中国隐蔽油气藏

SUBTLE RESERVOIR IN CHINA

潘元林　孔凡仙　杨申镳　郑和荣　主编

地质出版社

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·北　京·

内 容 简 介

本书是1996年10月由胜利石油管理局和壳牌中国石油开发公司赞助、山东石油学会举办的"隐蔽油气藏勘探学术研讨会"上精选的优秀论文集。该文集的21篇文章从不同角度论述了国内外10年来隐蔽油气藏勘探的进展，主要内容包括隐蔽油气藏成因、成藏条件、油气藏分布特征、勘探技术及勘探效果等。尤其是对沉积微相、三维地震勘探、储层预测、油藏描述、高分辨率层序地层学等方面的研究达到先进水平。本书涉及中国主要的油气区有：大庆、胜利、辽河、中原、江苏、长庆、南阳、四川、新疆及渤海海域等。

本书为油气勘探工作者提供了极有价值的理论研究及实际应用资料，也可供石油院校师生教学与学习参考。

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序

1996 年 10 月，在胜利石油管理局和壳牌中国石油开发公司的赞助下，由山东省石油学会在青岛举办了第二次“隐蔽油气藏勘探学术研讨会”。会后，从会上宣读的论文中优选出 21 篇汇编成本论文集，由地质出版社出版。

人类有史以来，虽然早已在中国四川、中东波斯湾、原苏联巴库和美国宾夕法尼亚州发现了各种产状的石油和天然气苗，并进行了小规模的钻井采油采气，但直到 1885 年美国地质家 I. C. 怀特发表背斜学说的理论后，油气勘探才获得了蓬勃的发展。石油地质家从此根据地质构造的知识和测量来预测哪里有石油和天然气。由于运用背斜学说在全世界各含油气盆地找到了许多重要的油气田，这个学说现在还是像当时一样为勘探家所遵循。但是，背斜学说在美国盛行半个世纪以后，1930 年在美国得克萨斯州东部，位于萨宾隆起西坡的盆地东缘，勘探者 C. M. 乔伊纳钻探发现了美国当时最大的油田——东得克萨斯油田。这是一个典型的大型地层圈闭油田。这个事实给石油地质界极大的振奋，并在认识上有了提高。1956 年，美国著名石油地质家 A. I. 莱复生在出版的《石油地质学》一书中把储油圈闭进一步划分成构造圈闭、地层圈闭和混合圈闭三大类。其后，在世界范围内，大量的勘探实例证实了这样分类的实用性和正确性，奠定了在石油勘探中寻找地层、不整合、岩性、生物礁和古地貌等隐蔽圈闭的理论基础。

我国含油气盆地具有比较复杂的地质演化史。在大多数陆相沉积盆地中，由于物源是多方向的，储层短距离岩性、岩相变化大，形成各类隐蔽圈闭的影响因素要复杂得多。因此，在勘探隐蔽油气藏的过程可能早、中、晚期均交替出现。在有些含油气盆地内，如陕甘宁盆地的上三叠统延长油田（1907 年发现）和下奥陶统大气田（1989 年发现），准噶尔盆地的克拉玛依大油田（1955 年发现），河南泌阳凹陷的双河油田（1970 年发现），辽河油田的西斜坡大油田（1975 年发现）和珠江口盆地的流花 11—1 大油田（1983 年发现）等，都是勘探早期发现的重要隐蔽油气藏。但从较长的勘探史角度着眼，也反映了世界大部分含油气盆地在进入高勘探程度或中等勘探程度阶段，探索隐蔽油气藏的重要性日趋明显。据美国北美地台俄克拉何马州将近 100 年的勘探历程分析总结，该州共发现各类油气藏 3379 个。其中，构造圈闭型油气藏 1182 个，占 35%；地层圈闭油气藏 2104 个，占 62%；未分类圈闭油气藏 93 个，占 3%。

现阶段我国各含油气盆地勘探工作的发展不平衡，有些盆地勘探程度高一些，有些盆地尚处于开创阶段。从全国来讲，包括陆上和近海，我国石油探明储量仅为预测资源量的 20%，天然气探明储量仅为预测资源量的 4%，在各油气盆地内发现各类新的构造圈闭油气藏和隐蔽圈闭油气藏（包括各类大型油气藏）的机遇率都比较高。随着勘探的技术和手段不断发展和提高，拓宽勘探思路，理论联系实际，在隐蔽油气藏的勘探领域中我们必将取得丰硕的成果。

李德生

PREFACE

"The second symposium on exploring subtle oil-gas pools" was held by Shandong Association of Geology in Qingdao in Oct. ,1996,subsidized by Shengli Petroleum Administrative Bureau and Shell China Petroleum Development. This book,including 21 selected academic papers from this symposium,will be published by Geological Publishing House.

Since the beginning of recorded history,people have found all kinds of oil and gas seep in Sichuan of China,Persian Gulf of Middle East,Baku of U. S. S. A. ,Pennsylvania of U. S. A. , and exploited oil and gas by small-scale boring . In 1885,American geologist I. S. White issued the theory of anticline,which accelerated the development of oil and gas exploration. After that time,petroleum geologists utiiized the knowledge and measure of geological structure to discover oil-and gas-field. Many important oil-and gas-field were discovered in world petroliferous basins by using this theory. Now,the theory of anticline is still recepted by geological prospectors as well as in that time. C. M. Joiner discovered the largest oil field——East Texas Oil Field in that time,a typical large-size oil field of stratigraphic trap,in east edge of basin of west side of Sabin Rise. The new discovery roused the petroleum geologists and improved the research level in oil and gas exploration. A. I. Levorsen,the famous American petroleum geologist classfied reserved traps into three sorts:Structural trap,Stratigraphic trap and complex trap in his book *Petroleum Geology*. Many exploration cases in the world have proved the classfication practical and valid,which laid the theoretical foundation of subtle trap exploration,eg. Stratigraph,unconformability,Lithology,bioherm,palaeophysigraphy.

The petroliferous basins in China have complicate geological evolution. In most of continental deposite basins,the factors of effecting the formation of obscure and subtle traps are complicate,because the provenance of basin is pleiotropy and lithology and facies of reservoir change obviously in short distance. Therefore,hidden oil and gas accumulation may be discovered in the early or medium or later stage of exploration. Many important subtle oil-gas pools were discovered in the early stage,Such as ,Yanchang oil field of Upper Triassic,discovered in 1907,and Large gas field of Lower Ordovician in Shaanxi-Gansu-Ningxia basin,discovered in 1987;karamay oil field in Junggar basin,1955;Shuanghe oil field in Biyang depression,Henan, 1970;Xixiepo Oil-field in Liaohe Oil Field, 1975;Liuhua 11-1 oil field in Zhujiang Mouth basin,1983. Because most of petroliferous basins in the world are in high or medium degree exploration,in the view of long history,the importance of exploration of subtle oil-gas pools gets more and more. From the analyses of nearly 100 years exploration history of Oklahoma,North American Platform,there are total 3379 oil-and gas-field,of which 1182 is structural trap,2104 is Stratigraphic trap,and 93 is non classfied trap.

In our country, the research level of petroliferous basins is very different, some basins in high-exploration, some in initial stage. The all reserves of oil reservoirs proved, including continental and marine oil fields, are only 20% of predictory resources ; the ration of gas reserves is 4%. So there are more chance of discovering the new structural traps and subtle oil and gas pools. With the development of technology and method of exploration, integration of theory with practice, we must get significal achievement in exploration of obscure and subtle traps.

Li Desheng

前　言

由胜利石油管理局和壳牌中国石油开发公司资助，山东石油学会于1996年10月举办了“隐蔽油气勘探学术研讨会”。本次研讨会的目的在于交流近10年来国内外隐蔽油气藏勘探方面的进展，包括成藏条件、分布特征、勘探技术方法及经验，以推动中国，尤其是中国东部油气区隐蔽油气藏的勘探。

本世纪初，隐蔽油气藏的发现是偶然的，例如美国东得克萨斯地层油藏是在1930年由美国地质家C. M. 乔伊纳发现的。限于资金，他转让了构造翼部的租让权，从而在这个60亿桶石油储量的大油田中，乔伊纳本人仅获得很少部分。1966年，著名美国石油地质家莱复生(A. I. Levorsen)在AAPG Bulletin发表了他的最后一篇题名“隐蔽圈闭油气藏(Obscure and Subtle Traps)”论文。1972年，美国地质家罗伯特(E. K. Robert)主编了《地层油气田》一书，分勘探方法、勘探实例两册，首次提出了隐蔽圈闭的勘探问题。1980年，美国石油地质家协会和勘探地球物理学家协会制定了联合召开“关于寻找隐蔽圈闭中应用原理讨论会”的计划，并于1981年6月2日在美国旧金山举行的AAPG年会上，进行了隐蔽油气藏专题讨论，共宣读了18篇论文。由美国著名地质家哈尔布蒂(M. T. Halbont)主编了《寻找隐蔽油气藏》专著。1983年4月，中国石油学会石油地质专业委员会出版了《中国隐蔽油气藏勘探论文集》。1986年10月胡见义主编的《非构造油气藏》出版。这些都促进了中国石油地质学和隐蔽油气藏研究及勘探的发展。到90年代，中国东部大部分含油气盆地相继进入中等和较高勘探程度阶段，西部各油区也相继发现了多种隐蔽油气藏，隐蔽油气藏在勘探开发中的地位日趋重要。迄今，胜利石油管理局所辖的济阳坳陷已发现四大类19种油气藏；其中，隐蔽油气藏就有12种。近几年，随着“储层预测”、“油藏描述”等新技术的发展，不断开拓了隐蔽油气藏勘探的新领域，使隐蔽油气藏的石油储量达到总储量的20%左右。为了进一步促进隐蔽油气藏勘探理论、方法、技术的发展，我作为中方主席与壳牌中国石油开发公司的胡根博先生(R. C. Hoogenboom)于1996年10月共同主持了在山东省青岛市举办的“隐蔽油气藏勘探学术研讨会”。出席本次会议的中外专家，学科广、专业多，交流论文涉及的范围及领域也比较广，勘探成果十分显著。

1. 涉及的地域广。有陆地，有海洋；有拉张型裂谷盆地，也有挤压型前陆盆地等。在其各自所处独特地质条件下的隐蔽油气藏的勘探方面，有成功的理论和实践的经验总结。

2. 隐蔽油气藏类型多。已找到10余种隐蔽油气藏，例如古潜山油气藏、河道砂及浊积岩砂体岩性油气藏、泥岩及火山岩裂缝油气藏、地层超覆油气藏、不整合油气藏、岩性尖灭油气藏……可谓琳琅满目，丰富多彩。

3. 在勘探技术和方法方面，国内各油田已基本掌握了当今先进的隐蔽油气藏勘探技术和方法，例如沉积微相研究、高精度三维地震勘探、高分辨率的层序地层学、储层预测、油藏描述等新技术，提高了隐蔽油气藏的勘探效益和效果。壳牌公司介绍的“运用三维地震-体积解释法”解释冲积河道砂岩、预测碳酸盐岩储层孔隙度和定量预测油气，给与会者很大的启

发。

4. 众所周知，与构造油气藏相比，隐蔽油气藏的勘探难度要大得多，必须在查清地质规律基础上才能取得良好的勘探成效。例如渤海石油公司对潜山裂缝发育及充填规律的研究、胜利油田对多河道与断层合理配置形成构造岩性油藏规律及陡坡带砂砾岩体的发育和成藏规律的研究、长庆油田对古沉积环境与今构造复合条件的研究等，都有效地指导了隐蔽油气藏的勘探，并提高了勘探成效。

隐蔽含油带和隐蔽圈闭是今后寻找新储量的重要目标。在探索隐蔽油气藏的历程中，勘探工作将会十分艰难。但只要运用丰富的想象力和创造性的思路，不断研制、完善和提高相关的勘探技术，就一定能够不断开拓出隐蔽油气藏勘探的新领域、新类型，并将隐蔽油气藏勘探推进到一个更加自觉和自由的新阶段。

为更好地进行技术交流和便于工作中参考，在本次会议提交的论文中，优选出部分重要论文，经过修改、编辑，汇编成《中国隐蔽油气藏》一书，由地质出版社出版，展示了中国隐蔽油气藏的勘探理论、成果和新技术的应用。

在举办隐蔽油气藏学术研究讨论会和本论文集编辑、出版过程中，山东石油学会、壳牌中国石油开发公司和《复式油气田》编辑部作了很大努力和有益工作，谨致谢意！

潘元林

FOREWORD

Subsidized by Shengli Petroleum Administrative Bureau and Shell China Petroleum Development, a symposium on *Exploring Subtle Oil-Gas Pools* was held in October 1996. It aimed at exchanging experiences on the development of the exploration of the subtle oil-gas pools in the last ten years, including the studies on reservoir-forming conditions, the pool-distribution features, and exploration techniques, in order to accelerate the exploration of the subtle oil-gas pools in China, especially in the east oil-gas areas.

At the beginning of this century subtle oil-gas pools were found by chance, for example, the stratigraphic reservoir in eastern Texas of America was found in 1930 by C. M. Jowenna. Because of limited fund, he transfered his lease right of the structure limb, so from such a large oilfield of 6 000 million barrels he only earned a small interests. In 1966, a famous American petroleum geologist A. I. Levorsen published his last paper entitled *Obscure And Subtle Traps* in an AAPG Bulletin; in 1972 an American geologist E. K. Robert compiled *Stratigraphic Oil-Gas Fields* (in two volumes), which suggested the exploration of subtle traps firstly. In 1980 the American Petroleum Geologist Association and the Explorative Geophysicist Association worked out a plan to hold a discussion about application principles to look for subtle traps; and on June 2, 1981an annual meeting was held in San Francisco, and on the meeting, the special topic of subtle oil-gas pools was discussed and 18 papers were issued. And an American famous geologist M. T. Halbont compiled a treatise on *Looking For Subtle Oil-Gas Pools*. In April 1983 the petroleum geology committee of China Petroleum Association published the *Thesis Collection On China Subtle Oil-Gas Exploration*; and in October 1986 Hu Jianyi compiled a book *Non-structural Oil-Gas Reservoir*. All these have promoted the development of researches and explorations of both China petroleum geology and subtle oil-gas pools. Up to 1990s most of the oil- and gas-bearing basins in the east part of China stepped into the higher and medium exploration stage, and in the west various kinds of subtle oil-gas pools were found. It becomes more and more important in oil exploration and exploitation. Up to now, in Jiyang Super-depression of Shengli Petroleum Administrative Bureau 19 kinds of oil-gas pools have been found, including 12 kinds of subtle ones. In recent years with the development of these new techniques, such as reservoir prediction and reservoir description, the new areas for the subtle oil-gas pool exploration have been opened unceasingly and oil reserves increased to about 20% of the total reserves. To promote the development of the theories and techniques on exploration of such pools, in October, 1996, R. C. Hoogenboom from Shell China Petroleum Development and I, as the chairman from China, together presided over *The Subtle Oil-Gas Pool Exploration Symposium* in Qingdao City of China. The experts both at home and abroad occupied a variety of subjects and specialities so their theses concerned about extensive areas, and their exploration effi-

ciencies are evident.

1. The theses concerned about a variety of areas, including tensional rift basins and compressive forelands on shore and offshore, the theories, practices and successful experiences on exploring the subtle oil-gas pools under specific geological conditions.

2. There are various subtle oil-gas pools, i. e. more than ten kinds of such pools were found, such as buried hill reservoirs, lithologic reservoirs in channel sand and turbidite sand bodies lithologic reservoirs, mudstone reservoirs, fractured hydrocarbon reservoirs in volcanic rocks, stratigraphic onlap hydrocarbon reservoirs, unconformity reservoirs, lithologic pinchout hydrocarbon reservoirs, etc.

3. Nearly all oilfields in China have already commanded the advanced exploration technologies and techniques, such as researches on microfacies of sedimentation, high-accuracy three-dimensional seismic exploration, high-resolution sequence stratigraphy, reservoir prediction and reservoir description. And these new techniques raised the exploration efficiency. The 3D Seismic-Volume Interpretation Method by Shell Company to interprete sandstone in alluvial rivers and predict porosity and oil and gas in carbonate rocks gave a great deal of enlightment to the conferee.

4. As everybody knows, it is more difficult to explore the subtle oil-gas pools than the structural ones. Only on the foundation of the understanding of geological regularity, good exploration effects could be achieved, such as the researches by Bohai Petroleum Corporation on development and compaction regularity of the fractures in buried hills; the researches on the regularity of the reasonal arrangements of multiriver courses and faults to form structural lithologic reservoirs, and on the development of the glutenite bodies and the regularity of oil and gas forming on the steep slopes by Shengli Oilfield; and the researches on paleosedimentary environment and composite structural conditions by Changqing Oilfield, which guided the exploration work effectually and raised the exploration efficiency.

The subtle oil-gas-bearing zones and traps are our target in the future for looking for new reserves. In the course of seeking such zones/traps the work is arduous, only when we have rich imaginative power and creativeness, and develop and raise new exploration techniques can we successfully find out new areas and new types of subtle oil-gas pools to promote the exploration work of such pools to a new free period.

For technical exchanges and references, we have selected some excellent articles from the theses to compile to the book *Subtle Oil-Gas Reservoir In China*, published by the Geological Publishing House, showing the theories, results and new techniques for exploring the subtle oil-gas pools in China.

Sincere acknowledgment should be given to Shandong Petroleum Association, Shell China Petroleum Development Company and Editor of *Multiple Oil-Gas Fields*, because they have done beneficial work not only for *The Symposium of Subtle Oil-Gas Pools* but also during the compilation and publication of this book.

Pan Yuanlin

目　录

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同裂谷层序内隐蔽圈闭的勘探

胡根博（R. C. Hoogenboom）

（壳牌中国石油开发公司物探经理）

过去，一般把隐蔽圈闭与地层和地貌圈闭联系在一起，并成功地寻找出大量的这类圈闭，从而使其它类型的地层圈闭也引起了各石油公司的广泛关注，并被列为远景目标。1995年5月，在伦敦召开的地质协会每半年一次的隐蔽圈闭会议上，Bramford（英国BP公司）给出了更为确切的地层圈闭定义："必须依赖人的创造性想像思维和技术的感性应用所确定的任何钻探目标"。这一定义说明过去只是偶然发现了很多隐蔽圈闭，而现在必须依靠现代的技术才能主动地寻找隐蔽圈闭。

目前，用于获取极佳地下成像的技术主要有高分辨率三维地震、真振幅叠前深度偏移、AVO分析、地震反演和高密度重力等。然而，单有地下成像，即使是极佳的、也是不够的。隐蔽圈闭的成功勘探不仅要求极佳的地下成像，还要与盆地的地史以及可能的成藏模式结合在一起综合运用。壳牌公司提出了许多有关东南亚第三纪盆地同裂谷层序的成藏模式（见封四图）。按远景依次增加的顺序排列如下（参见位于荷兰Rijswijk的壳牌公司研究技术服务中心的烃模拟研究小组资料）。

1. 火成岩型成藏模式

在印度尼西亚西北爪哇盆地查蒂巴朗油田见到的河流相中的裂缝性火山岩、砾岩和凝灰质砂岩是这一模式的实例。油型湖相源岩向储集层提供了充足的烃源。由于根据地震资料识别这些远景区比较困难，所以储层质量（破裂作用）的预测成功与否被视为主要风险。

2. 淋滤型成藏模式

邻近基底隆起的构造低部位中的同裂谷或前裂谷、来自花岗岩的碎屑沉积是这一模式的实例。油型湖相源岩提供烃源。储层和盖层质量被视为主要风险。

3. 冲积扇型成藏模式

像紧靠印度尼西亚巽他盆地Janto油田的下降盘（不常见）和上升盘的小型圈闭是这一模式的实例。油型湖相源岩提供烃源。储层质量和封盖性被视为这类模式的主要风险。

4. 风成沙丘型成藏模式

紧靠上升盘的区域封闭圈闭是这一模式的实例。中国尚未见到这种较好的类型实例。油型湖相源岩提供烃源，紧靠冲积扇的侧向封堵性被视为主要风险。

5. 湖相浊积岩型成藏模式

湖相浊积岩型是指近源盆地中在同裂谷早期出现的浊积岩提供有小型的构造和地层圈闭。Kemphaeng盆地中的Neung油田，是这一模式的实例。这些储层被包裹在提供烃源的油型湖相源岩中。与这类模式有关的主要问题是储层质量和在地震资料上的可识别能力。

在同裂谷层序中，类似于基底隆起（潜山）、湖相三角洲和海侵河成三角洲模式的其它非隐蔽地层或构造圈闭并未包括在本文附图中。

运用这些模式把地下成像转换成最可能的地质模型是今天勘探学家所面临的挑战。在1996年由胜利石油管理局组织、壳牌中国石油开发公司赞助的隐蔽圈闭研讨会上所发表的众多论文汇总在本书中，就是中国努力运用并进一步发展勘探家的创造性想像思维，以成功勘探中国隐蔽圈闭的最好例证。

Exploration of Subtle Traps in Syn-rift Sequences

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In the past subtle traps have been commonly associated with stratigraphic and geomorphic traps. Now that most of this type of traps have been successfully explored, other types of stratigraphic traps have gained interest in any oil company's prospect portfolio. A more suitable definition of stratigraphic trape was given by Bramford (BP) at the biannual Bath Conference of the Geological Society London in May 1995 on subtle traps: "Any target for the drill bit that is especially dependent on the creative imagination of the human brain and the perceptive application of technology". In the context of this definition, many subtle traps in the past may have been discovered by accident and only with today's technology a deliberate search for subtle traps become possible.

High resolution 3D seismic, true amplitude pre-stack depth migration , AVO analysis, seismic inversion and high density gravity are emongst the new technologies available to obtain a better image of the subsurface. However, a superior subsurface image on its own is not enough. Successful exploration of subtle traps requires a combination of a superior subsurface image, understanding of the geological history of the basin and understanding of possible play concepts. For syn-rift sequences in the SE Asia Tertiary Basins, Shell has developed a number of play concepts (See the figure on backcover of the book) A short summary ranked in order of increasing prospectivity is as follows (ref. Hydrocarbon Modeling Group of Shell's Research and Technical Services Centre in Rijswijk, The Netherlands):

—Fractured volcanics, conglomerates and tuffaceous sandstones in fluvial settings as seen in the Jatibarang field in the NW Java Basin in Indonesia, are examples of the volcanics play. Charge to these reservoirs is provided by the oil-prone lacustrine source rocks. Prediction of reservoir quality (fracturing) is seen as the main risk while recognition of these plays in seismic may be difficult.

—Syn- or pre-rift granite-derivde clastics in structural lows next to basement high are examples of the granite wash play type. oil-prone lacustrine source rock provide charge. Reservoir

and top seal quality are seen as the main risks.

—Small traps against the hanging and foot (less common) wall like the Janto field in the Sunda Basin in Indonesia are examples of the alluvial fan play type. Charge is provided by the oil-prone lacustrine source rocks and reservoir quality and seal are seen as the main risks for this play.

—Areally-confined traps against the hanging wall are examples of the aeolian dunes play. Examples of this in general good quality reservoir play types have not been seen in China. oil-prone lacustrine source rock provides charge while lateral seal against alluvial fans is seen as the main risk.

—Turbidites occurring during early syn-rift times in proximal basins provide small scale structural and stratigraphic traps. An example of this lacustrine turbidite play is the Neung field in the Kemphaeng basin. These reservoir are encased in oil-prone lacustrine source rocks which provide the charge. Reservoir quality and detectability on seismic are the main complications associated with this play.

Other non-subtle stratigraphic/structural traps in the syn-rift sequence like the basement high (buried hill), lacustrine delta and transgressive fluvial-deltaic play are not included in the above summary.

It is the challenge of today's explorationist to use these play concepts to translate the subsurface image into the most likely geological model. The many papers presented at the 1996 Subtle Trap Workshop organised by the Shengli Petroleum Administration Bureau and sponsored by Shell China Petroleum Development and summarised in this publication are examples of efforts in China to use and further develop the explorationist's creative imagination to successfully explore for subtle traps in China.

地层圈闭成因分类及研究方法

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摘　要　隐蔽圈闭是指目前勘探技术手段尚不易认识和不易找到的各种圈闭。主要大类有地层圈闭和隐蔽构造圈闭，其中地层圈闭具有巨大的资源潜力。本文根据有关地层圈闭的大量研究成果，扼要论述了地层圈闭的类型、成因、特点及最新研究方法。根据成因，可将地层圈闭划分为：原生或沉积地层圈闭；与不整合面有关的地层圈闭和次生地层圈闭。不同地层圈闭类型具有不同的特征和油气成藏规律。由于地层圈闭的隐蔽性和复杂性，必须采用最新方法，进行综合性研究。地震岩性模拟方法、地震波振幅分辨薄层法、地震资料综合预测岩性等地球物理方法，系统的成岩作用研究、地层异常压力研究及层序地层学等研究方法综合应用，是寻找隐蔽圈闭的有效途径。中国东部中、新生代盆地具有地层圈闭的良好条件。深入开展地层圈闭研究，对东部挖潜具有重要意义。

主题词　地层圈闭　成岩圈闭　不整合圈闭　岩性尖灭圈闭　沉积作用　不整合面　成岩作用　研究　方法

一、引　　言

所谓隐蔽圈闭是指目前勘探技术手段尚不易认识和不易找到的各种圈闭，包括隐蔽构造圈闭和地层圈闭，特别是地层圈闭（翟光明，1983）。著名石油地质学家 A. I. Levorsen 将这类圈闭称之为“不明显的并难以捉摸的圈闭（obscure and subtle traps）”（朱夏，1984）。随着勘探程度的提高、地震技术的迅速发展、资料的日益增多和认识程度的提高，对老油田挖掘新的油气资源潜力，隐蔽圈闭，特别是地层圈闭成为主要勘探对象。地层圈闭是指圈闭必要的几何形态和储层-盖层组合是由地层变化，而非构造变形所形成的圈闭（K. T. Biddle，1994）。

从国外的资料来看，地层圈闭油气藏在油气区内往往占有较大比例，如美国俄克拉何马州地层圈闭油气藏约占 50%，而落基山盆地地层圈闭油气藏所占比例高达 70%以上。而且一般的勘探规律是，随着勘探程度的提高，发现地层圈闭油气藏的数量会不断增加，最终地层圈闭（隐蔽圈闭）的资源量与构造圈闭的资源量可达到或超过 1∶1。当然并不是世界上所有的盆地都具有这样的资源量比例，但对我国东部中、新生代沉积盆地来说，地层圈闭油气藏是有很大潜力的。潜山披覆、地层超覆、复杂的相变等均为地层圈闭油气藏的形成创造了有利条件。因此地层圈闭油气藏的深入研究对我国东部挖潜来说具有十分重要的意义。

二、地层圈闭类型及成因

不同学者（A. I. Levorsen，1936；R. H. Sr. Dott 等，1969；C. R. Hemphill，1970；D. A.