

黄海埋藏古河道 及灾害地质图集

Atlas of Yellow Sea Buried Paleo-channels
and Geological Hazards

李 凡 张秀荣 唐宝珏 著

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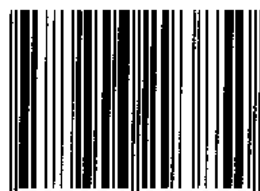
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内 容 简 介

本图集是根据 1983~1996 年间进行的 5000 多公里高分辨地球物理测量资料编写而成的。其中汇集了 93 幅各类典型的埋藏古河道、古湖泊、古三角洲剖面,以及活动性断层、浅层天然气等灾害地质因素剖面,分别标出了出现位置并行了地震地层学解释;对个别剖面给出了钻孔资料;同时绘出了 19 张晚更新世末期古水系分布、海底灾害地质因素分布和区划,以及海洋水文、沉积、地貌等成果图,分别进行了详细说明。

本图集可供海洋工程技术人员及海洋地质学、地理学等的科研、教学人员、研究生和大学生参考。

BRIEFS

This Atlas is drawn and edited based on data of surveyed line of more than 5000 km by high resolution geophysical method during 1983~1996. In this Atlas, 93 sections of buried paleo-channels, paleo-lakes, paleo-deltas with core datum as well as the geohazard factors such as active fault, shallow gas etc., are collected, positioned and illustrated by seismic stratigraphy. Meanwhile, 19 maps of the distributions of paleo-river system at the end of Late Pleistocene and the division and distribution of geohazard factors as well as the marine hydrology, sedimentary types, geomorphology with detail illustrations etc. are edited in this Atlas.

This Atlas is for the reference of marine engineers, researchers, scientists, teachers on marine geology and geography and graduate students.

2015.10.12

序 言

本书是李凡等同志多年来在黄海进行浅地震剖面及其他海洋地质调查工作的成果,近经仔细整编,删除了一些不必要篇幅,并搜集了有关的海洋物理和海洋地质资料编写而成。除图以外,还附有详细说明。这是我国海洋地质学上第一本此类著作,资料绝大部分为作者等实测,具有较大的创造性和很高的科学价值。

60年代以来,由于深海钻探及大洋钻探的进展,世界地球科学界越来越认识海洋地质是大陆地质必不可少的一个组成部分,两者的对比研究已经成为国际地球科学研究的前沿。本书系统地展示了黄海两期埋藏古河道剖面,可帮助我国开展大陆架海洋地质与大陆地质的对比研究,为进一步探索华北第四纪环境演变及黄河发育历史提供新的科学依据。

除了埋藏古河道以外,本书还汇集了黄海海区多种灾害地质因素的实测图谱和在该区多年来进行灾害地质研究的成果,给出了各种灾害地质因素的空间分布,这对于在黄海海区进行海洋工程建设和海洋灾害地质调查将有很大帮助,对于发展我国海洋灾害地质学研究也有一定的促进作用。

可以预期,本书的出版必将有助于我国地球科学走向国际前沿。

任美铎

1998年3月18日

FORWARDS

Chapters of the book, the first of its kind in China as edited by Prof. Fan Li on the information obtained from shallow profiler and other marine geological investigations over the Yellow Sea surveyed in the past many years, and other related marine physical and geological materials collected and sorted, were written from their own personal investigations, hence more creative and higher in scientific value in many respects.

With the progress of drilling technique applied to deep-sea and ocean since 1960s, marine geology has been considered by earth scientists indispensable to land geology and comprehensive study of them is going to be the frontier of earth science international. This book reveals systematically sections of buried paleo-rivers of two stages over the Yellow Sea, enables us to develop comprehensive study between continental shelf geology and land geology, and also offers us new scientific base to probe to Quaternary environmental evolution and the development of the Huanghe River.

Besides buried paleo-channels, profiles surveyed over many geohazard factors and some achievements in marine geological hazards and marine geology were also collected. Spatial distribution of various geohazard factors mapped up in this Atlas are to be much helpful to marine engineering and geological hazard research in the Yellow Sea and promotive to further develop marine geological hazard study in China.

It can be foreseen that the publication of this book will help our earth science move ahead to international frontier.

Mei-e Ren

Mar. 18, 1998

前 言

第四纪以来,世界海平面经历了多次大幅度的升降变化,这种变化也影响到了中国陆架海域。黄海位于中国陆架海北方海区,历经沧桑变化。大量资料表明,晚更新世以来,黄海海区曾经发生过3次大规模的海退、海侵过程,如果加上中更新世末期的一期低海面,则可认为,距今约13万年以来,黄海陆架大部分海区曾经发生过4次大规模的海水退出而裸露成陆的过程。在低海面时期,黄海陆架区,即当时的陆地上,曾经发育了大小不同、形态各异的河流、三角洲、湖泊、沼泽、沙丘、海岸等地貌单元。随着海平面的上升,它们纷纷沦入海底,并且被埋藏在不同厚度的沉积物层之下。被埋藏的古河流、古湖泊、古海岸线及古沙丘等地貌单元,在后期沉积速率较小的海区内,不同程度地尚能部分保留其原有的地貌特征,其地貌形态依稀可辨。而在物源供给丰富、沉积速率较大或侵蚀作用强烈的海区,其形迹则荡然无存。以前有的学者曾经根据海底地貌及海底沉积的部分资料,对于晚更新世末期低海面时期的古地理环境及古河道分布,特别是古黄河和古长江的流路做过各种分析和推测。近十几年来,随着高分辨地球物理测量仪器的应用和发展,黄海海区内被埋藏在不同深度下的古河道、古湖泊、古沙丘及古海岸线等不断被发现,中外文献不时报道,从而为我们认识黄海陆架的古地理环境演变过程积累了丰富的资料。1983~1986年,中国科学院海洋研究所和美国伍兹霍尔海洋研究所合作,进行了南黄海沉积动力学调查,曾经在多处发现了埋藏古河道断面。近10年来,在3次国家自然科学基金的资助下,利用“科学1号”调查船,对黄海的埋藏古河道进行了大量调查研究,初步查清了黄海西部(124°E 以西)古水系的分布轮廓,对于古黄河、古长江的流路和特征也有了进一步的认识。 124°E 以东的情况目前资料甚少,有待今后条件成熟时进行研究补充。

埋藏古河道、古湖泊、古三角洲等地貌单元,其沉积物层具有沉积构造复杂、沉积相变化快、分布不连续等特征。从工程地质的角度出发,则其沉积物具有物理性质和力学性质复杂、荷载强度多变、地层不稳定等特征,因而,对于石油平台或其他大型海洋构筑物来说,常被视为灾害地质因素或不稳定因素,成为海洋工程地质调查的重要内容之一。

近 30 多年来世界上近海石油开发的蓬勃发展,促使了海洋灾害地质学这一边缘学科的产生和发展。为了更好地为我国海洋石油开发及其他海洋工程建设服务,提高埋藏古河道科研成果的实用价值,在进行黄海埋藏古河道调查研究的同时,又从本区大量浅地层剖面资料中,提取了埋藏古河道以外丰富的灾害地质因素信息,汇集了各种灾害地质因素的剖面记录资料,绘出灾害地质因素分布图,并且对黄海海区的工程地质性质进行了分区和评价。因此可以认为,本图集是建立在大量高精度的高分辨地球物理实际调查基础上的,资料准确可靠,对石油开发和有关的海洋工程建设将有所裨益。

大自然中,河流、湖泊等地貌体千姿百态,灾害地质因素变化万千。在黄海海区约 5000 多公里的地球物理测量剖面中,得到了有价值的埋藏古河道及其他灾害地质因素图谱 200 余幅,现选择其中 93 幅典型者汇集成册,奉献给读者。为了便于读者更好地了解本海区地质环境和灾害性地质背景的总体面貌,也将部分有关的海洋水文、海底地形、地貌、海洋沉积以及灾害地质因素分布和区划等 19 幅基本成果图纳入图集。

应当指出,黄海只是我国北方陆架海区的一部分,由于受调查区测线密度和其他因素的限制,本图集也只能反映出该区浅地层结构、埋藏古水系和灾害地质因素丰富多采内容之一“斑”,而古黄河、古长江水系在黄海陆架区的发展历史和来龙去脉——这一地理学和地质学界广为关注的问题尚得不到满意的回答,大量埋藏在海底以下深处的重要信息,例如南黄海北部海底 30~40m 以下的大型埋藏古河道、古三角洲的起源和形成时代以及某些重要地震地层的沉积相等问题,也因缺乏钻孔资料而无法得到理想的解决。特别是对于黄河的形成时代和入海流路问题,至今仍是众说纷纭,而在中国渤、黄、东海陆架区——对解决这一问题极为有利的地区内,却由于某些原因至今得不到深入调查,这对于地理学和第四纪地质学界莫不深感遗憾。然而本图集毕竟对此问题的解决提供了珍贵的线索,可供有关专家进一步研

究参考。

为了能够将真实的信息奉献给读者,本图集以汇集原始记录剖面为主,仅对剖面中有关本课题的主要地质现象进行简单的说明,作为引玉之“砖”,希望读者能够从中提取更多的有用信息,为发展我国的海洋地质科学事业做出贡献。

本图集是在完成3次国家自然科学基金项目的基础上经过进一步研究编写而成的。基金项目实施过程中,参加海上资料采集的有“科学1号”调查船实验室唐宝珏、于建军、庄杰枣、王刚、杜全胜、王绍智等。参加室内资料整理的有张秀荣、林美华、姜秀珩、李本兆、毛彦平等。丁宗信教授提供了海洋水文图和有关说明。由于本人水平所限,图集中可能会出现不少问题,请诸君不吝指正。

本项目3次得到国家自然科学基金资助,并得到中国科学院海洋研究所有关领导和科研处、船舶处的积极支持。海上调查中,“科学1号”调查船的全体船员和实验室人员给予了大力帮助。在图集的出版过程中得到了周以忱、李本川教授等的热情帮助,谨致谢意。

李 凡

1998年2月

PREFACE

Sea-level all over the world had undergone up-and-down changes many times since Quaternary, influencing the sea-regions on China shelf, and subsequently the Yellow Sea on the northern part of China Sea. Evidences from the information recorded on Yellow Sea region show that transgressions and regressions of large scale had occurred three or four times if the one occurred in the Mid-Pleistocene was added since Late Pleistocene. Therefore it could be estimated that most part of Yellow Sea shelf regions had confronted four times with the processes of regressions and land exposures in the past 130 000 years. In time of low stand of Sea-level, the land exposed were developed into various geomorphological units, such as rivers, deltas, lakes, marshlands, sand dunes and sea coastlines etc.. With the rising of sea-level, all of the formerly exposed geomorphological units submerged as sea-floor or buried under sediment layers in various thickness. Those buried paleo-channels, paleo-lakes, plaeo-coastlines and paleo-sand dunes etc. under the sea-floor could still be slightly observed with their original forms of geomorphological units where the sedimentation rates were comparatively low but could be hardly seen where sedimentation rates were intense. Scientists in the past, based on sea-floor geomorphological features and sedimentations, had made some analyses and inferences on paleo-geographical environments and distributions of paleo-rivers, especially on the river courses of the Paleo-Huanghe river and Yangtze River in time of low sea-level at the end of Late Pleistocene. In recent years, along with the application and development of high resolution geophysics surveying instruments, some buried paleo-channels, paleo-lakes, paleo-sand dunes and paleo-coastlines had been discovered and reported, which helped us accumulate much information on understanding the evolution process of paleo-geographic environment on the Yellow Sea shelf. In 1983-1986, Institute of Oceanology Chinese Academy of Science in collaboration with Woodshole, U. S. conducted a cooperative investigation on sedimentary dynamics in the Southern Yellow Sea, and dis-

covered many crossed sections of buried paleo channels. In 1987~1996 by the financial support of State Natural Science Foundation (SNSF) and aid of R/V "Science 1", we made an extensive investigation on buried paleo-channels in the Yellow Sea, clarifying initiatively the distributional framework of paleo-channels in the west of Yellow Sea and further realizing the characteristics of the Paleo-Huanghe River and the Paleo-Yangtze River to the west of 124°E. However less information was accumulated to the east of 124°E, and more research work is needed.

The sedimentary structure of geomorphologic units such as buried paleo-channels, paleo lakes and paleo-deltas etc. are complicated in view of their physical geotechnical properties, their sedimentary facies changed fast, and distribution discontinued, constituting unstable factors or hazard for marine engineering.

Along with the booming development of oil exploitation offshore in recent 30 years, marine geohazard is emerging and developing as a frontier science. In course of doing scientific research on buried paleo-channels in the Yellow Sea, some informations of geohazard factors were extracted from the large amount of shallow stratigraphic materials, consequently the distributional chart of geohazard was mapped out on the bases of a large amount of reliable and precise data to serve better marine oil exploitation and marine engineering.

The geomorphological figures of rivers and lakes in nature are intricately changing and the factors of geohazard are also variable. There were more than 200 valuable buried paleo-channels and geohazard pictures as collected from the geophysical profiles surveyed in the Yellow Sea region in range of 5000 km. Of them 93 typical ones were compiled into one volume. For the convenience of grasping the overall appearance of marine geological environment of this region, some graphs of marine hydrology, submarine topography, geomorphology and sediment patterns and others were also shown in this Atlas.

It should be pointed out that Yellow Sea region is only a part of northern continental shelf of China Sea and this Atlas, owing to restriction of surveyed area, surveying line density and some other factors, is only able to sketch out the general outlook of its complicated shallow strata structure, buried channel system and geohazard. Other problems like history of the Paleo-Huanghe River and Paleo-Yangtze River on the Yellow Sea shelf as concerned from marine geologic and geographic point of view are not too satisfactory. Some important information such as the origin and formation age of buried paleo-rivers and paleo-deltas and problems of sedimentary facies of im-

portant acoustical strata under the 20~40 m sea-floor of the Yellow Sea are also not solved satisfactorily for lack of drilled data. Especially the problem of formation age of the Huanghe River—known as China “Mother River” and its course to sea is still controversial and far from being solved today, though the geographic locations of Bohai Sea, Yellow Sea and East China Sea might be helpful to its solution. This Atlas, however, does offer some valuable clues to scientific researchers concerned.

This Atlas is mainly aimed to collect more information of the original recorded profiles for the readers, to give a fundamental concept to the geologic topics, and to provide only a simple explanation to the profiles, which is expected to be conducive to drawing more useful information and to contribute more to the marine science development of our country.

This Atlas was based on the high resolution data from geophysics surveys from 1983~1996 and subsidized by the SNSF. Prof. Fan Li headed the project. Others are Baojue Tang, Jianjun Yu, Jiezao Zhuang, Gang Wang, Quanshen Du, Shaozhi Wang, Xiurong Zhang, Meihua Lin, Xiuhang Jiang, Benzhaoli, Yanping Mao etc. R/V “Science I” carried out the survey.

Marine hydrographical maps were offered and illustrated by Prof. Zongxin Ding.

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