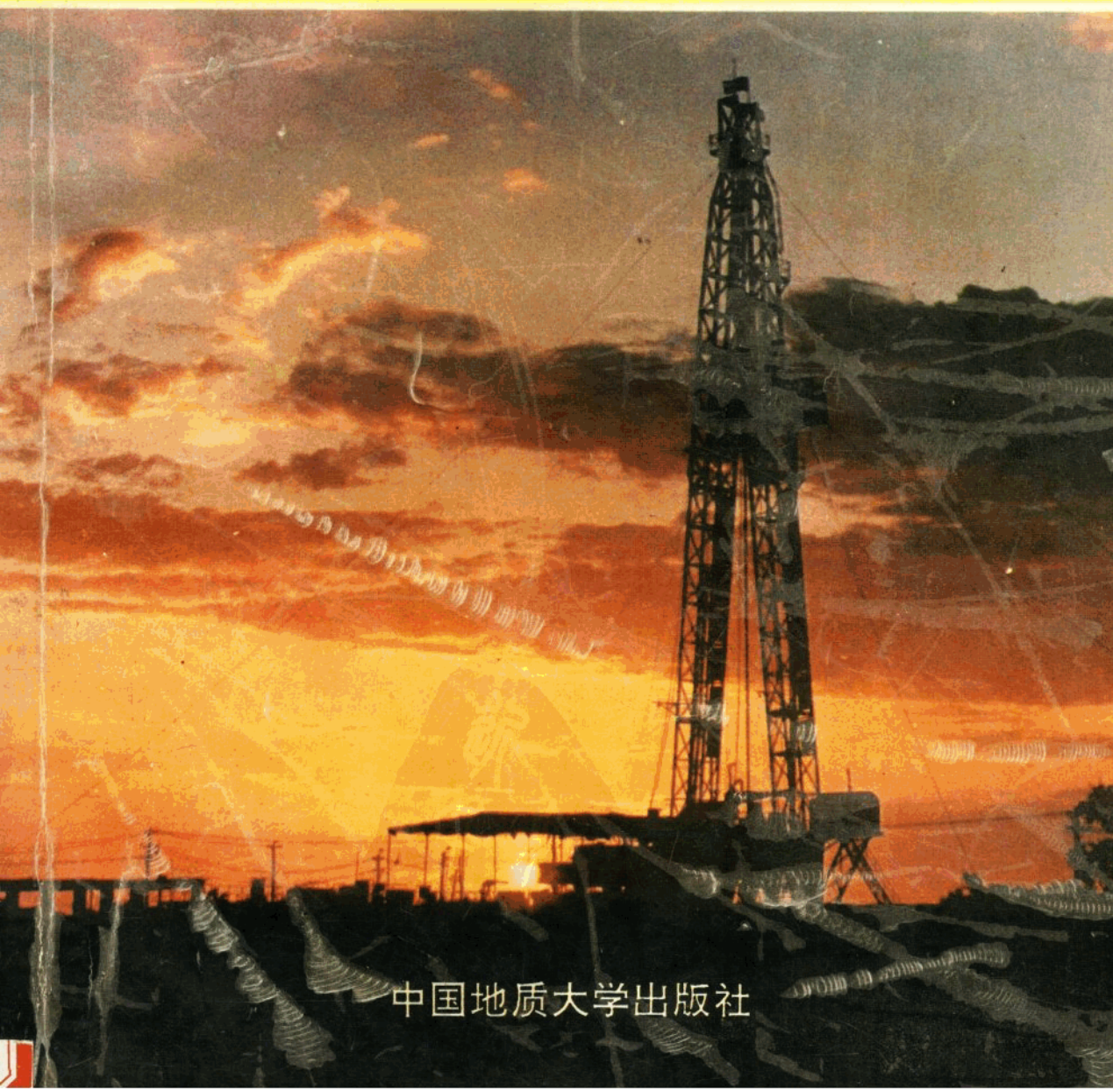
中国塔里木盆地北部油气地质研究

第一辑　地层沉积

贾　润　胥　主编



中国地质大学出版社

提高理论开展科研

找油找气依靠勘探

黄汲清题 一九九〇年十二月廿日

序

[redacted]木里[redacted]勘查，以陆相油田作为勘探重点是适宜的成功的，并建立了具我国特色的[redacted]。1984年9月22日塔里木盆地北部沙参2井在井深5391m海相奥陶系碳酸盐[redacted]中喷出优质高产油气。经“七五”国家重点科技攻关第54项03课题《塔里木盆地东北地区油气地质条件和盆地远景研究》成果表明：沙参2井的油气来自海相寒武-奥陶系生油层。沙参2井的井喷，是塔里木乃至全国范围内下古生界工业油气流层位的首次发现，并且是我国继四川及台湾之后海相油气的新发现。其重要意义还在于将中国油气勘查从单一的陆相转向海、陆相并举的新时期。这是我国油气勘探与开发史上新的里程碑和转折点，也是一历史性的伟绩。

地质矿产部进军塔里木可分四个阶段：(1) 1956—1958年初探塔里木；(2) 1969—1970年研究评价塔里木；(3) 1978—1979年油气勘查首战塔西南；(4) 1980—1990年转战塔东北，陆续获得重大突破。

三次塔里木盆地油气资源座谈会（1979，1980，1984），表现出地质界不同理论不同学派与个人对塔里木地质构造和含油气资源有着不同的认识。正如我在第三次塔里木座谈会闭幕词中总结的那样：有的认为塔里木具有两个世代，两套地壳运动体制，三个构造层；有的提出板块运动机制与原型含油气盆地；有的提出古生代盆地型和中、新生代槽盆广盆型；有的认为青（海）新（疆）是一个统一的大盆地；有的类比中亚盆地评价了塔里木的远景；有的对阿瓦提-满加尔坳陷形成时期提出争议……。不管百家怎样争鸣，各家各派都在一定程度上为塔里木寻找油气资源提供了依据。

塔里木地质构造复杂，勘探程度很低。“七五”（1986—1990）期间塔北联合勘探，特别是集中25个勘探、科研、教学单位500余名专家、教授和科技工作者，用五年时间齐心协力科研攻关，对许多石油地质问题和油气成藏规律有了崭新的认识。诸如：1. 应用板块构造理论，探讨了塔里木盆地大地构造背景。提出塔里木板块是一个独立的块体，塔里木盆地是在稳定地块（克拉通）基础上发展起来的中、新生代陆内盆地；划分了塔东北地区各主要地质时期沉积盆地原型；阐明了盆地演化历史；从宏观上提出盆地控油的地质依据。2. 系统建立了地层层序，厘定并调整了一系列地层界线，统一了地表与钻井地层划分对比。为区域地质和石油地质研究奠定了扎实的基础。3. 研究了沉积相和古地理，建立了碎屑岩和碳酸盐岩的综合相模式，论证了各地质时期的沉积特征、相带展布和古地理变迁，指出各层系有利生、储油相带，对科研和油气勘查具有重要指导意义。4. 评价了各套生油层系。提出奥陶系是主力生油层系，其次是寒武系和三叠系，侏罗系是库车坳陷的主要生油层系；石炭系在西南部有生油能力；志留系在东部可能生油。5. 发现并圈定了大型生油坳陷。满加尔为寒武-奥陶系与三叠-侏罗系叠覆的生油坳陷，阿瓦提-沙西地区为寒武-奥陶系与石炭系叠覆的油气源区。6. 建立了油气资源评价系统，计算塔东北地区油气资源总量为105亿t，定量地展示了塔东北巨大的找油气前景。7. 对储层、盖层和成岩作用；对局部构造、断裂和不整合面控油；对低地

温场、多期生油、多期供油、晚期成藏、深层孔隙、典型油气藏、圈闭类型及成矿模式都进行了不同程度的研究。以上研究成果为生产实践提供科学依据，从而使塔北油气勘查钻井命中率大大提高，找到了三个有利构造带和六个油气田（藏），证实了八个工业油气层位，进一步评价了塔里木具有形成大油气田的规模和前景。

《中国塔里木盆地北部油气地质研究》一书为75-54-03课题攻关成果的汇编，分三辑出版。第一辑地层沉积，第二辑构造油气，第三辑物化探和钻井，约120万字。这是广大科技工作者在塔里木戈壁大漠，风餐露宿、呕心沥血、辛勤耕耘的结晶。这些成果对指导塔里木找油气有重要价值。我有机会为本书作序十分荣幸，并向地学界和关心塔里木的朋友们推荐这部内容丰富的好书。

中国科学院学部委员
关士聪
一九九一年元旦

PREFACE

In our prospecting for hydrocarbon resources it is appropriate and successful to put the stress on the hydrocarbon exploration in terrestrial facies, and thus the theory of "terrestrial origin of petroleum" with strong Chinese colour has been established. On Sept. 2, 1984, high quality and production of oil and gas gushed from the marine Ordovician carbonate at depth of 5391 m in the well Shacan-2 (parameter well Sha-2) in the northern Tarim basin. Results of "Study of Geological Conditions Controlling the Hydrocarbon Accumulation and Prospects in the Northeastern Tarim Basin", the national priority scientific-technological key project 54-03 in the Seventh Five-Year-Plan period, have indicated that the oil and gas from the well Shacan- 2 were sourced by the marine Cambrian-Ordovician source beds.The fountain in the well Shacan-2was the first strike of commercial oil and gas flow from the Lower Paleozoic reservoirs in the Tarim basin and even in our country, and is a new discovery of marine oil and gas following those of our Sichuan and Taiwan provinces. The significance of this discovery lies also in the fact that it has opened up a new period of shifting the oil and gas exploration in our country from merely continental domain to marine one and paying equal attention to both domains, which set up a new milestone and marked a turning point in our oil and gas exploration and development history, and thus became a historic great feat.

Historically, the marching into the Tarim basin of the Ministry of Geology and Mineral Resources can be divided into four stages: (1) initially reconnoitering the Tarim basin in 1956-1958; (2) researching and evaluating the basin in 1969-1970; (3) first battling of exploration for oil and gas in the southwestern Tarim in 1978-1979; (4) shifting the oil and gas exploration into the northeastern Tarim basin and attaining important breakthroughs in succession in 1980-1990.

Quite different understandings from different theories and schools of thought in the geologist circles on the grologic structure and hydrocarbon potentials of the Tarim basin appeared in the past three symposiums on the oil and gas resources in the Tarim basin (1979, 1980, 1984). Just as I summarized in the closing address for the third symposium: someone thought the Tarim to possess two generations, two sets of crustal movement regimes, and three tectonic formations; someone proposed plate tectonic mechanism and prototype of oil-and gas-bearing basin; others suggested the Paleozoic platform basintype

and the Meso-Cenozoic geosynclinal basin and widespread basin types; somone considered the Qinghai-Xinjiang a unitary huge basin; somebody evaluated the oil and gas prospects of the basin through analogy to the Central Asian basins; others argued on the formation time of the Awat-Manjiaer depression, etc. No matter how a hundred schools of thought contend, ecah school of thought has to some extent offered the scientific basis for finding hydrocarbon resources in the Tarim basin.

The geological structure of the Tarim basin is complicated, and the degree of exploration in the basin is fairly low. Through the joint exploration in the northern Tarim basin in "the Seventh-Five-Year-Plan" period (1986-1990), especially by concentrating over 500 experts, professors and scientific-technical workers in explorational, scientific researching and educational institutions with one mind and concerted efforts for five years on the tackling key problems in science and technology, brandnew understandings have been attained on many problems of petroleum geology and hydrocarbon accumulation regularity, such as (1) having approached the tectonic setting of the Tarim basin from the viewpoint of plate tectonics, suggested the Tarim basin as an independent massif and a Meso-Cenozoic intracontinental basin developing on the basis of craton; distinguished prototypes of basins in various major geological times of the northeastern Tarim basin; elusidated the evolution history of the basin, and thus proposed macroscopically the geological controlling factors on the hydrocarbon accumulation; (2)having systematically established stratigraphic sequences, collated and modified a series of major stratigraphic boundaries, integrated the division and correlation of the surface stratigraphy with the subsurface stratigraphy in drilling wells, and thus laid a solid foundation for the study of regionaland petroleum geology; (3) having studied the sedimentary facies and paleogeography, constituted the synthetic model of clastic and carbonate facies, demonstrated sedimentary features, distribution of facies zones and changes of paleogeography in different geological times, and thus p—ointed out favourable generating and reservoiring facies in respective sequences, which is of an important guiding significance to the scientific research and the hydrocarbon exploration; (4) having evaluated all of source rock horizons, suggested the Ordovician as the principal horizon and the Cambrian and the Triassic as next ones, the Jurassic being major source beds in the Kuqa depression, the Carboniferous being of potentials of generation in the southern Tarim basin, while the Silurian being capable of generating oil in the east of the basin; (5)having found out and delineated large scale oil-generating depressions, for instance, the Manjiaer area as a superimposed oil-generating depression of Cambrian-Ordovician and Triassic-Jurassic, and the Awat-Shaxi area being a superimposed source bed area of Cambrian-Ordovician and Carboniferous; (6)having estab-

lished an assessment system of hydrocarbon resources, calculated the total resources of hydrocarbons in the northeastern Tarim basin being 105×10^8tons, which has quantitatively shown the huge oil and gas prospect in this region; (7) having studied to various extents the diagenesis and the good porosity in the deep buried environment, reservoirs and seals; the oil-controlling effect of faults and unconformities; and the low geothermal field, the multiple phases of generation and expulsion, the late accumulation of hydrocarbons, the types of traps and typical oil and gas deposits, as well as patterns of hydrocarbon accumulation. These research results mentioned above have provided the scientific basis for the exploration practice; and thus, the success ratio of exploratory wells considerably increased, three favourable structural belts and six oil and gas fields (deposits) have been discovered; and eight horizons with commercial oil and gas have been verified, which has further evaluated the Tarim basin being of the scope and prospects for giant oil and gas fields.

The book "Research of Petroleum Geology of Northern Tarim Basin in China" is a corpus of results in tackling key problems of the project 75-54-03, and will be published in three collections with total scope of 1.2 million Chinese characters; the first collection is concerning the stratigraphy and sedimentology, the second one covering the structural and petroleum geology, and the third one involving the exploration geophysics and geochemistry, as well as drilling techniques and technology. This book can be thought to be a crystallization of vast numbers of scientific and technical personnel through eating in the wind and sleeping in the dew, shedding their heart's blood, and industriously cultivating in the Tarim Gobi Desert. These fruits are of important values to guide the searching for oil and gas in the Tarim basin. I feel greatly honoured to take this opportunity to write the preface for the book, and recommend the outstanding works with substantial content to the geoscience circles and friends who are concerned with the Tarim basin.

Guan Shicong
the commiteeman of Geoscience Department
of the Academy of Science of China
New Year'sDay, 1991

前　言

我国石油天然气工业是在新中国成立之后发展起来的。四十年来广大石油地质工作者，闯出一条新的道路。50年代，冲破“中国贫油”论的束缚，勇于开拓在陆相盆地开展第一轮石油普查勘探，找到以“大庆”为代表的一大批油气田，形成具中国特色的“陆相成油”理论。70年代末，地质矿产部提出开展古生界海相碳酸盐岩找油，开始了以“四新”（新领域、新类型、新地区、新深度）为主要内容的第二轮油气普查。1984年9月在塔里木盆地下古生界海相碳酸盐岩地层首次获得重大突破，沙参2井以日产原油1000m³，天然气200×10⁴m³的高产畅喷，开拓了我国由陆相找油向海、陆相并举的重大转变的里程碑。正如原地质矿产部部长孙大光同志题词：“沙参2井的重大突破，实现了塔里木盆地找油气的新转折”。从1985年起，国家计委批准，由地质矿产部西北石油地质局承担《塔里木盆地北部油气普查勘探及主要油气田评价》国家重点勘探项目，从而拉开了塔里木大规模油气联合勘探的序幕。

由于塔里木盆地地质构造复杂，工作程度偏低，1986年由国家经委批准立题攻关，即“七五”国家重点科技攻关项目“塔里木盆地东北地区控油地质条件和盆地远景研究”。五年来在国家和各级组织领导下，由25个勘探、科研、教学单位500多名科技人员组成的多学科、多工种、多部门联合攻关，取得了丰富的资料和重要的新成果。提高了对区域地质、石油地质条件及油气成藏规律的认识，建立了适合本区油气勘探的具有国内外先进水平的新技术、新方法，为勘探选区和单井突破指出了方向，为提高钻井命中率、连续突破三个构造带、找到六个油气田（藏）、实现八个地质层位突破作出了贡献，为在塔里木寻找大型油气田提供了科学依据。

“七五”科技攻关成果已经产生了积极影响，塔里木的重大发现和良好的经济效益已经引起中外石油地质专家和勘探开发公司的重视，这块处女地正在成为举世瞩目的热点。为了把科研成果尽快转化为生产力，更好的推广应用和交流，我们特组织编辑《中国塔里木盆地北部油气地质研究》一书，汇“七五”攻关成果之大成，公诸于世，以飨同道。渴望为加速塔里木油气勘探开发和新疆经济建设的腾飞添砖加瓦，为石油地质理论的发展献上一朵小花。

在攻关研究和本书出版过程中，得到有关领导、课题指导陈发景教授、杨朴局长、朱大绶总工以及黄汲清、王鸿祯、关士聪、刘光鼎、苏云山、王金琪、王福庆、韩新民、张良臣、姜春发、康玉柱等教授、专家的热忱关心和悉心指导，还得到地质矿产部塔北油气勘查联合指挥部等单位的大力支持和帮助，谨此表示诚挚的感谢。

本书不足之处，诚望关心塔里木的同志和广大读者批评指正。

贾润胥

1991年1月

FOREWORD

...gas industry started to devlop after the founding of the People's Re... In the past forty years, the broad masses of the people worked in ... have broken a perfect new way. In 1950s, they smashed the trammel ...nce "China is poor in petroleum", opened up a new prospect, waged the first ...ploration in nonmarine basins, discovered a number of oil and gas fields repre... Daqing Oilfield and founded the theory "terrestrial facies origin oil" of strong ...colour. In 1970s, the Ministry of Geology and Mineral Resources proposed to ...for oil in Paleozoic marine carbonate rocks, thus beginning the second round oil ex... aimed at "new field, new type, new region and new depth". In Sept. 1984, ...ant break through was firstly made in the Lower Paleozoic marine carbonate rock ...im Basin. Shacan-2 Well, with the yields of 1000 m^3 crude oil and 200×10^4 ... per day, laid a milestone in the transformation from searching for oil in nonmarine ...es to that in both marine and nonmarine facies, just like the words written by late ...inister Sun Daguang: "The significant break through in Shacan-2 Well has made a new ...urn to oil and gas exploration in Tarim Basin". In 1985, it was ratified by the State Planning Commission that the Northwest Bureau of Petroleum Geology of the Ministry of Geology and Mineral Resources (MGMR) undertook the nation's important exploration project "Hydrocarbon exploration & prospecting in North Tarim Basin and the assessment of major oil and gas fields." Since then, the prelude of large scale cooperative oil and gas exploration was opened in Tarim.

Since the basin is complicated in tectonic situation, and exploration work was poor, the State Economic Commission aproved to set a subject on the project in 1986. That is the state's key project in science and technology of the 7th "Five-Year-Plan": "Study on geological condition to control oil and gas in Northeast Tarim and the basin's oil potential". In the past 5 years, under the leadership of verious government departments and organizations, more than 500 scientific workers from 25 units of geological exploration, scientific research and universities were organized into a vital new force of multi-subject, multi-technique and multi-branch to take the project. Through hard work, they did obtained a great deal of information and important results, improved their knowledge in regional geology, the condition of petroleum geology, the formation regularity of hydrocarbon pools

in the study area; they found a series of up-to-date techniques and new methods that are available to the region's oil and gas exploration, pointed out the way how to choose target area and to hit oil in single well; they also made significant contributions in improving hit ratio of oil exploration, discovered 3 hydrocarbon-bearing structural belts, 6 oil and gas fields (or pools) and 8 geological horizons. They provided scientific basis for the discovering of big oil and gas fields in Tarim.

The achievements made in the key project of the 7th "Five-Year-Plan" have yielded active effect. The significant discoveries and excellent economic benefits obtained in Tarim Basin have attracted the interests of the petroleum geloigists and oil exploration companies the world over. This virgin land is now becoming the focus of the global attention. In order to transform these achievements into productive force and to further speed, exchange and make use of them, we especially compiled the monograph"Study on Oil and Gas Geology in North Tarim Basin of China". The monograph epitomized the scientific and technical results of the key project of the 7th "Five-Year-Plan" and published them to the public so as to share enjoyment with those work in the same domain. We hope to accelerate hydrocarbon exploration and prospecting in the present region, to make more contribution in speeding up Xingjiang's economic construction and to make perfection still more perfection for the development of petroleum geology.

During the process of the research work of the project and the book publishing, we gained enthusiastic concern and devoted guidance from Professor Chen Fajing, the guide of the project, Mr. Yang Pu, head of the Bureau of Petroleum and Marine Geology, Mr. Zhu Dashou, chief engineer of the bureau, and experts and professors Huang Jiqing, Wang Hongzhen, Guan Shicong, Liu Guangding, Su Yunshan, Wang Jinqi, Wang Fuqing, Han Xinmin, Zhang Liangchen, Jiang Chunfa, Kang Yuzhu etc.. We also got energetic support from the Combined Headquarters of Oil and Gas Exploration in North Tarim of MGMR and other units and organizations. We wish to take this opportunity to express our sincere thanks to all of them.

We invite whole heartily criticisms and proposals from masses of readers and all those who show their concern to Tarim Basin.

Jia Runxu

Jan. 1991

目　　录

CONTENTS

塔里木盆地东北地区控油地质条件及油气资源研究课题攻关新进展

贾润胥　周永昌　刘鹏生　蒋炳南

（地质矿产部西北石油地质局，乌鲁木齐）

本文系“七五”期间国家重点科技攻关项目，塔东北地区油气地质理论与勘探技术方法研究课题取得的新进展，主要反映三个方面。(1)提高了对区域地质石油地质条件及油气成藏规律的认识；(2)建立了适合本区油气勘探的具有国内外先进水平的新技术、新方法；(3)在勘探选区和油气突破上已获得了重大经济效益和社会效益，为塔里木发现大油气田提供科学依据。

引言

在浩瀚苍茫的塔里木盆地，是中国内陆最大的叠加复合型盆地。1984年9月盆地北部雅克拉构造上的沙参2井于海相奥陶系碳酸盐岩中钻获高产油气流，从而拉开了塔里木盆地大规模油气勘探的序幕。这一举世瞩目的成果，是我国二轮油气普查提出向新地区、新领域、新层系勘探度进军的重大突破。这一突破进一步展示了塔里木盆地具有寻找大油气田的广阔前景，为满足国民经济发展对油气资源与日俱增的需求，为开发建设大西北，使塔里木成为我国石油工业后备基地，国家决定加速塔里木盆地的油气勘查，1985年初经国家计委批准，由地矿部西北石油地质局承担《塔里木盆地北部油气普查勘探及主要油气田评价》国家重点勘探项目，使塔里木盆地的油气普查勘探进入了一个崭新的阶段。

一、立题背景

塔里木盆地边缘从50年代开始已有一定规模的油气勘查工作，也找到柯克亚和依奇克里克两个中小型油气田，但盆地三分之二为沙漠覆盖勘探程度低，对盆地整体地质结构，主要含油地质特征缺乏全面深入研究。诸如：覆盖区古生界特别是下古生代地层、沉积相展布；构造特征、演化，特别是几期构造运动对油气运移、聚集的作用；主要生油层及油气源区；储、盖条件及成油组合，特别是碳酸盐岩的储集类型与性能；油气生成、演化、成藏规律及模式；资源前景等等。此外，勘探目的层埋深大，物化探、钻井、测井、测试也存在一系列新的技术难关。为使塔北勘查项目得以顺利实施，能在较短的时间里有较大进展，依靠科技进步势在必行。本课题就是在这种背景下提出的。

二、课题攻关目标

1. 通过课题研究，基本掌握本区控油地质条件，指出找油有利地带，为完成“七五”期塔北地勘项目总任务，为油气资源的早期开发，为进一步勘探和发现新的含油气区及大油气田，提供科学依据。

2. 改善深井钻井、测井、测试技术工艺，充实完善碳酸盐岩地区油气普查勘探中的新技

术，新方法。

3. 探索物、化探直接找油的新技术，新方法。

三、攻关基本思路

紧密围绕油气勘查生产急需解决的问题，进行应用科学研究。

（一）油气勘查地质理论方面

从区域地质入手，深入研究石油地质特征和控油条件，重点抓以下几个方面作为攻关对象。

1. 研究4套（$\in$-O、C-P、T-J、N_1）生油层系，查明主力生油层系，指出有利生油气区，重点查明下古生界生油条件和潜力。

2. 查明主要勘探目的层系。

3. 以构造演化为主线，研究区域构造规律，查明构造格局、断裂和局部构造与油气的关系。

4. 研究沉积埋藏史、构造运动史、储集空间发育史、有机质热演化史，以及四者之间的内在关系。

5. 通过上述研究，指出有利的勘探区块并进行成藏评价。

（二）勘探技术工艺方法方面

为提高勘探效率、勘探效果、成果质量和降低勘探成本，开发和引进一系列国内外先进的新技术、新工艺、新方法进行攻关试验。如三维地震勘探、转换波地震勘探、垂直地震剖面、岩性地震特殊处理、地震物理和数学模型模拟、大地电磁测深、高精度重力测量、综合物化探直接找油、碳酸盐岩测井解释、超深井钻井参数优选，以及高精度分析化验新技术的应用等。

四、主要攻关成果

四年多攻关成果显著，对塔东北控油条件和成藏规律等重大问题有了崭新的认识。攻关成果在油气勘探中发挥重要作用，使塔北勘探连获重大突破，将勘探从单井突破推向拿面积、拿储量、拿大油气田的全面发展新阶段。概括起来有以下三个方面。

（一）提高了对区域地质、石油地质特征成藏规律的认识

1. 应用板块观点探讨塔里木板块构造与含油气盆地。提出塔里木板块是一个独立的块体，塔里木盆地是其重要组成部分。在稳定地块（克拉通）基础上，塔东北地区早古生代为克拉通内坳陷盆地、克拉通边缘盆地及被动大陆边缘盆地，中晚古生代为类前陆（克拉通内复杂坳陷）盆地，中、新生代为晚期类前陆和前陆（陆内坳陷）盆地。寒武-奥陶纪克拉通边缘盆地是最有利的生油坳陷区。

2. 在地层层序和划分对比方面取得显著成绩。首次发现多时代牙形刺、孢粉和轮藻等微体化石，采集了大量大古生物，建立了多层位的化石带。系统研究并调整理顺了震旦—白垩纪地层层序，与地震资料结合确定了地震层序和波组属性。建立并推荐却尔却克山奥陶系剖面为“层型”剖面。重新厘定柯坪寒武-奥陶系界线，将下丘里塔格群归属中上寒武统。[illegible]人定为中下泥盆统的塔塔埃尔塔格组划归中上志留统。提出新的石炭-二叠系生物地层[illegible]案。新建覆盖区三叠系层序。提供了磁性地层研究新成果。为区域地质和石油地质[illegible]

[illegible]

[illegible]罗纪沉积相和古地理，编制了11幅岩相古地理图，划分出5个[illegible]亚相。建立了碎屑岩和碳酸盐岩的综合沉积相模式，论证了[illegible]布、古地理变迁和有利的生、储油相带，对科研和油气勘查[illegible]

[illegible]系，圈定了主要生油坳陷，预测了油气资源前景，为在塔东北地区[illegible]质基础。

[illegible]-震陶系、石炭-二叠系和三叠-侏罗系3套生油岩系。首次提出奥陶[illegible]次为寒武系和三叠系。侏罗系是库车坳陷的主要生油层，石炭系在西南[illegible]和可能具有一定的生油能力。震旦系亦可能生油，但埋藏过深，未作[illegible]

[illegible]定满加尔大型叠覆生油坳陷，面积7.5×10⁴km²。寒武-奥陶纪为克拉通边[illegible]厚达1000—3000 m。三叠-侏罗纪为半深水湖盆，生油岩厚达200—700[illegible]。有机质丰富，保存条件优越，是本区最好的大型生油坳陷区。阿瓦[illegible]陶系属克拉通内浅海台地-陆棚相及静海盆地相沉积，生油岩厚300 m，[illegible]200 m，两者叠覆，亦是一个较好的油气源区。

[illegible]资源预测评价系统，对油气资源远景进行了全面预测，用成因体积法计[illegible]为105.13×10⁸t，其中油71.99×10⁸t，气33.14×10⁸t。资源的区域分布是：[illegible]7.04×10⁸t，满西浅坳4.42×10⁸t，阿瓦提断陷8.33×10⁸t，沙雅斜坡30.24×[illegible]陷5.10×10⁸t。定量地展示了塔东北找油气的巨大前景。

[illegible]成岩、构造等方面系统研究了储层。表明具有储集层位多、产层多、分布广、[illegible]多、储集空间类型多、次生孔隙发育等特点。

[illegible]区至少有12个层位可做储集层，其中已有8个层位（Z、Є、O、C、T、J、K_1、[illegible]工业油气流。多数层位呈区域性大面积展布。储层岩石类型主要有白云岩、灰岩[illegible]类。白云岩储层最好的层位是中上寒武统下丘里塔格群及下奥陶统上丘里塔格群[illegible]好的层位是下寒武统肖尔布拉克组和上震旦统奇格布拉克组。储集空间为晶间孔、晶[illegible]孔、粒间溶孔及大的溶蚀洞穴等。灰岩储层主要是下奥陶统上丘里塔格群中上[illegible]间类型有溶孔、溶洞、裂缝、微孔隙及缝合线等。碳酸盐岩最好的储集相带是台[illegible]带和形成白云岩的潮坪相。碎屑岩储层最好的层位是上白垩统-下第三系库姆格列木[illegible]三系苏维依组和三叠系阿克库木组，较好的层位是下白垩统、志留-泥盆系和石炭系。[illegible]类型有粒间溶孔、粒间溶蚀扩大孔、粒内溶孔、沿裂隙的溶缝等。碎屑岩的储集相[illegible]以各种滨岸相带最好；陆相以河流、三角洲和滨浅湖相带最佳。

[illegible]研究表明，储层孔隙以次生溶孔为主。有利储集空间发育的成岩作用主要为溶蚀[illegible]、古表生溶蚀）作用和白云石化作用。由于地温场低，深埋3000—5800 m仍有发[illegible]孔隙，波斯坦下石炭统埋深5700—5800 m，平均孔隙度达15%左右，高者达20—[illegible]渗透率为56×10⁻³μm²，高者达200×10⁻³—400×10⁻³μm²，大大拓宽了找油气深[illegible]

[illegible]研究了封盖条件和生储盖组合。塔东北地区从古生界至中、新生界均有盖层发育，[illegible]，生储盖组合配置得当，这是本区又一重要的石油地质特征。