准噶尔盆地东部

烃类微渗漏研究

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内 容 提 要

本书是在准噶尔盆地东部阜康—吉木萨尔地区进行了三年大规模的非地震物化探方法勘探油气藏的综合性生产试验之后，又继续进行的、旨在验证一些物化探方法的理论机制和查明油气田内外烃微渗漏作用具体细节的研究所获得的成果。书中列举了两口各深 600 米钻孔的连续岩心 207 个样品在作了 4 类 26 项分析检测后得到的大量数据和图谱，以实际资料肯定了烃微渗漏作用的存在；探讨了烃微渗漏作用与地下烃信息源和地表异常的关系，以及有条件地将一些项目引入地表化探的可能性。这是国内首次进行的旨在阐明烃微渗漏内在规律的探索性、开创性研究，其成果对油气勘探的生产实践、科研和教学都有重要的参考价值。

主题词： 研究　烃微渗漏　准噶尔盆地东部

前　言

石油工业的发展，一是要依靠不断地发现新油气田，特别是大油气田；二是要尽可能地使用新的先进技术，以提高工效、降低成本，这样，才能获取最大的经济效益，继续扩大再生产。由于电子技术在生产中的广泛应用，传统的油气勘探手段在近一二十年间获得了飞跃发展，从信息采集、资料处理到出最终成果，已实现了一条龙自动化；施工工艺也实现了快速化和系列化。圈闭识别的数字地震技术、油层识别的综合测井和录井技术、优质泥浆和油层保护技术…等现代化系列工艺，已使油气勘探的成功率提高到了空前的水平。然而，资金的投入量和成本的上升幅度也是惊人的。因此，另辟蹊径，寻找和开发新的、廉价的有效勘探方法，成了当代勘探者们的时尚追求。在我国，探索、引进、开发、利用油气勘探新方法的试验方兴未艾，石油行业和各有关部门、院校的广大科技工作者都积极投入了这个热潮。

在中国石油天然气总公司的积极倡导和大力支持下，新疆石油管理局从1988年～1990年的三年时间内在准噶尔盆地东部地震勘探精度已相当高的勘探热点，即以三台为中心的阜康—吉木萨尔地区，实施了一次大型的、系统的非地震物化探方法找油试验。此项目工程实施的方法计有：机载遥感及其地表的地物波谱和地植物验证、地表化探、放射性测量、激电法、高精度重磁力、可控音频磁大地电流、近地表测温、氧化还原电位、井下含油气岩石弹性特征参数测定等多种，在6500km^{2}面积内，实现了几种主要方法的覆盖，取得了非常丰富的信息和多种成果。其中，机载遥感、地表化探、放射性勘查、激电法、氧化还原电位等方法都是以在地表直接检测地下油气分布信息为目的。所以各自都展示了测区内的异常分布，并评价和推荐了

与地下油气藏相关的有利异常。自然，这些不同工种的异常，彼此能叠合的极少，往往是各自不同。人们也总是直观地将这些异常与已知油气田的分布状况作对比，并认真地进行研究。结果发现并不是非此即彼。各种异常都有一部分与已知的油气田、油井或多或少有不同程度的对应关系，因而也曾经使勘探者们受到鼓舞。然而，更多的情况则是异常与油气田没有对应相关性：或者是油气田上没发现明显的异常；或者是许多明显的大型异常却集中分布于并无已知油气田的石油地质条件不利区内，这种不利区有的是已经查明的无油气藏区。这种反常现象又使勘探者迷惘，弄不清这些异常是否与地下油气田必然有关，这些方法是否真正能检测到地下油气田的展布信息。

除去放射性勘查以外，这些方法中的大多数，工作原理都是建立在油气田上方存在着烃类微渗漏柱的基础上。或者是直接检测油气田上方地表土壤中所保存的微渗漏烃，或者是间接地检测微渗漏烃到近地表后所引起的一系列化学场和物理场的变化，包括矿物蚀变、生化反应等等。从逻辑上讲，油气田上方烃的垂直微渗漏现象是能成立的，也普遍被涉足这一有关学术领域的人们所接受。然而，对烃微渗漏作用的具体研究却是很不够的，以致对烃微渗漏作用的过程和具体细节，很难作出准确的说明。至于油气田以外有利区带的其他领域和广大的背景区，是否也有烃的微渗漏，看来无人反对，却并未见人论及；又即使纵然有这种渗漏，是否也能够在地表引起异常，则更未见人论及。如果油气田上方确实普遍存在烃的垂直渗漏，且各种异常都确实只是因这种微渗漏直接或间接引起的话，那么所有异常都应该与油气田所在位置完全相符或大体相符，油气田上方不能没有异常，油气田之外的背景区不能有异常。实际结果却正好相反，异常并不是或并不都是由油气藏的渗漏引起的。后者涉及到各种方法的理论基础及异常机制，很有必要开展深入的研究，包括一些十分必要的生产验证工作。烃渗漏既然是引起各种异常的根源，那么，深入研

究地下烃微渗漏作用的实际状况、具体细节和模式以及控制和影响渗漏过程的因素，就非常必要和十分迫切了。直观地统计异常与油气田的符合率固然也是必要的，但这种停留于表象的相关分析远不能触及问题的实质。

鉴于上述，在第一期试验工程实施之后，又选择了异常与油气田符合程度被认为是最高的激电法进行机制验证：在已知油气田内北16井区的强激电异常中和在已查明无工业油气藏的北2—北6井区的激电场背景区内各钻了一口全取心的机制对比验证井。在油田内的为JJ_1井，深601.4米；在北2—北6井区的为JJ_2井，深601.7米。第二期研究工程的任务，一方面是检验激电异常内黄铁矿化蚀变作用是否存在，另一方面是比较研究油田内外烃渗漏作用的异同。在将这两口井的岩心作了20多个项目的系统分析以后，得到了这项研究成果。其中有几点是很突出的：在岩心敞开放了一年，经历隆冬严寒和盛夏高温、挥发干缩以后，还能普遍检测到相当含量的烃类，不仅有轻烃，还有高碳数的组分；由于所钻剖面无生油岩，特别是高碳数组分的普遍存在，证明烃是来自下伏的油气田或含油气层，也证明了烃渗漏作用的存在；所钻剖面均为未充分压实的沉积岩，具有烃渗漏所需的足够的孔隙空间和通道；虽然烃渗漏的浓度很小，但渗漏的强度油田外却比油田内还强，这是很意外的；油田内也没有发现黄铁矿化现象。我们相信，对这些成果和其与地表各种异常关系的进一步深入研究，必将回答非地震物化探方法用于直接找油的许多本质问题，并促进各种方法的健康发展。

当然，烃渗漏的研究还有待深化，主要是拓展研究的空间范围，包括加大采样深度和增加不同的采样环境，这将是第三期工程的任务。

本研究项目由新疆石油管理局勘探开发研究院管理，项目负责人彭希龄。报告初稿分别由彭希龄、盛志纬编写，最后共同修改定稿。

样品分析工作主要由大庆石油管理局研究院有机地化室、新疆石油管理局研究院沉积室、物性室、有机地化室、古生物室完成，石油天然气总公司研究院实验中心也作了少量分析。管理局总工程师李立诚应作者之请担任项目的地球物理方法顾问，并审阅了初稿的前言和后记，提出了宝贵的修改意见；蒋秀麟组织了新疆石油管理局研究院所承担样品的分析化验工作，并对第 8 章的编写协助搜集资料和提供咨询；张玉兰、许怀先、李平科、宋孚庆、舒念祖、肖廷荣、李选、李芳、龚莉等同志帮助处理数据和打印报告，新疆石油管理局研究院测绘室和梁大新同志帮助清绘图件，曹自强、李树梁同志为报告的编写提供咨询，谨此一并致谢。

PREFACE

There have been two demands in the development of the petroleum industry: the first is to discover new , especially large, oil and gas fields continually; the second is to apply new and advanced technologies as possible as we can so thst the efficiency could be enhanced and the cost could be decreased. The only purpose is to achieve the greatest economic benefits and go on to enlarge reproduction. Because of the spread and wide application of electronic technology in production, traditional oil and gas exploration methods have developed rapidly during the last score years. Data acquisition and processing have been automated, highspeed and seriation in construction technology are also realized. The digital seismic technique in distinguishing traps, the comprehensive logging technique in distinguishing oil reservoir, the high quality mud and reservoir protection technique, and other modern technologies, have improved the success rate of oil and gas exploration considerably. However, the great amount of investment and the increase of cost are also surprising. That it is a fashionable seek for the explorers of our times try to locate some orther way for to find and develop new , cheap, and effective exploration methods . In our country, the trial of probing, introducing, developing and utilizing new exploration methods is now beginning. Scientific reseachers relative to departments, universities and institutes take part in the work vigorously.

In Fukang—Jimusaer region of the eastern Junggar, trial of a large scale and systematic nonseismic physical and chemical exploration for oil was carried out in three years. In an area of 6500 km^2, the cover with a few main techniques was implemented, and plenty of information and results were obtained. Many of the new methods aimed directly at detecting the ground information of underground oil and gas reservoirs. There are corresponding relations to different extent between some of many abnormalities and known oil fields or oil wells. However, most of the abnormalities were not related to oil fields: either no abmormalities had been found on the oil fields; or many obvious, large scale abnormalities were concentrated on the areas of disadvantageous geological conditions, and without known oil fields, some of the areas have proved no oil reservoir. Explorers wonder whether there are necessary relations between the abnormalities and oil fields, and whether the distribution information of underground oil fields could be actually detected with these techniques.

Among all the techniques, most of them are based in principle on microseeping of hydrocarbons over the oil fields. It is logically possible that there is vetical microseeping of hydrocarbons over the oil fields. However, the specific research on hydrocarbon microseeping is not enough so that it is difficult to describe the procession and details. For the above results, there are only two possibilities: either hydrocarbon microseeping did not occurred only over the oil fields; or the abnormalities were not or were not all the results of hydrocarbon microseeping. The latter touched upon the theoretical basis of various techniques, and is very necessary to make a thorough resrearch. Because the hydrocaebon microseeping is the source of various abnormalities, it is very necessary and urgent to seriously and thoroughly study the actual state, specific details, and models of microseeping of underground hydrocarbons, as well as the factors controlling and affecting microseeping procession.

During the later stage of the trial, two wells, 601.4m and 601.7m deep, completely cored to verify the mechanism, were drilled respectively in the strong abnormality of induced polarization in well BEI16 area and in the induced polarization background in wells BEI2—BEI6 area where there is not any industrial oil reservoir.

The cores from the two wells were analysed and researched in order to verify the theoretical mechanism and investigate the specific details, difference and resemblance of hydrocarbon microseeping inside and outside the oil field. In this paper, a lot of data and diagrams from four kinds, 26 items of analyses and tests of 207 samples cored from the two wells were shown. The existence of hydrocarbon microseeping was surely verified. We found that the microseeping hydrocarbons were not only light hydrocarbons but also high carbon number of hydrocarbons, and that the intensity was greater outside the oil fields than inside them. The relation between hydrocarbon microseeping and underground hydrocarbon information source and ground abnormality was probed, The possibilities of conditionally introducing some techniques into ground chemical exploration were also discussed. It is a initiating research in our country, which is aimed at illustrating the rules of hydrocarbon microseeping, and is of important reference to production, scientific research and education.

There are still more things to be done in the research of hydrocarbon microseeping, and it is necessary to focus on spreading the space's scope of research: one is to increase the sampling depth and the other is to increase different sampling environment.

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