



塔里木盆地油气勘探丛书

BOOK SERIES ON PETROLEUM EXPLORATION IN THE TARIM BASIN
WELL LOG INTERPRETATIONS AND
RESERVOIR DESCRIPTIONS

石油测井解释与储层描述

欧阳健 等著 Ouyang Jian *et al.*

石油工业出版社

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内 容 提 要

本书以地质资料为基础,综合钻井、测试所取得的丰富资料,充分论述了测井资料在评价塔里木盆地的储层参数、油气层解释、地层压力剖面、沉积、构造等方面的成功应用。

本书充分体现了油公司的测井解释特点,即在岩石物理、测井理论指导下实现“岩心刻度测井”的精细解释;在现代地质学理论指导下,用测井对油藏进行评价与描述,是测井、地质工作者一本较好的参考书。

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序

《塔里木盆地油气勘探丛书》一套十卷,经过塔里木盆地和全国石油地质工作者的集体努力,以及石油工业出版社同志们的辛勤劳动,终于和大家见面了。

这是塔里木盆地油气勘探史上的一件大事。丛书的公开出版,必将引起国内外石油界的广泛瞩目和兴趣。

新中国石油天然气勘探最早始于我国的西部,50年代末大庆油田的发现,标志着油气勘探战略的向东转移,接着是渤海湾盆地一系列油气田的重大发现,中国石油年产量也随之跃升到一亿吨以上,成为世界前列的产油国家。到了80年代末期,西部新疆塔里木盆地油气勘探不断有新的发现,人们把寻找大油气田的目光重新投向了西部地区,1989年4月经国务院批准由中国石油天然气总公司组织了塔里木盆地石油会战,从而为在塔里木盆地全面展开勘探迈出了勇敢的一步。

塔里木盆地的油气勘探,从1981年算起已经有十多年了,其间因为种种原因,经历了“几上几下”的曲折历程,也积累了丰富的资料和经验教训。现在这场会战,正是在新疆广大石油工作者30年野外地质调查、石油物探局十年挺进大漠所取得丰硕成果基础上进行的。四年多来,因为投入了大量的人力物力,进行了大范围的区域勘探。应当说,取得的勘探成果和认识上的深化,也是过去几十年所不能比拟的。

四年多来,一共发现了6个大、中型油气田,20个工业性含油气构造;发现了塔北轮南地区中生界高产油气田群;发现了中国陆地上第一个石炭系海相砂岩高产油田——东河塘油田;发现了我国目前埋藏最深(5953m)的英买力地区奥陶系碳酸盐岩油藏;发现了轮台断隆带上的第三系、白垩系天然气高产富集带;第一次在塔克拉玛干沙漠腹地发现了高产的古潜山油气藏和石炭系亿吨级海相砂岩油藏。目前,塔里木盆地已经具备在“八五”期间建成年产500万吨原油和6亿 m^3 天然气的资源能力。

实践证明,塔里木盆地油气资源的确十分丰富。它是我国目前测算石油气资源量在100亿吨以上的三大盆地之一,其中的两个——松辽盆地和渤海湾盆地,都已经找到了几十亿吨的油气储量,塔里木盆地也一定能够找到大油气田。这一点,中外石油地质家都是从不怀疑的。

另一方面,塔里木盆地的石油地质条件又十分复杂,表现在:

它不同于我国东部的中生代陆相含油气盆地,也不同于我国中部海相古生界产气、陆相中生界产油的四川、陕甘宁盆地,又不同于我国西部准噶尔、吐鲁蕃、柴达木等陆相含油气盆地,它是我国独一无二的主要为海相成因油气田的含油气盆地,许多原油都有多源混合、多期成油的特点。

它不是一个简单的单旋回盆地,而是一个不同时期、多个原型盆地拼合而成的大型叠合、复合盆地;沉积中心和沉降中心经历过多次转移。

它的发育历史很长,从震旦纪到第四纪,其间多次抬升,区域不整合面数量之多,是全国少见的;它经历过几次“翘翘板”式的反向升降运动,新构造运动之强烈,也是我国少见的;造成油气运移和油气再分配的状况十分复杂。

它的某些地区局部构造幅度较小,而盆地中地震速度变化之大却是全国之最,这就为准确圈定构造带来许多困难。

它的碳酸盐岩储集层裂缝、孔洞发育很不均匀,靠测井很难准确判定流体性质;它的地层水矿化度很高,超低电阻率油层的判别很不容易。

它的油气层埋藏很深,在不同地区分别在 3600m 和 4500m 以下,最深达到 6000m;地层复杂,高压盐水层、膏盐层、盐岩层、欠压实泥岩层、裂缝火山岩层广泛分布;油气水关系复杂,一口井往往钻遇多个油气水系统,这就给地震、钻井、测井、测试技术提出了更加苛刻的要求。

它的地面条件十分复杂,一望无际的沙丘、沙山覆盖了盆地的主要部分,夏季的酷热,冬季的严寒,再加上春天的狂风与沙暴,给我们的野外勘探活动带来了极大的挑战。

所有这些,都是塔里木盆地油气勘探工作中遇到的一系列理论和技术难题,其中相当部分是我们还没有经历过的,甚至可以说有些是世界上从未遇到过的难题。我相信,随着这些难题的解决,一定会取得一批具有世界水平的科研成果。

这套丛书系统总结了前人对塔里木盆地的研究工作,特别是总结了会战第一、二年(1989~1990 年)的勘探实践和认识。其中既有基础研究成果,也有油气富集规律的概括,又有新技术、新方法的应用。但我们不能认为这些成果都达到了十分成熟、十分完美的地步;正相反,毕竟塔里木盆地的勘探程度还相当低,许多矛盾尚未被充分揭露,未知的东西还很多,我们的认识还处在“必然王国”阶段。可贵的是,塔里木盆地的石油地质工作者勇于实践,勇于探索,不断总结经验教训,敢于把这些成果拿出来,接受实践的检验。我相信,这套丛书的出版,定会丰富中国石油地质学的理论与实践,并且对今后的勘探工作起到重要的指导作用。

随着塔里木盆地油气勘探不断取得更大进展,人们的认识将更加接近客观实际,在不远的将来,实现从“必然王国”向“自由王国”的飞跃。到那时,塔里木盆地将出现一个油气储量增长的高峰期,塔里木盆地真正成为中国石油工业战略接替基地的日子,就会到来。

衷心希望这套丛书的出版,能够起到“抛砖引玉”的作用,能够在一定程度上满足全国石油地质界的关心和支持塔里木盆地找油事业的专家、同行的需要,并且引起更多人的兴趣,参与到塔里木盆地油气勘探的行列中来,共同探索塔里木盆地的奥秘。

邱中建

1993.11

Preface

The *Book series on Petroleum exploration in the Tarim Basin*, which is a set of ten volumes, has finally been publicly available. It is the result of a collective effort of petroleum geologists from all over the country. It is also the fruit of hard working of the editors of Petroleum Industry Press.

The publication of this series is a big event in the history of oil and gas exploration in the Tarim Basin. It will certainly bring great attention and interests to the petroleum geological domains both at home and abroad.

The development of oil and gas industry of the new-born China (after 1949) was first concentrated in the west of the country. The discovery of the Daqing oil field at the end of 1950's marked the eastward shifting of the Chinese oil and gas exploration strategy. It was followed by the great discoveries of a series of oil and gas fields in the Bohai Bay Basin. China's annual oil productivity has reached a level of over 100 million tons which has made China one of the major oil-producing countries in the world. Towards the end of the 1980s, there had been continuous new discoveries during the oil and gas exploration in the Tarim Basin, Xinjiang. People refocused their attention to the western area of the country and were looking forward to finding big oil and gas fields. In April 1989, under the permission of the State Council, the China National Petroleum Corporation organized a campaign for oil in the Tarim Basin, which advanced a brave step for the beginning of a full-scale exploration in the Tarim Basin.

Started from 1981, oil and gas exploration in the Tarim Basin has already been going on over 10 years. Because of various reasons, the exploration experienced many times "start and stop" circles during which abundant information, experiences and lessons have been accumulated. The current campaign is just based on the substantial achievements gained by petroleum geologists from Xinjiang who have worked for the last 30 years in the field doing the basic geological survey, and by workers from the Oil Geophysical Prospecting Bureau, who have, for the last 10 years, entered into the desert for oil exploration. For the last 4 years, a great deal of work have been done and regional exploration has been extended to a large area. It is not excessive to say that the exploration achievements and the deepening of cognition in this four years can not be matched by those gained through last few decades.

During the last 4 years, 6 big to medium-sized oil and gas fields and 20 industrial oil and gas-bearing structures have been verified. A series of highly productive oil and gas fields have been revealed in the Mesozoic in Lunnan area, the northern part of the Tarim Basin. A

highly productive oil field, the Donghetang Oil sandstones in the land of China. The currently deepest-buried (5953 meters) oil pool in China has been located in Ordovician carbonate rocks in the Yingmaili region. High-yielding gas accumulation belts have been discovered in Tertiary and Cretaceous in the Luntai fracture-uplifted zone. Discoveries of high petroleum-yielding buried hill reservoirs and a 100 million ton-sized oil field in Carboniferous marine sandstones have been made for the first time in the interior of the Taklimakan Desert. Currently, ascertained oil and gas resources in the Tarim Basin are capable of satisfying an annual production of 5 million tons crude oil and 600 million cubic meters gas during the "Eighth five-year" period.

It has been proven by practice that the Tarim Basin is very rich in oil and gas resources. It is one of the three basins in China which have been predicted to have oil and gas resources over 10 billion tons. Over billions tons of oil and gas reserves have been found in the other two basins — the Songliao Basin and the Bohai Bay Basin. There is no doubt for petroleum geologists both at home and abroad that big oil and gas fields can certainly be found in the Tarim Basin.

On the other hand, the geological conditions of the Tarim Basin are extremely complicated. The complications are reflected in the following areas:

The Tarim Basin is different from the non-marine Mesozoic and Cenozoic oil and gas-bearing basins in the east of the country, from the marine Paleozoic gas-producing and the non-marine Mesozoic oil-yielding Sichuan Basin and Erdos Basin in the center of the country. It is also different from the oil and gas bearing non-marine basins in the west of the country, such as the Junggar, Turpan and Qaidam Basins. It is the only oil and gas-bearing basin in the country that contains oil and gas fields with mainly being marine origin, and with the crude oil being a mixture of multiple sources and multiple stages.

The Tarim Basin is not a simple basin with a single developing circle, but a big complex superimposed basin pieced together of many original basins of different periods. Its sedimentation and depression centers were also experienced migrations many times.

The basin had a long history of development. From Sinian to Quaternary, it went through many times of elevation. The large number of regional unconformity surfaces existing in the basin can hardly be found in anywhere else of the country. The basin experienced several times "seesawing" movements of reverse elevation and depression. The high degree of neotectonic movements in the basin is also scarce in other parts of the country. This further complicated the situation of oil and gas migration and redistribution.

The scale of structural movements in some parts of the basin is small, but the variation of

seismic velocity in the center of the basin is the greatest in the country. This has brought many difficulties for the accurate outlining of structures in the basin.

The distribution of fissures and pores in the carbonate reservoirs is extremely heterogeneous. It is very difficult, with well-logging, to accurately determine the nature of fluids. The highly mineralized formation water in the basin has made the discrimination of oil-bearing horizons with ultra-low resistivity extremely uneasy.

The oil and gas-bearing horizons are located deep under the surface; the depths reach more than 3600 meters and 4500 meters in different areas, with the deepest being 6000 meters. The stratigraphy of the basin is very complicated. High pressure saline aquifers, gypsum layers, salt horizons, less compacted mudstone and fractured volcanic rocks are widely distributed. There is a complex oil, gas and water relation. Many types of oil-gas-water system can be encountered often in one well. All these have brought much harsher terms to the seismic, drilling, well logging, testing technologies.

Conditions on the ground of the Tarim Basin are extremely complicated. A boundless stretch of sand dunes and hills covers the major part of the basin. In addition to the fierce wind and sand storms in spring, the extremely hot and cold whether in summer and winter, has brought exceeding difficulties to our field exploration activities.

All those mentioned above are the theoretical and technical difficulties encountered during the oil and gas exploration in the Tarim Basin. Many of them are those we have never come across before. One can even say that some of the difficulties have never been run into in the rest of the world. I believe that as these difficulties going to be solved, a series of world class scientific achievements will be obtained.

This series of books has systematically summarized the research work of previous scholars in the Tarim Basin, especially the practice and understandings gained through the first two years (1989-1990) of the campaign. The series includes not only the results of basic research and the generalizations of oil and gas accumulation patterns but also the usages of new technology and methods. However, we do not think that all these achievements have reached a very mature and perfect extent. On the contrary, explorations in the Tarim Basin are still at low level, many problems have not yet been revealed, many unknown matters are still exist, and our understandings of the basin are still considerably limited. It is highly commendable that the petroleum geologists from Tarim Petroleum Exploration and Development Headquarters are brave in practice and exploration. They have continuously summed up their experiences and lessons, and bravely presented these results to face up the test of facts. I believe that the publication of this series will certainly enrich China's petroleum geological theory and practice, and that this series will play an important role in the future exploration.

As more progresses gained in the oil and gas exploration in the Tarim Basin, people's understandings will get nearer to the objective reality, and the leap from "realm of necessity" to "realm of freedom" will be realized in the near future. By that time, a golden period of the increase of discovered oil and gas reserves in the Tarim Basin will occur, and the day when the Tarim Basin really becomes a strategical replacing base of the Chinese petroleum industry will come soon.

I hope cordially that the publication of this series will play the role of "casting a brick to attract jade" and may satisfy, to some extent, the needs of specialists and colleagues from the petroleum domain throughout the country, who are caring and supporting the oil-seeking undertakings in the Tarim Basin, and will attract the interests of more people to join the team of oil and gas exploration in the Tarim Basin and to jointly explore the secrets of the basin.

Qiu Zhongjian
November, 1993

编 者 的 话

《塔里木盆地油气勘探丛书》经过塔里木石油勘探开发指挥部、新疆石油管理局、石油地球物理勘探局和北京石油勘探开发科学研究院上百名石油地质工作者的集体努力,在石油工业出版社的大力支持下,现在公开出版了。

长期以来,特别是1989年塔里木盆地石油会战开始后,全国石油地质界早就盼望石油部门有一本自己的塔里木盆地石油地质专著,能够系统总结前人成果,同时包含近年来会战中所取得的极其丰富的新资料、新认识。现在,这套共十卷的专著同大家见面了。

40年来,全国石油地质工作者,特别是新疆石油管理局和石油物探局的勘探工作者,怀着在塔里木盆地找到大油田的强烈愿望,进行了30年野外地质调查和十年挺进大漠的地震勘探,取得了大量珍贵的地质和物探资料,其中不少人奉献出了青春甚至生命,他们是塔里木盆地找油事业的先驱!

40年来,公开或内部发表了许多关于塔里木盆地石油地质的论文、专著和研究报告。这些论文和报告,以其真知灼见,推动着塔里木盆地油气勘探的发展。特别是1983年以后,石油物探局完成了19条纵贯塔克拉玛干大沙漠的区域地震大剖面,使人们对盆地的地质结构有了进一步的整体认识。在这一基础上,1986年,原石油工业部组织完成了“塔里木盆地油气资源评价报告”,初步总结了盆地的石油地质特征,第一次测算出盆地的油气总资源量为185亿t,预测了含油有利区带和构造,从而为后来的石油会战提供了科学依据。这是第一份比较系统、完整的塔里木盆地综合研究成果,但是未公开出版。

1986年以后,中国石油天然气总公司继续组织力量,参与了国家“七五”重点科技攻关课题“塔里木盆地东北地区控油地质条件和盆地远景”的研究,做了大量工作,取得了很有价值的成果。但是,由于当时在盆地内部、特别是沙漠腹地探井很少,更没有工业油气流井,对于大漠之下有无油气田存在,还处在推测阶段,因此进一步总结全盆地油气分布规律的条件,还不够成熟。

1989年4月,塔里木盆地石油会战揭开序幕,短短两年间,打了近60口探井和评价井,勘探范围东至盆地东端孔雀河斜坡和中央隆起东段,西至塔北隆起西端的南喀拉玉尔滚地区,南至沙漠腹地塔中隆起顶部,北至轮台断裂带,方圆近20万km²,地震勘探工作量每年近2万km。两年内,先后探明了轮南、桑塔木、东河塘等油田;特别是,首次在沙漠腹地发现了塔中1号古潜山高产油气藏;新发现了侏罗系、石炭系和奥陶系三套工业含油层系,取得了比以往历年丰富得多的地质资料和认识。在这种情况下,进一步总结塔里木盆地油气分布规律就十分必要,其条件也已基本成熟。为此,1990年底,塔里木石油勘探开发指挥部组织地质研究大队,主要成员是北京石油勘探开发科学研究院参战科技人员,完成了“塔里木盆地油气分布规律及勘探方向”研究报告,其中包括地层、生油、储层、沉积相、盆地构造演化、圈闭、油气藏和含油气区带研究等13个分报告,系统总结了前人成果,提出了盆地十大石油地质特征和六大油气分布

规律,指出了勘探方向。这项研究成果,获得了中国石油天然气总公司1991年度科技进步一等奖。

现在的《塔里木盆地油气勘探丛书》,就是在这项研究成果的基础上,组织更多的专家和科技人员,重新编写完成的。

二

这套丛书共分十卷,依次为:

- 第一卷 塔里木盆地石油地质总论
- 第二卷 塔里木盆地地层
- 第三卷 沉积相与油气
- 第四卷 生油层与油源
- 第五卷 储集层与油气分布
- 第六卷 盆地构造演化与区域构造地质
- 第七卷 构造与油气圈闭
- 第八卷 塔里木盆地盆地油气藏
- 第九卷 石油测井解释与储层描述
- 第十卷 地球物理勘探技术

这套丛书的安排,既考虑到基础地质研究,又考虑到规律性总结,还考虑到新技术、新方法的应用。各卷之间既可独立成书,又共同组成塔里木盆地油气勘探相对完整的体系。

应当说明的几点是:

第一,这套丛书中所引用的资料,截至1990年底,不牵涉到正在进行、尚未完成的“八五”国家重点科技攻关项目的资料和成果。

第二,作为公开出版的专著,它不同于生产现场的研究报告,应当反映出先进技术和理论水平。为此,我们提请各位作者,尽可能按照专著的要求,进行理论的上升和概括,少一点繁琐的数据和资料罗列,多一点学术性探讨。但是,因不少作者常年在塔里木盆地从事现场生产研究,各种文献、手段缺乏,虽经努力,仍然不能认为这种上升和概括,已经尽如人意了。

第三,油气勘探作为一门综合性多专业、多学科的应用科学,各专业之间互相渗透、互相依存,是不可避免的;各卷之间又是独立写作,虽经我们删简,仍然难免有少量内容重复。

第四,目前塔里木盆地部分地区已经对外开发,实行风险勘探招标,将来还可能进一步开放。考虑到这一点,丛书中的部分图件和数据,作了保密处理。

第五,这套丛书的作者,虽然只有几十人,但是他们来自全国二十多个油田、大专院校、科研院所和石油物探局;在作者的背后,有过去几十年为塔里木盆地石油勘探艰苦工作的同志,有过去长年累月在塔里木盆地会战现场默默无闻、埋头苦干的许多同志,为他们提供了大量资料、分析化验数据、基础图件和观点。应当说,这套丛书,是全国石油系统科技人员集体劳动的结晶。

三

塔里木盆地的油气勘探,已有40多年的历史。会战5年来取得的成果,是令人鼓舞的。短短5年间,探明了6个大、中型油气田,发现了20个工业性含油气构造,具备了“八五”期间建成500万t原油和6亿m³天然气年产能力的储量资源;人们的认识,也以这5年发展得最快。实践证明,塔里木盆地油气资源十分丰富,它是中国目前预测油气资源量在100亿t以上的三大盆地(松辽、渤海湾、塔里木盆地)之一。

另一方面,塔里木盆地的石油地质条件又十分复杂。迄今为止,我们尚未找到与56万km²盆地面积、14000m沉积岩厚度相称的大型、特大型油气田。肯定有某些控制塔里木盆地油气分布规律的关键性、本质性的东西,我们还没有搞明白。正因如此,这套丛书中的认识、观点和理论概括,还是很初步的,不完整的,有的很可能是错误的。在丛书公开出版之际,我们热切期待着全国石油地质界的专家、同行,提出宝贵的意见和建议;我们还希望丛书的出版,能够吸引更多的石油地质家来关心、支持塔里木盆地的找油事业,共同解决塔里木盆地勘探中遇到的难题,共同探索塔里木盆地的奥秘,共同丰富中国石油地质学的理论与实践,攀登科学高峰!

谨以这套丛书,奉献给塔里木盆地找油的前驱者和国内外热爱、关心、支持塔里木盆地找油事业的各位专家、同行。

《塔里木盆地油气勘探丛书》

主编:童晓光 梁狄刚

1993年12月

Editorial Notes

(1)

The *Book series on Petroleum Exploration in the Tarim Basin* has now been published. It is the result of a collection effort of many petroleum geologists from the following organizations: Tarim Petroleum Exploration and Development Headquarters, Xinjiang Petroleum Administration Bureau, Oil Geophysical Prospecting Bureau, and Beijing Research Institute of Petroleum Exploration and Development. The publication of these books is also benefited greatly from the active support of Petroleum Industry Press.

Over the years, particularly since 1989 when the campaign for oil in the Tarim Basin began, the petroleum circles of the country have long been waiting for the publication of a monograph on the petroleum geology of the Tarim Basin. The monograph should not only systematically summarises the results of previous research, but also contains the vast new information and knowledge derived from the campaign. Now, this series which contains ten volumes has finally come to the public.

For more than 40 years, bearing a strong desire of finding big oil fields in the Tarim Basin, petroleum geologists from all over the country, particularly those from the Petroleum Administration Bureau and Petroleum Geophysical Exploration Bureau of Xinjiang, have spent 30 years on basic geological investigations in the field and 10 years on seismic exploration in the interior of the desert. Vast valuable geological and geophysical information has been accumulated. Many of these geologists have dedicated their youths or even lives to this work, they are the pioneers of the course for oil exploration in the Tarim Basin!

A large number of papers and investigation reports concerning the petroleum geology of the Tarim Basin have been published during the last forty years or so. These papers and reports have greatly helped the development of oil and gas exploration in the Tarim Basin. Especially after 1983, the Oil Geophysical Prospecting Bureau has finished 19 regional seismic sections which cross the Taklimakan Shama Desert. This has brought further fresh understandings on the overall geological structures of the Tarim Basin. Based on this information, the former Ministry of Petroleum Industry complied a report entitled "An Evaluation on the Oil and Gas Resources in the Tarim Basin", which preliminarily summarised the petroleum geological characteristics of the basin, estimated for the first time that the overall oil and gas resources were 18.5 billion tons, and predicted many favourable oil-bearing zones and structures. This report has laid a scientific foundation for the later campaign for petroleum. Al-

though not publicly available, it was the first relatively systematic and complete result of a comprehensive research in the Tarim Basin.

After 1986, China National Petroleum Corporation continued to organize research force to participate in a research which was a national key project during the "Seventh five-year" period and entitled "The Geological Conditions and Prospects of Oil Reserve in the Northeastern Region of the Tarim Basin". A large quantity of work had been done and valuable results had been achieved. However, there were few exploration wells within the basin, particularly in the hinterland of the desert, not even to mention an industrial oil-gas flow well, at that time. Geologists were not sure whether there was an oil and gas field under the great desert. Therefore, the conditions for making a further evaluation on the oil-gas distribution pattern in the whole basin were premature.

The campaign for oil in the Tarim Basin began its prelude in April, 1989. Nearly 60 exploration and evaluation wells were drilled within the following two years. The exploration area covered a region of about 200,000 square kilometers. It extended in the east to the Peacock River Slope and the eastern end of the Central Uplift on the eastern edge of the basin, and in the west to Nankelayirkun region situated on the western end of the Tabei Uplift. The area reached, in the south, the top of the Tazhong Uplift, which is the centre of the desert, and the Luntai Fracture Zone in the north. Nearly 20,000 kilometers sections of seismic exploration were finished every year. Within the two years, Lunnan, Sangtamu and Donghetang Oil Fields were verified. Particularly, geologists discovered for the first time a highly productive oil and gas reservoir, the Tazhong No. 1 buried hill reservoir, in the centre of the desert. They newly revealed three oil-bearing horizons in Jurassic, Carboniferous and Ordovician. They gained much more abundant geological data and knowledge than ever before. Under these circumstances, it was necessary to further evaluate the oil-gas distribution pattern in the Tarim Basin. Conditions for this evaluation was also mature. Therefore, at the end of 1990, organized by the Tarim Petroleum Exploration and Development Headquarters, a geological research brigade, with members mainly from Beijing Research Institute of Petroleum Exploration and Development, finalized a report on the oil and gas distribution patterns and exploration orientation in the Tarim Basin. This report was consist of 13 sub-programs covering researches on stratigraphy, oil generation, oil reservoirs, sedimentary facies, structure evolution of the basin, oil traps, oil and gas accumulation, and oil and gas-bearing zones, etc. The report, on the basis of systematically summarizing the results of previous researches, suggested 10 petroleum geological characteristics and 6 oil and gas distribution patterns in the basin, and pointed out the exploration directions. The achievements of this research were honored a first class Award of Scientific and Technological Progress in 1991, by the China National Petroleum Corporation.

The *Book series on the Petroleum Exploration in the Tarim Basin* is based on the results of

the above mentioned researches and written by many relevant specialists and scientific and technological workers.

(2)

This series is consist of **10** volumes, namely:

- Vol. **1** Generals: the petroleum geology of the Tarim Basin
- Vol. **2** Stratigraphy of the Tarim Basin
- Vol. **3** Sedimentary facies and petroleum accumulations
- Vol. **4** Source rocks and petroleum generation
- Vol. **5** Oil reservoirs and petroleum distribution
- Vol. **6** Tectonic evolution and regional structural geology of the Tarim Basin
- Vol. **7** Structures and oil and gas traps
- Vol. **8** Oil and gas reservoirs of the Tarim Basin
- Vol. **9** Well log interpretations and reservoir descriptions
- Vol. **10** Geophysical exploration techniques

The arrangements of this series of books are based on the following considerations: basic geological research, regularity summarization and the usages of new methods and techniques. These books form a relatively complete system for the oil and gas exploration in the Tarim Basin, in the meantime, each volume can also be treated as a separated book.

It is necessary to mention the following few points:

Firstly, the materials quoted in these books are up to the end of **1990**. They do not include the information and results of the "Eighth five-year" national scientific and technological key project which is currently underway.

Secondly, as a published monograph, this series of books differs from a research report for production. It should reflect the advanced technology and theoretical level. Therefore, the authors of these books have been suggested to follow the basic guidelines for monograph as much as possible, theoretically evaluate the available information, and include more academic approach and fewer tedious data enumeration. However, for many of the authors, who have long been engaged in production-related researches in the Tarim Basin, there is lack of basic references and some means of research. Therefore, the academic evaluations in these books are still not completely satisfactory, despite great efforts have been made by the authors.

Thirdly, oil and gas exploration, as a comprehensive applied science, comprises many sub-

jects and multiple disciplines. Inter-infiltration and interdependency among the different subjects and disciplines are unavoidable. As each volume is compiled independently, there are still a few duplications in the contents of those volumes despite our simplification.

Fourthly, for the time being, some parts of the Tarim Basin have been opened to the outside world for oil exploration, adopting risk exploration bidding. There may be more areas opened to the outside world in coming future. Therefore, some maps and data in this series of books have been treated for the reason of secrecy.

Fifthly, although there are only tens of authors, they are from more than **20** organizations all over the country, including oil fields, colleges and universities, research institutes and academy, and the Oil Geophysical Prospecting Bureau. Behind these authors, there are many hard-working scientists who have been engaged in oil exploration in the Tarim Basin in the last few decades, and many workers, too, who have quietly immersed themselves year in year out in hard work on the spots of the campaign. These scientists and workers have provided the authors with a great deal of information, analytical data, basic maps and opinions. Therefore, it is right to say that this series of books is the result of the collective efforts of the scientists and technicians from the petroleum circles all over the country.

(3)

There have been forty years history in the oil and gas exploration in the Tarim Basin, the results achieved during the last five year's campaign for oil are most encouraging. During the "Seventh five-years" period, 6 large and medium-sized oil and gas fields have been verified, 20 industrial oil and gas-bearing structures have been discovered. As certain oil and gas resources are capable to satisfy annual productions of 5 million tons crude oil and 600 million cubic meters gas during the "Eighth five-year" period. People's understanding on the Tarim Basin has also gained the greatest progress during the five years. It has been proven by practice that the Tarim Basin is very rich in oil and gas resources. It is one of the three basins (Songliao, Bohai Bay and Tarim) in China which have been predicted to have hydrocarbon resources over 10 billion tons.

On the other hand, the geological conditions in the Tarim Basin are extremely complicated. So far, we have not found oil and gas fields big enough to match with the basin which has an area of 560,000 square kilometers and a sedimentary sequence of 14,000 meters thick. It is certain that we have so far not fully understood some essential key aspects which control the oil and gas distribution pattern in the Tarim Basin. Therefore, the knowledge, opinions and theoretical evaluations of these books are still tentative and incomplete, and some of them may even be wrong. At the time of this series coming to publication, we are earnestly