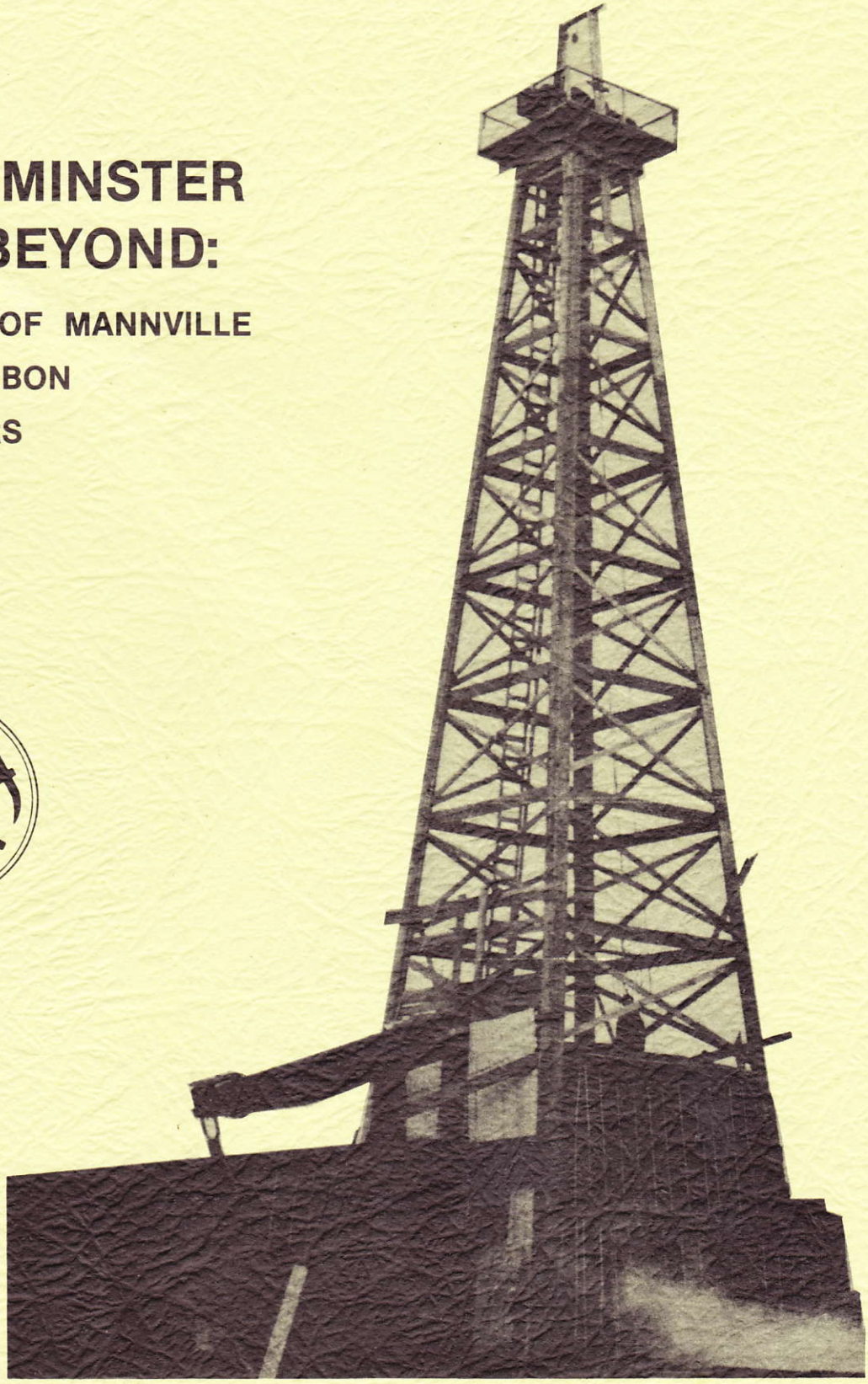
LLOYDMINSTER AND BEYOND:

GEOLOGY OF MANNVILLE HYDROCARBON RESERVOIRS



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Cover: Lloydminster Gas Company No. 1 Well
This historic well hit commercial natural gas in March 1934. The rig is a standard cable tool rig with a timber derrick.

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Geology of Mannville Hydrocarbon Reservoirs

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FOREWORD

All events have a beginning, and as far as the development of geological thought on the hydrocarbon deposits of the Lloydminster area is concerned, it would be presumptuous to suggest that it begins on p. 1 of this volume. Although the editors do not claim to know where it all began, in leafing through the Annotated Bibliography of Saskatchewan Geology by W.O. Kupsch the following entry is found on p. 97:

"Edmunds, F.H. (1940 c) ...

Oil and Gas developments in the Lloydminster area: Canadian Inst. Mining Metallurgy Trans. v. 43, p. 201-273, 4 figs."

It is therefore only appropriate, in this volume on the geology of the Lloydminster heavy oil deposits, that the late F. Harry Edmunds be remembered and honoured for his pioneering work on this cinderella of oil prospects.

These Mannville deposits were not always the attractive prospects they are today, and those who pursued them were regarded in some quarters as moon-struck. Time has made those pioneers eminent prophets.

Students of the Mannville have come into their own of late; thanks to the surging interest in heavy oil deposits. The various lines of research into the geology of the Mannville are now converging, even colliding. Thus the timeliness of the Symposium and this attendant volume is self-evident.

The editors thank the contributors and their employers who risked fame and fortune on the five-week publication deadline, and the Saskatchewan Department of Mineral Resources (Geological Survey) for our imposition on their staff, in particular, Jagdish Bilkhu who typed the manuscript.

L. S. Beck
J. E. Christopher
D. M. Kent

ERRATA

Table of Contents, line 3; change "Hall" to "Wall"
line 35; change "Francis" to "Frances"

Page 1, line 3: change "Hall" to "Wall"

Page "100", change to "101"; Page "101", change to "100"

Pages 197 to 216; change Fig. numbers IN CAPTIONS ONLY as follows:
1b to 2; 2 to 3; 3 to 9; 4 to 5; 5 to 6; 6 to 7;
7 to 8; 8 to 4; 9 to 10

Page 200, line 11; change "(Fig. 2)" to "(Fig. 3)"

Page 204, line 2 of caption; change "Figure 3" to "Figure 4"

Page 218, line 4; change "Francis" to "Frances"

Page 248, line 17 from bottom; change "nil" in extreme right column to "9%"

TABLE OF CONTENTS

EARLY CRETACEOUS PALEOGEOGRAPHY IN THE ALBERTA FOOTHILLS AND ADJACENT PLAINS

J.R. McLean* and J.H. Hall**

ABSTRACT

The Early Cretaceous paleogeography of the Alberta Foothills region developed in two principal stages. The first was a period of predominantly erosion, with an extensive drainage system carved into the underlying Mesozoic and Paleozoic sediments. Local topographic relief exceeded 100 m in some areas. Rivers flowed generally in a northerly direction towards a boreal sea.

The second stage was predominantly depositional and accompanied the gradual southward transgression of the Moosebar-Clearwater sea. River valleys were flooded, forming extensive estuaries and, with stream gradients lowered, aggradation took place in alluvial valleys, eventually filling them.

The Cadomin Formation represents deposition during the erosional and earliest depositional phases. The overlying Gladstone Formation represents deposition during the marine transgression when the drainage system was infilled, and the Moosebar Member of the Malcolm Creek Formation represents the phase of maximum transgression of the sea.

The Gladstone Formation in the Alberta Foothills between the Crowsnest Pass and Smoky River can be divided into two informal units: a lower unit characterized by fluvial deposits and an upper part (Calcareous member) characterized by generally fine grained sediments containing diagnostic microfossil suites.

The lower unit represents aggradational deposits in alluvial valleys during transgression of the sea, and is generally

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more prevalent in the western Foothills and southern Plains. The upper unit, south of the North Saskatchewan River, contains an entirely nonmarine faunal suite, but between the North Saskatchewan and Berland Rivers, a mixed fresh and brackish water faunal suite is present. The southern sequence is interpreted as deposition in a lacustrine or inner estuarine environment and the northern sequence as outer estuarine to marginal marine. Equivalent beds in the upper part of the Gething Formation between the Smoky and Wolverine Rivers do not contain a marine fauna and were deposited in an alluvial-deltaic complex which extended eastward beyond the limits of the Foothills.

The Moosebar Member abruptly overlies the Gladstone Formation and is present in the Foothills at least as far south as the Clearwater River, considerably beyond the recognized limit of marine influence in the Gladstone Formation. A thin glauconite and pebble bed occurs at the base of the Moosebar Member in the central Foothills, but was not observed in more southerly sections. The pebbles are a lag deposit of the transgressing sea and the glauconite formed under slow sedimentation conditions during, and immediately following, the transgression. The upper part of the Moosebar Member, as well as the overlying Torrens and Grande Cache Members of the Malcolm Creek Formation represent deposition during regression of the Moosebar-Clearwater sea.

Events in the development of the Lower Cretaceous sequence in the Alberta Foothills can be extrapolated to the adjacent plains of Alberta and Saskatchewan where similar sedimentary sequences have been reported.