谨以此书献给我国西部地区大开发

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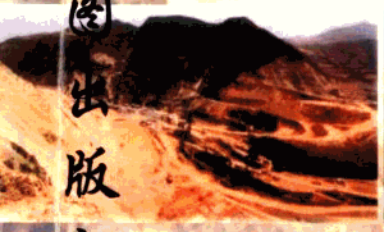

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THE MESOZOIC BASINS AND PETROLEUM GEOLOGY IN NW CHINA

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Xi'an Cartographic Publishing House

内容提要

本书从构造动力学入手，厘定了西北地区中生代盆地原型及其并列迭加关系，研究了不同阶段盆地沉积实体的展布特征和沉积模式，揭示了构造变形作用及其所形成的构造组合与油气配置的关系，划分、评价了西北地区中生代盆地的含油气系统，并选择典型实例进行了解剖。

本书内容丰富，资料翔实，可供地质类科研生产人员和大专院校师生参考应用。

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Preface

The 21th century will be era of a great development of western regions. The pipeline, which transports gas from west to east of China , will be carried out in the initial of new millenary , and become another giant project subsequent to Three Gorges Power Project to be finished on the Changjiang River.

Exploration activities and studies results of petroleum geology had demonstrated that western regions would be served as a very important strategic substitution area for oil and gas industry in China, and special emphasis is certainly placed on the need to quicken the tempo of investigation and exploration of hydrocarbon in western regions. While the comprehensive petroleum exploration in the Mesozoic basins, which occupies as more as sixty percent of total area of western regions, will play a critical role in the completing of this gigantic strategic task, in which the western regions will be successful turned into the most important substitution area for oil and gas production in China. Based on the above consideration, The China National Star Petroleum Corporation (CNSPC) have respectively set up two research projects, i. e, 'Prediction to potential areas and approach to exploration strategy of the medium and small sized Mesozoic basins in north China' and 'Petroleum geology and prediction to potential areas of the Mesozoic basins in western regions'. The above studies are regarded as a scientific basement for future petroleum exploration activities.

The present book is the collection and integration of research achievements in above projects, and also an attempt to bring together of the most recent results of exploration practices and studies. As far as concerned, the studied area is NW China with its borders reaching Helan Mountains to east and Kunlun Mountains to south.

It is well known that petroleum and other nonrenewable fuel resources are derived from sedimentary basins, therefore, the flow chart of studies can be concluded as follows: sedimentary fills will firstly be systematically described, and the history process associated with generation, development and disappearance stage of basins will be then documented in sequence, in which the overall understanding of the integrity, sequence and dynamics of sedimentary basins will be simultaneously required. In this book, an effort is made to delineate the juxtaposition and superimposition features of the Mesozoic basins in western regions based on tectonic geodynamic studies of sedimentary basins, and to further illustrate the essential characteristic of basins or various blocks in a basin with regard to source rocks, reservoirs, cap-rocks and their combination by thorough analysis of some representative basins of different genetic types.

In light of our study, the great number of the Mesozoic basins were formed and developed in NW China with a variety of geodynamic background. It is essential to bear in mind that the concept of compressional basin cannot be throughout applied to the description and interpretation of

origination of the Mesozoic basins occurred in NW China. Moreover, it is suggested that the oil and gas accumulation condition is different in correspond with either the various dynamic settings in a certain basin generation process or boundaries of different blocks in a same basin, therefore, an approach to petroleum geology of the Mesozoic basins and different blocks of a basin in comparative way, and to dividing oil and gas accumulation belts with different potential levels have certainly an important guiding significance for pushing the exploration activity in either the Mesozoic basins or blocks of a basin in western regions.

Two aspect studies are dealt with and applied in the analysis of the gas and oil-bearing basins of NW China. One of the most important part is to provide an insight into the essential feature for the major petroleum systems based on the detailed description of some typical petroleum system in terms of boundaries condition, main characteristics, typical pools and oil fields, and key control factors and so on, and this is really essential that sets the scene of further studies, another is progressed to focus upon the comparative studies and resources assessment of the petroleum system with respect to hydrocarbon discharge condition, entrapment style and mechanism, migration direction and reservoirs and other integrated indexes. The purpose of above studies is to unravel how temporal and spatial change of the petroleum systems in NW China, and to make further analysis of the hypothetical petroleum systems with a rather lower-degree hydrocarbon exploration, but having a promise potential prospect in context of interpretation of geological background.

It is confirmed that the tectonic deformation had been through prevailed in the process of basin generation for the Mesozoic basins, especially for the large and middle size of oil and gas-bearing basins in NW China, in other words, basin is originated in the process of tectonic deformation, and tectonic deformation is dominated in the course of basin formation. A point which is especially to be noted that the difference on tectonic deformation and its related basin generation for various blocks of a basin determined a wide variety of hydrocarbon generation and preservation condition. Therefore, as far as concerned, for the Mesozoic basins in NW China undergone multicycles tectonic deformations, a fresh conscientious thought is urgently needed in promoting of continuing prosperous of hydrocarbon exploration, to be more exactly, the better understanding of the sequence of tectonic deformation, and relationship between various structures and association of hydrocarbon migration and accumulation formed in each of tectonic episodes, and distinguishing from highly complex structural deformation patterns occurred in multiple episodes of structural alternations are invaluable in prediction of favorable structures and tectonic belts. It herein can take follow comments as a review of above knowledge, for those oil and gas -bearing basins undergone deformation and alternations, the good potential zones or blocks for hydrocarbon exploration in basins cannot be selected without a detailed studies on sequence of tectonic episodes and various tectonic combinations associated with the tectonic deformation.

This book consists of 7 chapters. Preface is initialed in chapter 1, The Mesozoic basins and geodynamics in NW China is outlined in chapter 2, Sedimentary evolution of the Mesozoic basins in NW of China is delineated in chapter 3, Tectonic deformation and preservation of hydrocarbon

of the Mesozoic basins in NW of China is dealt with in chapter 4, Petroleum system of the Mesozoic basins in NW China is integrally presented in chapter 5, Examples of the petroleum system of the Mesozoic basins in NW China is illustrated in more detail in chapter 6, and Conclusion is shown in chapter7.

This book is an embodiment of the collective endeavours of Ji Rangshou, Qian Yixiong, Fan Xiaoling, Pan Wenlei, Liu Guangxiang, Qin Deyu and Gao Changlin, each chapter is fulfilled by different authors. Chapter 1, 4, 7 by Ji Rangshou, chapter2 by Qin Deyu and Fan Xiaoling, chapter 3 by Pan Wenlei, chapter 5 by Liu Guangxiang, Qian Yixiong, Gao Changlin, chapter 6 by Qian Yixiong, Fan Xiaoling, Liu Guangxiang, and Ji Rangshou, and Pan Wenlei and Liu Guangxiang undertook the refinement of all diagrams in this book, and Ji Rangshou took on the modification and appraising of the manuscript.

The authors are deeply indebted to the follow units for their help during the implement of the two projects, these units include: Bureau Of Geology And Mineral Resources of Ganshu, Jiuquan Regional Geological Investigation Party Of Ganshu, BGMR, No. 1 Regional Geological Investigation Party Of XinJiang, BGMR, No. 3 Geological Survey Party Of North China Bureau Of Petroleum Geology, and Lanzhou Institute Of Geology, Chinese Academy of Sciences. The authors are also grateful to those for their research projects and exploration achievement reports, articles and books available, which are taken for reference and partly adopted in this books. In addition, during the assessment and evaluation of the projects, Profs. Sun Zhaocai, Zhou Yuqi, Zhang Pinglan, Zhang Yuchang and Zhang Kang gave a lot of specific advice, and their comments are most useful for the writing of book, therefore, their efforts are highly acknowledged and appreciated. In conclusion, sincerely thanks go to all of them for their encouraging thought and help.

In this book, we attempt to provide some essential materials, and earnestly hope the birth of this book will serve as a catalyst for further great development of petroleum exploration in NW China, however, due to limited knowledge and references, the contents of this book may included errors or omissions which remains responsibility of the authors, your criticism and suggestion are invaluable which sincerely welcomed.

Authors

The Spring Festiral in 2000, in Wuxi

目　　录

Contents

1 前言

21世纪将是中国西部大开发的时代。西气东输，将是新世纪初中国继长江三峡水电工程后的又一伟大工程。已有勘探结果表明：西北地区将成为我国石油天然气工业的战略接替区，加快勘探开发西北地区石油天然气已成为紧迫的任务。占西北地区总面积60%以上的中生代盆地的油气全面勘探开发，将在实现西北地区成为我国石油天然气的战略接替区中占有重要的份额。正因为如此，“九五”期间，中国新星石油公司先后设立了科技项目《中国北方中生代中小型盆地油气资源预测选区与勘探战略研究》(95-21)和《西北地区中生代盆地石油地质条件及勘探战略选区研究》(96-48)。期望通过上述研究，为中国新星石油公司对西北地区中生代盆地勘探布署提供科学依据。

本专著在上述两个科研项目的研究成果的基础上，吸收了新近该区域的勘探开发和科研成果撰写而成，其论及的区域范围为贺兰山以西、昆仑山以北的中国西北地区。

众所周知，油气的载体是沉积盆地，因此从沉积实体研究出发，研究沉积盆地的发生、发展和消亡的历史，把握并揭示沉积盆地的整体性、序次性和动态性；运用盆地构造动力学研究，厘定西北地区中生代盆地的并列迭加关系，并通过不同类型的代表性盆地分析，确定盆地或盆地的不同区块生储盖特征及其配置关系。

通过研究得出，我国西北地区发育了众多的中生代盆地，它们的形成具有多样的构造动力学背景，不是可以用“压性盆地”而一统我国西北地区中生代盆地的成盆作用的。即使同一盆地，其不同区块所处的边界条件不同，在同一成盆过程中，其动力学条件也是千差万别的，因而其油气富集的条件也不一样。类比我国西北地区中生代盆地及其同一盆地不同区块的石油地质条件，筛分出不同级别的油气富集区带，必将有益于分类指导西北地区中生代盆地或盆地的不同区块的勘探。

在西北地区中生代含油气盆地研究中，一方面通过西北地区中生代盆地较典型的含油气系统的解剖，包括系统边界、主要特征、典型油气藏、关键控制因素等的刻画，阐明含油气系统的基本特征；另一方面进行含油气系统的比较研究与评价，即通过含油气系统的油气充注条件、圈闭机理与样式、运移途径以及资源量大小等综合指标的分析，揭示西北地区中生代盆地含油气系统时空迁移变化规律，进而在油气勘探程度低，但依据地质背景分析又具有较好勘探前景的地区进行推测性含油气系统分析。

我国西北地区中生代盆地特别是一些大、中型含油气盆地，构造变形作用贯穿于成盆过程的始终，亦即变形过程中成盆，成盆过程中变形。不同区块的构造变形及相应的成盆作用的差异性，决定了油气生成和保存条件的差异。因此对于像我国西北地区经历过多期构造变形的中生代盆地而言，要获得油气勘探的繁荣，必须革新观点，深入研究成盆后的构造变动序次，研究每一期构造变动所形成的各类构造与油气运移、聚集的配备关系，筛分出由多期构造变动而形成的复杂构造变形图形中的有利构造和构造区带。因此，可以说：“对于经受变形和改造了的含油气盆地而言，不研究构造变动序次，不研究构造变动而形成的各类构造组合，就很难寻