

中国油气勘探

PETROLEUM EXPLORATION IN CHINA

邱中建 龚再升 主编

Qiu Zhongjian Gong Zaisheng

第三卷 东部油气区

石油工业出版社
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内 容 提 要

本卷主要论述了大庆、吉林、胜利、大港、下辽河、华北、二连、中原、江苏、江汉、河南以及南方诸油气区的勘探历程和成就，并对各油田的典型勘探实例进行了剖析，总结出具有启发性的经验和认识，对今后油气勘探工作具有重要参考意义。

本卷内容翔实生动、图文并茂，其中尚有以往鲜为人知的可贵史料，可供从事油气勘探工作的决策、管理、科研及工程技术人员参考，同时也可作为有关大专院校师生的参考用书。

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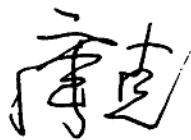
序

在中华人民共和国建国 50 周年来临之际,《中国油气勘探》一书即将问世。该书全面系统地论述了我国半个世纪以来,在极其复杂的地质条件下,经过艰难曲折的勘探历程,取得了巨大的成就。从一个石油工业基础十分薄弱的国家,原油年产仅有 $12 \times 10^4 \text{t}$ 的水平,发展到目前年产 $1.6 \times 10^8 \text{t}$,跃入了世界产油大国的行列。这个成就为世人所公认,国外石油界同行们也给予很高的评价。

该书用历史的观点,概括地总结和回顾了我国走过的艰难而辉煌的勘探历程和丰富而生动的勘探经验。其中对不同沉积盆地的勘探典型实例加以剖析,对勘探中正、负两方面的经验秉笔直书,可供后人借鉴。这是一部不可多得的文献,对今后勘探工作将会起到促进作用。

从 40 年代我国老一辈地质家提出陆相生油观点以来,相继在我国西部发现了几个油气田,其中老君庙油田是在抗日战争初期极其艰苦的条件下开发的,为我国现代石油工业打下了初步基础。新中国成立以后,石油工业有 4 次重大的飞跃。第一次是石油勘探战略东移,在松辽盆地发现了特大型的大庆油田,说明了陆相地层不但可以生油,而且可以形成巨型油田。第二次是渤海湾盆地的突破,通过对复杂断陷盆地的勘探实践,总结出复式油气聚集区(带)的理论。到 1978 年原油产量已超过 $1 \times 10^8 \text{t}$ 。第三次是改革开放以后,70 年代末期沿海大陆架对外开放与国外各大石油公司合作勘探开发石油,并迅速取得成果。目前海洋的石油与天然气产量均具相当规模。第四次是 80 年代末期,在“稳定东部、发展西部”的方针指引下,在积极勘探东部的同时,对西部各大型沉积盆地加大了勘探力度,塔里木、鄂尔多斯、准噶尔、四川、吐哈、青海等盆地均取得了重要的进展,原油年产量由 $964 \times 10^4 \text{t}$ 增加到 $2143 \times 10^4 \text{t}$ 。特别应该指出的是,天然气的储量有很大增长;海相油、煤成油、低熟油、低渗透和裂缝性油气藏理论又有新进展。抚今追昔,深感这些重大成果来之不易。这些成果的取得是在党中央领导下,全体石油职工半个世纪以来共同努力奋斗的结果。我作为一个曾是石油战线上的老兵,读后感慨万千!

展望今后我国社会主义现代化建设,原油生产能力与需求还存在着差距。应当积极广泛地开展国内油气勘探,力争储量不断增长,重视老油田挖潜;同时稳妥地合作开拓国外市场,内外结合,持续发展我国石油工业,以满足国家建设、人民生活日益增长的需要。这是我们石油工作者义不容辞的责任,任重道远。在本书即将出版的时候,我愿与同行们共勉,并一道将此书献给中华人民共和国建国 50 周年!



1999 年 2 月

Preface

With the advent of the 50th anniversary of the People's Republic of China, the book *Petroleum Exploration in China* will soon be published. The book completely and systematically summarizes the great achievements reached after going through a hard and twisty road under the Chinese complicated geological conditions during more than half a century. The achievements changed China from an oil poor country (annually producing only 120, 000 tons in 1949) into one of the major oil producers in the world (annually producing 160 million tons currently) . This has been accepted worldwide and was highly appreciated by foreign colleagues.

The book summarizes and reviews the hard but brilliant exploration history and very rich and vivid experiences achieved in a historical view, in which the typical cases of exploration in various sedimentary basins and both the positive and negative experiences arising from the exploration are described and analyzed in detail. The book is worth being used for reference and surely is a rare literature that must be useful for guiding the future exploration practice.

After the putting forward of the nonmarine oil origin theory in 1940s by Chinese old generation geologists, several oil/gas fields were subsequently discovered in western China, among which the Laojunmiao oil field was put into production under the very hard conditions of early Anti-Japanese war. This established a basis for Chinese modern petroleum industry. Since the founding of the People's Republic of China, four significant progresses have been made in Chinese petroleum industry. The first is the strategic transfer from West China to the East China, during which China discovered its largest oil field — Daqing Oilfield, which indicates that the nonmarine sediments can not only generate oil but also be capable of forming giant oil field. The second progress is the breakthrough of the Bohai Bay basin, from which a profound theory on composite oil/gas accumulative zones was proposed through exploration practice in the complex faulted basin. By 1978, Chinese crude oil output had exceeded 100 million tons per year. The third progress was made after implementation of the reform and opening policy in late 1970s, when the eastern offshore areas were opened for cooperative exploration and production with foreign oil companies. Up to now, considerable oil and gas producing capabilities have been established in the offshore areas. The fourth progress was made in late 1980s, when not only the sedimentary basins in the Eastern China continued to be strongly explored, but the large-scaled sedimentary basins in Western China were also enhanced with exploration under the guidance of the policy of “Stablizing the East and Developing the West” . Since then, significant achievements have been reached in all the basins of western China including Tarim, Ordos, Junggar, Sichuan, Turpan-Hami and Qinghai etc. , making the annual crude oil output of

the basins increasing from 9.64 million tons into 21.43 million tons. It should be especially noted that the natural gas reserve of China has been greatly increased, and the theories on marine origin oil, coal origin oil, low maturity oil, low permeability and fracture reservoirs are all improved. By recalling the past, I deeply feel that the achievements are not easy to have been reached. They are results of the joint efforts of all the members of the petroleum industry under the leadership of the Chinese Communist Party during over a half century. As an old fighter in the petroleum industry, I recalled the past events with deep feeling after reading the book.

In the future socialist modernization construction of China, there still exists a gap between the crude oil production and oil demand. As a result, further greater efforts have to be made to enhance the domestic oil exploration for reaching more new reserves and for further increasing the potential of the old oil fields. Moreover, the overseas strategy has also to be paid with sufficient attention for reaching more oil supply to ensure sustainable development of the petroleum industry and to meet the demand of the country's construction and growth of the people's living level. This is our unshirkable duty as a member of the petroleum industry. As the book will soon be published, I'd like to encourage each other with our colleagues and together devote the book to the 50th anniversary of the People's Republic of China.

Tang Ke

Minister of the former Petroleum Industry Ministry
of the People's Republic of China

Feb. 1999

前 言

中国是发现、利用石油和天然气最早的国家之一。在历史上,中国天然气、卤盐的勘探,创造了当时世界上领先的技术水平。到了近代,中国于1878年首次用新式钻机在台湾苗栗钻获石油,其后是1907年在陕北延长用顿钻钻了大陆第一口油井——延1井。从那时到1949年的40多年间,由于各种原因石油产业发展缓慢,1949年,石油产量(包括人造石油在内)只有 $12 \times 10^4 \text{t}$,中国所需油品基本靠国外进口。

中华人民共和国建国以后,我国石油工业的发展取得了巨大的成就,原油年产量由原来很低的水平达到现在的 $1.6 \times 10^8 \text{t}$,进入石油大国的行列。这些成绩的取得来之不易,是全体石油职工在党中央领导下,经过了异常艰难曲折的道路,积累了正、负两方面的经验而取得的,走出了一条我国自己发展石油工业的道路。

这本书概括地回顾和总结了我国油气勘探历程和勘探经验,并对主要油气盆地的典型实例加以分析,使读者清晰地了解主要油气田的发现过程,并可供国内外同行借鉴。

原国务院国务委员、石油工业部老部长康世恩和中国科学院院士翁文波生前曾提出建议,希望能好好总结中国油气勘探经验。在原中国石油天然气总公司周永康总经理和勘探局高瑞祺局长的支持下,由原石油工业部唐克老部长和原中国石油天然气总公司邱中建副总经理、中国海洋石油总公司龚再升总地质师分别担任名誉主编和主编,并组成了本书的编委会。这些编委都是中国油气勘探的亲身参加者和组织者,在各油气区的勘探中,经历过多次的成功与挫折和新技术的应用与发展,而今大多已离、退休,身居二线,有较多时间对各地区的勘探历程和勘探实例加以生动的总结和剖析。

本书不同于一般史志、学术论文,而是从认识论角度总结我国油气勘探的历史过程,编写原则是:以总结中国油气勘探实际经验为主线,从认识上、理论上及新技术应用上总结正反两方面经验;尊重历史,尊重事实,客观地、科学地、实事求是地回顾勘探过程,尊重在勘探过程中的不同意见;通过实践,以客观事实为依据,写出特色,写出风格,要有高起点;分析和解剖各主要盆地成功和挫折的实例,总结出生动的、有启发性的经验和认识,以便对今后勘探工作有所借鉴。

本书共分4卷:第一卷 总论(1~6章)、第二卷 西部油气区(7~13章)、第三卷 东部油气区(14~25章)、第四卷 近海油气区(26~33章)。

各章参与编写人员如下:

第一卷 总论:第一章,罗志立;第二章,张清、梁狄刚;第三章,王文彦、张树国;第四章,物探部分瞿杰、吕友生,钻井部分陈元顿,测井部分谭廷栋,最后由徐旺汇编而成;第五章,邱中建;第六章,邱中建、徐旺。附录,徐旺根据有关资料汇编。

第二卷 西部油气区:第七章,宋四山、凌升阶;第八章,包茨、李远章、魏玉秀、沈耕田、杜尚明;第九章,王昌桂、徐旺;第十章,彭希龄、陈莉;第十一章,梁狄刚、姚国范、郭宏;第十二章,顾树松;第十三章,路锡良、梁世君、王武和、肖国平、石家雄。

第三卷 东部油气区：第十四章，郭占谦；第十五章，毛超林、康伟力、刘鸿友、王永春、崔学周；第十六章，帅德福、杜公仪、曹叔彬；第十七章，薛士荣、刘鸿滨、潘耀威；第十八章，蒋宝铤、葛泰生、王守刚；第十九章，朱连儒；第二十章，党振荣、吴华元；第二十一章，赵春元、陈树文；第二十二章，刘国坚、张永康、杨大荣；第二十三章，戴世昭、王典敷、郑晓玲、张士万、刘岭山；第二十四章，徐世庸；第二十五章，谢展、周堃。

第四卷 近海油气区：第二十六章，王善书、陈斯忠；第二十七章，马启富；第二十八章，王向辉、王毓俊；第二十九章，宋建民；第三十章，李泽松、郭水生、陈炜煌；第三十一章，张启明、郭水生；第三十二章，陈炜煌、龚再升；第三十三章，龚再升、王善书。

本书编写历时3年半，先后于天津大港油田、湖南大庸、广东湛江由邱中建主持召开了三次编委工作会议，对编写原则、提纲、一稿、二稿进行了充分讨论，反复推敲，补充修改，至少三易其稿。最后由执行编辑徐旺、张清、王文彦、梁狄刚、张建雄等统稿，并请唐克作序，由石油工业出版社、地质出版社编辑出版。该书实为百万石油职工劳动的结晶，得以在短时间内完成出版，应特别感谢原中国石油天然气总公司和中国海洋石油总公司领导、原中国石油天然气总公司勘探局、石油勘探开发科学研究院和中国石油学会以及各油田领导的大力支持与指导。

本书文前照片，主要选自《中国石油工业画册》、《中国石油画册》、《中国海洋石油总公司》中的照片，在此对原作者一并致谢。

编 者
1999年4月

Foreword

China is one of the first countries who discovered and utilized crude oil and natural gas. Historically, China created leading technology in natural gas and salt exploration. By recent, China got its first crude oil well by using new rig in MiaoLi Taiwan in 1878, and drilled its first on-shore oil discovery — Yan 1 well by using cable rig in Yanchang, Shaanxi in 1907. However, China's petroleum industry grew very slowly due to certain reasons over the 40 years from 1907 to 1949, with the crude oil production (including synthetic oil) in 1949 being only 120, 000 tons. Then the oil demand depended predominantly on import.

Since the founding of the People's Republic of China, the petroleum industry has reached huge achievements, with the crude oil output increasing from a very low level up to 160 million tons per year, having entered the ranks of major oil producing countries of the world. The achievements are not so easy to have been reached. They are results of the joint efforts of all the petroleum staffs of the country, under the leadership of the Chinese Communist Party, by going through a very harsh and twisted road and by accumulating both positive and negative experiences and lessons. Up to now, China's petroleum industry has paved a road suitable for its own development.

This book to be published reviews the history of the Chinese petroleum exploration and summarizes the experiences reached from the history, and especially gives detailed analyses on the typical cases in exploration of the major petroleum basins. It enables readers to see a vivid picture illustrating the discovering process of some major oil and gas fields in China, and can be used by colleagues of the home and abroad for reference.

Mr. Kang Shien, the deceased state councillor of the State Council and minister of the former Petroleum Industry Ministry, and Prof. Wong Wenbo, a deceased academician of the Academia Sinica, both suggested to collect and summarize the experiences of the Chinese petroleum exploration. Under the support of Mr. Zhou Yongkang, former president of China National Petroleum Corporation (CNPC), and Mr. Gao Riqi, Director of the Exploration Bureau of CNPC, an editorial board for compiling the book was established, with Mr. Tang Ke, minister of the former Petroleum Industry Ministry, Mr. Qiu Zhongjian, former vice president of CNPC, and Mr. Gong Zhaisheng, chief geologist of China National Offshore Oil Company, as honorary chief editor and executive chief editors, respectively. The members of the editorial board are all the real participants and/or organizers of the past oil and gas exploration activities in Chinese petroleum provinces, all having experienced multiple successes and failures and new

technological development and application. Most of them have up to date retired and thus have enough time to summarize and analyze the exploration history and exploration cases in various petroleum provinces.

Unlike general historical records and academic themes, this book summarizes the oil and gas exploration history of China in epistemological view. The book is compiled upon the following principles. With the Chinese oil and gas exploration practice as a main clue, the book summarizes both the positive and negative experiences and/or lessons in aspects of knowledge, theories and new technological applications. The book reviews the exploration history objectively, scientifically and realistically upon the principle of respecting the history, the truth and different opinions arising from the exploration history. Standing at a higher viewpoint, the book presents a unique characteristics and style strictly according to practice and objective facts. The book analyzes and discerns the typical cases of both success and failure and picks out vivid and suggestive experiences and/or lessons from the cases so that it will be useful for the future exploration practice.

The book includes four Volumes. The Volume I, General, is from Chapter 1 to Chapter 6; the Volume II, Western Petroleum Province, from Chapter 7 to Chapter 13; the Volume III, Eastern Petroleum Province, from Chapter 14 to Chapter 25; and the Volume IV, Offshore Petroleum Province, from Chapter 26 to Chapter 33.

The writers are as following. In the Volume I, the Chapter 1 was written by Mr. Luo Zili; the Chapter 2, by Mr. Zhang Qing and Liang Digang; the Chapter 3, by Mr. Wang Wenyan and Zhang Shuguo; the Chapter 4, by Mr. Qu Jie, Lu Yousheng, Chen Yuandun, Zhou Yuhui, Zhang Keqing, Tan Tingdong and Xu Wang; the Chapter 5, by Mr. Qiu Zhongjian; and the Chapter 6, by Mr. Qiu Zhongjian and Xu Wang. Finally the chronicle of events is written by Mr. Xu Wang.

In the Volume II, the Chapter 7 was written by Mr. Song Sishan and Ling Shengjie; the Chapter 8, by Mr. Bo Ci, Li Yuanzhang, Wei Yuxiu, Sheng Gentian and Du Shangming; the Chapter 9, by Wang Changgui and Xu Wang; the Chapter 10, by Pen Xiling and Cheng Li; the Chapter 11, by Liang Digang, Yao Guofan, Guo Hong; the Chapter 12, by Gu Shusong; the Chapter 13, by Lu Xiliang, Liang Shijun, Wang Wuhe, Xiao Guoping and Shi Jiaxiong.

In the Volume III, the Chapter 14 was written by Guo Zhanqian; the Chapter 15, by Mao Chaoling, Kang Weili, Liu Hongyou, Wang Yongchun and Cui Xuezhou; the Chapter 16, by Shuai Defu, Du Gongjing and Cao Shubing; the Chapter 17, by Xue Sirong, Liu Hongbing and Pan Yaowei; the Chapter 18, by Jiang Baoxi, Gou Taisheng and Wang Shougang; the Chapter 19, by Zhu Lianru; the Chapter 20, by Dang Zhenrong and Wu Huayuan; the Chap-

ter 21, by Zhao Chunyuan and Cheng Shuwen; the Chapter 22, by Liu Guojian, Zhang Yongkang and Yang Darong; the Chapter 23, by Dai Shizhao, Wang Dianfu, Zheng Xiaoling, Zhang Shiwang and Liu Lingshan; the Chapter 24, by Xu Shirong; and the Chapter 25, by Xie Zhan and Zhou Kun.

In the Volume IV, the Chapter 26 was written by Wang Sanshu and Cheng Sizhong; the Chapter 27, by Ma Qifu; the Chapter 28, by Wang Xianghui and Wang Yujun; the Chapter 29, by Song Jianming; the Chapter 30, by Li Zeshong, Guo Shuisheng and Cheng Weihuang; the Chapter 31, by Zhang Qiming and Guo Shuisheng; the Chapter 32, by Cheng Weihuang and Gong Zhaisheng; and the Chapter 33, by Gong Zhaisheng and Wang Shanshu.

During preparation of the book, three symposiums were held in Dagang Tianjing, Dayong Hunan and Zhanjiang Guangdong, respectively. The symposiums were chaired by Mr. Qiu Zhongjian, and at the symposiums, the principles, outline, and the first and second draft manuscripts were discussed and revised in depth. After three times of modification, the book was finally organized by Implement Editors Mr. Xu Wang, Zhang Qing, Liang Digang, Wang Wenyan and Zhang Jianxiong. Mr. Tang Ke, the old minister of the former Petroleum Industry Ministry, was invited to write a preface for the book.

The book is published by the Petroleum Industry Press and Geological Publishing House. Publication of the book might be thought of being a result of the joint efforts of all the staffs of the petroleum industry. For its publication in a so limited time period, special acknowledgement should be extended to the leaders of China National Petroleum Corporation (CNPC), China National Offshore Oil Corporation (CNOOC), Exploration Bureau of CNPC, Research Institute of Exploration and Development, China Petroleum Society and various oilfields in China.

Editors

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