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40. Petroleum Geology and Other Sciences(石油地质学与其它科学) 1. Petroleum geology is the application of geology (the study of rocks) to the exploration for and production of oil and gas. Geology itself is firmly based on chemistry, physics, and biology, involving the application of essentially abstract concepts to observed data. In the past these data were basically observation and subjective, but they are now increasingly physical and chemical, and therefore more objective. Geology, in general, and petroleum geology, in particular, still rely on value judgements based on experience and an assessment of validity among the data presented. 1、石油地质学是地质学(岩石研究)在油气勘探开发和生产中的应用。地质学本身是以化学、物理和生物学为基础，应用其基本的抽象理论概念来解释观察到的资料。在过去，这些资料主要凭主观观察获取。现在借助物理和化学手段，因而更具客观性。从根本上讲，地质学和石油地质学，仍然特别依赖于基于经验的数值判断和对现有资料的有效性评估。 2. The application of chemistry to the study of rocks (geochemistry) has many uses in petroleum geology. Detailed knowledge of the mineralogical composition of rocks is important at many levels. In the early stages of exploration certain general conclusions as to the distribution and quality of potential reservoir could be made from their gross lithology. For example, the porosity of sandstones tends to be facies related, whereas in

carbonate rocks this is generally not so. Detailed knowledge of the mineralogy of reservoirs enables estimates to be made of the rate at which they may lose porosity during burial, and this detailed mineralogical information is essential for the accurate interpretation of geophysical well logs through reservoirs. Knowledge of the chemistry of pore fluids and their effect on the stability of minerals can be used to predict where porosity may be destroyed by cementation, preserved in its original form, or enhanced by solution of minerals by formation waters.

2、化学应用到石油地质的岩石研究(地球化学)中有许多作用。岩石矿物组分的详细资料在许多方面很重要。在勘探早期，就潜在储层的分布和质量我们可以从总的岩性得出某些通用的结论。例如，砂岩孔隙度一般与相有关，而一般在碳酸盐岩中则并非如此。储层矿物学的详细知识可以帮助我们估计出在埋藏过程中孔隙度损失的速率。这样详细的矿物组分资料对于准确地解释储层地球物理测井非常必要。了解孔隙流体的化学组成及其对岩石稳定性的影响，有助于预测哪些地区孔隙度因胶结作用而变差，哪些地区孔隙度保持不变，哪些地区孔隙度因地层水的溶蚀作用而提高。

3. Organic chemistry is involved both in the analysis of oil and gas and in the study of the diagenesis of the plant and animal tissues in sediments and the way in which the resultant organic compound, kerogen, generates petroleum.

3、有机化学则可应用于分析原油和天然气，研究沉积物中植物和动物组织的成岩作用，研究动植物组织转化为合成有机化合物，揭示由此而生成的有机化合物干酪根生成石油的方式。

4. The application of physics to the study of rocks (geophysics) is very

important in petroleum geology. In its broadest application geophysics makes a major contribution to understanding the earth's crust and, especially through the application of modern plate tectonic theory, the genesis and petroleum potential of sedimentary basins. More specially, physical concepts are required to understand folds, faults, and diapirs, and hence their roles in petroleum entrapment.

4、在石油地质中，将物理应用到岩石研究(地球物理)中很重要。地球物理的广泛应用对于了解地壳，尤其是应用了现代板块构造理论后，对于了解沉积盆地的成因和潜在石油资源作出了重要贡献。更为特别的是，在理解褶皱、断层和底辟以及它们在石油圈闭过程中的作用时需要物理概念。

5. Modern petroleum exploration is unthinkable without the aid of magnetism, gravity, and seismic surveys in finding potential petroleum traps. Nor could any finds be evaluated effectively without geophysical wireline well logs to measure the lithology, porosity, and petroleum content of a reservoir.

5、利用现代石油勘探手段寻找潜在的石油圈闭时，如果没有地磁、重力和地震勘探，是不可想象的。同样，如果没有地球物理电缆测井测量岩性、孔隙度和储层中石油的含量，对任何发现的圈闭也不可能做到有效评价。

6. Biology is applied to geology in several ways, notably through the study of fossils (paleontology), and is especially significant in establishing biostratigraphic zones for regional stratigraphical correlation. The shift in emphasis from the use of macrofossils to microfossils for zonation, caused by oil exploration, has already been noted. Ecology, the study of the relationship between living organisms and their environment, is also important in

petroleum geology. Carbonate sediments, in general, and reefs, in particular, can only be studied profitably with the aid of a detailed knowledge of the ecology of modern marine fauna and flora.

Biology, and especially biochemistry, is important in studying the transformation of plant and animal tissues into kerogen during burial and the generation of oil or gas that may be caused by this

transformation. 6、生物学可以从几个方面应用于地质学。较为明显的是用于化石研究(古生物学)，同时，生物学对区域地层对比和建立生物层序地层带具有极为重要的意义。由石油勘探引起的划带重点化石已经显然由大化石转移到微体化石。生态学，即研究生物与其环境之间关系的科学，在石油地质中也很重要。碳酸盐岩沉积物，特别是生物礁，只有在现代海洋动物群落和植物群落生态学详细资料的帮助下才能获得有益的研究成果。生物学，尤其是生物化学，对于埋藏过程中动植物组织转化为干酪根并由此生成石油和天然气的研究很重要。 7. Geologists, in contrast to some nongeologists,

believe that knowledge of the concepts of geology can help to find petroleum and, furthermore, often think that petroleum geology and petroleum exploration are synonyms, which they are not. Theories that petroleum is not formed by the transformation of organic matter in sediments have already been noted and are examined in more

detail. If the petroleum geologists view of oil generation and migration are not accepted, then present exploration methods would need extensive modification. 7、地质学家相对于非地质学家来说，更相信了解地质概念有助于寻找石油。而且，常常认为石油地质和石油勘探是同义词，而实际上并非如此。石油并

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不是由沉积物中的有机物转化而来的理论已经引起人们的关注，并在许多细节问题上得以证实。如果石油地质学者关于油气生成和运移的观点不被接受，那么目前的勘探方法需要大幅度改变。

8. Some petroleum explorationists still do not admit to a need for geologists to aid them in their search. In 1982 a successful oil finder from Midland, Texas, admitted to not using geologists because when his competitors hired them, all it did was to increase their costs per barrel of oil found. The South African State Oil Company (SOEKOR) is under a statutory obligation imposed by its government to put to the test every claim to an oil-finding method, be it a dowsing or some sophisticated scientific technique. These examples are not isolated cases, and it has been argued that oil may better be found by random drilling than by the appliance of scientific principles.

8、一些石油勘探家仍然不承认在找油过程中需要地质学家的帮助。1982年，一位德州米德兰油田的发现者声称没有雇佣地质学家。他的对手雇佣了地质学家，结果只是增加了每桶原油的成本。南非国家石油公司在政府法律强行规定下，对每种发现石油的方法(寻找矿藏和水源机械方法或复杂的科学方法)必须进行测验。上述事例并非是独一无二的，它说明寻找石油可能的较好方法是随机钻探，而不是应用科学原理。

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