

中原东部

第四纪环境及其影响的研究

项目主持者 朱明伦

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内 容 提 要

该书主要介绍豫东及部分淮北平原 200 万~300 万年以来自然环境演变及其对地下水、自然灾害等影响。因此,该书内容涉及到区域地质、地理、古气候、古生物、沉积物、古土壤、新构造运动、古水系和古人类等方面的变化,以及这些变化与地下水动态和赋存,水旱灾害和地震等自然灾害之间的因果关系,从而为现实生产和人类生存环境提供科学论据。

本书可供地理、地质、气候、生物、土壤、环科、水文、考古、灾害、农林牧、治黄、治淮工程及规划等有关单位和同行进行科研、教学参考。

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第四纪环境及其影响的研究

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朱明伦,男,39岁,河南虞城县人,地理学硕士毕业生,高级工程师。在中国人民解放军00933部队时参加过全国1/20万水文地质普查,1985年获国家科技进步二等奖;并在云贵高原和长江中下游第四纪环境研究中也获得一定成果。1989年转任商丘市城市规划与土地管理局局长时,积极撰写科技论文和第四纪环境专著等多种;并领导和主持编制了商丘市总体规划,各专业规划和详细规划,为商丘城市建设事业作出优异功绩。现任河南省商丘地区计划建设委员会副主任。



徐 馨,男62岁,安徽贵池人,南京大学大地海洋系教授。1957年毕业于南京大学地理系。留校任教30多年来,一直从事教学与科研工作,先后开过7—8门专业课,参加过20多项各类课题和国家自然科学基金项目,已发表40余篇学术论文,主编和参加撰写教材、专著12种,共计200余万字,获得过多次教学和科研奖,并被选入世界名人录,是国内小有名气的第四纪自然环境、孢粉、地貌等研究方面的科学工作者。

前 言

《中原东部第四纪环境及其影响的研究》这本专著,是以河南东部及安徽北部部分地区为研究对象的,经过作者近年从中原东部自然地理因素、地质背景和第四纪的地壳运动、沉积物特征、古气候旋回、动植物化石、人类文化发展等方面研究,论证了第四纪环境演变和未来发展趋势;进而探讨了第四纪环境对区域地下水含水量、赋水条件、水质水量和利用前景以及各种类型自然灾害的形成原因、危害程度、与防灾减灾对策等影响;最后对区内不同地段的自然环境、地下水动态和主要自然灾害分布进行了分区叙述。并在上述分析基础上,结合区域自然资源条件、经济发展现状和未来前景,提出全区社会经济发展方向的预测性设想,供有关决策部门和领导参考。

全书包括绪言和 8 章正文共 24 节,书中有插图和表格 150 余幅,约计 40 余万字。比较全面地总结了中原东部地区第四纪环境、地下水动态和自然灾害 3 个方面的主要问题以及解决问题的方法,并提出这些问题与现实经济发展的关系。因此,它是一部至今为止首次研究中原东部地区理论与实际融为一体的综合性区域研究成果。书中内容新颖、丰富,文字清晰、易懂,图文并茂,理论与实践相结合,修正了某些旧的观点,创建了一些新概念,为本区第四纪环境研究、开发利用资源、防灾减灾对策和未来经济发展规划,提供了可行性的科学依据。这将对研究中原东部及黄、淮两河流域的地质、第四纪地质、区域地理、环境保护、水文、水利、水资源和地下水开发利用、古气候、古生物、土壤、水土保持、农林牧、考古以及社会经济和城乡规划、流域综合整治和区域规划等学科都有一定的帮助和参考价值。

本项目研究由商丘地区计建委朱明伦高级工程师主持,南京大学徐馨教授组稿,河南省地矿厅第三水文地质工程地质队卢积堂、郭新华、刘玉梓和贵州省地矿局陈佩英等专家参加下完成的。其中,绪言和第 8 章由徐馨、朱明伦执笔;第 3 章由徐馨、朱明伦、陈佩英执笔;第 4 章由徐馨执笔;第 1 章由刘玉梓执笔,卢积堂参加部分撰写工作;第 2 章由卢积堂执笔;第 5、6 两章由郭新华执笔;第 7 章由徐馨、刘玉梓执笔。全稿完成后,再由徐馨、朱明伦作最后统编定稿。由于本书是全体作者分章撰写,虽经统编协调,不免还存在一些欠妥或不足之处,特请有关专家和广大读者批评指正。

在本项目研究和本书编写的过程中,曾得到河南省地矿厅第三水文工程地质队领导和商丘市规划土地管理局的同志们以及其他同行的热诚帮助和大力支持,河南省地矿厅第一水文地质队李玉信和第二水文地质队石钦周两位高级工程师提供部分资料。在书出版中还得到贵州省地矿局沈志达高级工程师帮助联系出版和印刷等事宜,贵州科技出版社为本书出版提供支持和方便,书中的插图大部分由石宗祥老师清绘,作者仅此一并表示谢意。

徐馨 朱明伦

1994 年 1 月

摘 要

中原东部研究区是指黄河以南,嵩箕山—伏牛山以东,大别山—桐柏山以北的广大山地丘陵与平原地区。区内自然地理条件具有较强的过渡特征,在复杂的地质背景和类型较全的区域地貌基础上,不论在气候、水文、植被、动物、土壤、沉积物等方面都表现为由南向北、由东向西过渡特性。由于地表起伏较大,各自然地理因素还具有垂直变化特征。这些变化原因,一方面是自然地带的变化造成的,另一方面也与区域地质构造和第四纪构造有密切关系,尤其是第四纪差异升降运动的影响,使山区长期处于剥蚀过程,而平原地区则处于长期沉陷加积之中,不同时期的气候变化,影响沉积粒度的改变,这些都对区内地下水资源和自然灾害有着直接的影响。

区域第四纪地层成因类型与区域地貌和气候变化十分密切,在不同的地貌部位和气候条件下则有不同类型的第四纪沉积物,这些沉积物的矿物岩石和化学成分的差异,则决定于区域岩层的成分。在周边广布变质岩及岩浆岩的中原东部,第四纪地层是具有较复杂的成分。可以根据气候地层、生物地层、岩石地层、构造地层和年代地层学等分层原则和岩相古地理、沉积间断、生物气候和年代学等划分标志,以及沉积物的颜色、结构与构造、矿物与化学成分、粒度特征等进行综合分析,建立了区内第四纪地层成因类型和层序关系,从而为第四纪地层划分建立典型剖面打下坚实基础。确定区内第四纪下限和全新世底界,则从构造地层学、气候地层学和岩石地层学等标志,提出第四纪下限放在吉尔伯特和高斯极性世之间(340万年前)较合适。全新世底界在10000年左右。在划分第四纪沉积物成因类型方面,提出早更新世冰川沉积,伴有大量融冻泥石流堆积;中晚更新世堆积在伏牛—大别山前亚粘土为风积黄土,中更新世红土很少;全新世灰黑色亚粘土为沼泽相成因,并与国内或邻区进行了对比。区内黄、淮河形成是海面下降引起河流溯源侵蚀的结果,平原区河流,特别是淮北—豫东平原上的淮河支流,大多数于全新世后期发育的。

第四纪气候变化是本区自然环境演变的主要原因,气候变化的标志反映在植物群演替、沉积物韵律和沉积旋回的形成,堆积与间断、颜色的变化等等。在气候变化影响下,区内植物群发生20余次的更替,从植物化石孢粉分析结果得知,反映冷暖或干湿变化的植被类型就有23、24种。说明第四纪气候波动相当频繁,其中有湿冷和温暖阶段,也有干冷和干暖时期,温湿、温干或干凉等变化更为频繁。在地貌形态和堆积物特征等方面,反映在第四纪期间有过冰川作用,不过规模较小,为山岳冰川类型。环境变化也引起动物群和人类文化发展,第四纪动物化石和遗骸反映,本区既有喜冷的动物群,也有喜暖的动物群。动物群发展深受环境影响,它们所反映的第四纪气候变化也是相当剧烈的。从生物群反映本区第四纪温差可达10~20℃以上。人类文化是在与自然环境作斗争中发展的,研究表明,我国古代人类在中原大地生息繁衍为期甚早,遗留大量文化遗存,表明本区及豫西山地区是我国人民先辈主要发祥地之一。从夏、商时期建都以后,历代不少都城都建在本区或邻区,中国的灿烂文化史上,本

区占有很重要席位。

丰富的地下水资源(约 142.8 亿 m^3),分别赋存于六类含水岩组中,尤其是巨厚的松散沉积物中,不仅面积大赋水程度好,分布较均匀,埋藏浅、补给条件好,而且易开采,具有重要开发利用价值。地下水补给和排泄,随着不同地貌部位有着不同的方式。近年来由于城市过量开采地下水,造成平原区地下水不同程度下降而呈沉陷漏斗。但地下水总的动向是从山前流向平原,因而平原地下水矿化度大于山前区。不同层次矿化度不一致,所含矿物也不相同,南部降水丰沛矿化度较小,仅 0.5—0.8g/l,平原北、东部矿化度高,达 1.0g/l 以上。尤其是深层地下水含氟量稍偏高,对开发利用有一定影响。不过全区开发利用地下水程度小于 50%,故有较大的开发潜力。但必须严格科学管理,以免水位大幅度下降,出现地面沉降和地裂缝的形成,更要保护地下水资源不受污染、盐碱化、生态环境恶化等。要控制超采,以免引起水源枯竭。

自然灾害是本区经济发展制约因素。境内历来是多灾并发,尤其水旱灾害,时空交错,并具有准周期性,长周期 150 年,短周期 11 或 22 年。境内自然灾害主要有地质灾害(旱涝、地震、地裂缝等),共占总数 66%,次为气象灾害(包括暴雨、干旱、大风、沙暴等)。这类灾害危害农作物发育和收获,也危及某些建筑物、民房、林业和人畜安全等。生物灾害(病、虫害等)危害面积较大,会给经济带来一定损失。为了防灾减灾,应建立适当机构、制定对策,采取防减措施和人力、物力、财力及技术准备,最大限度地减缓或消除灾害造成的损失。

但是第四纪环境与水文条件和自然灾害在全境并非一致。山地丘陵区因受地面高差较大,地表切割严重,自然生态环境和地表水、地下水运动具有山区特性,尤其是地表水运动比较活跃,是塑造地表形态主要动力,许多自然因素也因地表高差悬殊具有垂直分布特征,这种特点表现在降水、温度、植被、土壤、动物群各个方面,乃至沉积物堆积多少也带有垂直分带特征。而平原地区,黄河平原则受黄泛影响,不论是河型或沉积物,抑或是微地貌形态,还是地表水、地下水动态方面,都不同于淮河谷地及淮河平原,第四纪沉积物两者也不大一样,淮河谷地物源主要来自西部和南部山区,沉积物的矿物和化学成分就比黄河平原复杂,成因类型更是多种多样。所以这两个地区各具特色,因而黄河平原与淮河谷地及淮河平原自然环境当然不一致。从地层、古生物、水系、地面发育诸多方面变化,淮河比黄河更复杂,因此两者第四纪环境及水文特征和自然灾害均不一致。

在上述自然环境及自然资源条件下,发展本区经济有有利一面,也有不利因素,有利的方面,区内有丰富的各类矿产资源、水力资源、工业基础、农业基地等,为经济发展提供必需的条件,特别是全国主要交通大动脉通过本区,构成本区与国内各地和国外联系与交往的通道。但也有不足的条件,那就是过去基础比较薄弱,水资源利用率不高,地下水仍很有限。农业生产、工业基础、财力和物力尚比不上沿海发达地区,因而影响社会经济快速发展。但是中原大地具有漫长的人类文化发展史,历史上曾多次成为全国政治、经济、文化中心,还有强大的劳动大军和人才需待开发和安排,只要有计划进行宏观控制和协调,发挥市场经济优势,积极调动各方面智慧和力量,就一定能把本区经济搞上去。

Abstract

The study area in the eastern part of the central plain includes those widespread hilly and plain regions south of the Huangho (Yellow) River, and east of the Songji — Funiu Mountains and north of the Dabei — Tongbai Mountains. The physico-geographical conditions of this area are of strong transitional characters, which are shown by their climates, hydrology, vegetations, animals, soils, sediments and others, all changing from south to north and from east to west on the basis of the complicated geological settings and regional geomorphology of almost all types. Owing to the rolling Earth's surface, all the physico-geographical factors are characterized by vertical changes. These changes were resulted from the changes in natural zones and also closely related to regional tectonics and Quaternary structure. In particular, the effects of the Quaternary differential elevation and subsidence put the mountain areas into a long-term process of denudation and the plain areas into a long-term sinking accretion. Climatic changes in different periods affect the changes in depositional grain-size. These had direct effects on groundwater resources of the study area and natural calamities.

The genetic types of the regional Quaternary rocks were closely related to the regional landforms and climatic changes. With different positions and climatic conditions, there are Quaternary rocks of different types. The differences between minerals, rocks and chemical compositions were decided by the compositions of the regional rocks. The Quaternary rocks are comparatively complicated in composition in the eastern part of the central plain where metamorphic and magmatic rocks are widely distributed on its periphery. The genetic types and stratigraphic sequences in the study area may be established on the basis of the principles of stratigraphic division of the climatostratigraphy, biostratigraphy, lithostratigraphy, tectostratigraphy and chronostratigraphy and the standards of divisions of the lithofacies — paleogeography, interruption of sedimentation, bioclimatology and biochronology, as well as the colours, texture and structure of sediments, mineralogical composition and the characters of grain-size, laying the solid foundations of stratigraphic division and establishing type sections. To determine the lower limit of the Quaternary and the basal boundary of the Holocene, the tectostratigraphy, climatostratigraphy and lithostratigraphy are used as standards to propose that the lower limit of the Quaternary should be suitably drawn between the Gilbert reverse epoch and the Gauss normal epoch (3400000 B.P.). The basal boundary was dated at about 10000 years. In the division of genetic types of the Quaternary sediments, the Early Pleistocene glacial deposit was proposed to be associated with a great quantity of thawed mud-rock flow

accumulations. The Middle Pleistocene accumulations of clayey are wind-carried loess at the foot of the Funiu—Dabei Mountains. The Holocene grey—black clayey is of swamp-facies origin and has been correlated with those in the neighbourhood. In the study area the Huang and Huai Rivers were formed by the fluvial headward erosion resulting from the falling of sea level. The rivers in the plain areas, especially those tributaries of the Huaiho River on the Huaibei—Yudong Plain, were mostly developed in the Late Holocene.

The Quaternary climatic changes are the important cause of the evolution of the natural environments of these areas. The marks of climatic changes are expressed by the floral succession, the formation of the rhythm of sediments and the sedimentary cycles, accumulation and interruption and changes in colors. Under the influence of climatic changes, the replacements of floras had taken place for more than 20 times. Judging from the analysis of sporopollen fossils, there are 23 to 24 vegetation types indicating the cold—warm and dry—moist changes, suggesting that in the Quaternary, the climatic fluctuations were very frequent, and there were moist—cold and moist—warm stages as well as dry—cold and dry—warm periods. Changes in temperate—moist, temperate—dry or dry—cool were more frequent. The aspects of land form and accumulation characters indicate that there were small-scale glaciations of mountain glacier type. Environmental changes also resulted in the environment of faunas and human culture. The Quaternary animal fossils and remains indicate that there were cryophilous and hygrophilous faunas in these areas. Development of faunas were strongly effected by environment. They also indicate that the climatic changes in the Quaternary were also very great. The temperatures in the Quaternary in these areas were reflected by biotas to have a difference of 10°C to more than 20°C . Human culture was developed together with their struggle with natural environment. The study shows that ancient men of China in the central plain were flourishing very early, which was proved by large numbers of cultural relics showing that these areas and the mountain areas in west Henan was one of the important birthplaces of China's ancient culture. After the establishment of capitals by Xia and Shan Dynasties, there were many dynasties that had their capitals in these areas or in their neighbourhood.

Rich groundwater resource (about 142.80000000m^3) are respectively distributed in 6 kinds of water-bearing rocks, especially in those very thick and soft sediments. They are not only large in area, but also rich in water and have an even distribution and a shallow burial. They are sufficiently supplied and easy to exploit. In recent years, due to overpumping, the groundwater in cities began to fall in varying degrees, sinking in a funnel shape. However, the groundwater flows still from foreland into the plain. Therefore, the groundwater in the plain is more mineralized than that in the foreland. In the south of the plain, the rainfall is great, mineralization is small, only $0.5\text{--}0.8\text{g/l}$; in the north and east, exceeding 1.0g/l . Especially, the deep underground water has a slightly high F-content, which has some influences on the exploitation and use. But the underwater in whole areas

is exploited only by 50%, there are still great potentialities for exploitation. Strict scientific treatment must be carried out in order to prevent the water level from falling greatly and from sinking of Earth's surface and formation of geofracture. It is more important to protect the underground water resources from pollution and salinization and the ecologic environment from deterioration. Exploitation must be controlled in order to prevent the water resource from being dried up.

Natural calamities are the controlling factor in the development of economy. In these areas, calamities, especially floods and droughts have occurred frequently and had their paraperiodities, a long period of 150 years a short period of 11 or 12 years. The chief natural calamities in these areas are geological calamities (droughts, floods, earthquakes, and geofractures), occupying 66% of total calamities, and metrological calamities (storms, hurricane, sandstorm, etc.), damaging crops, buildings, forests, livestock and human beings. Biological calamities (plant diseases and insect pests) have done a lot of damage to the economy in vast areas. Suitable organizations should be established to prevent and decrease calamities.

Quaternary environment, hydrological conditions and natural calamities are not the same in these areas. In the Mountain and hilly areas, due to great height difference, Earth's surface was seriously dissected. Natural ecological environments, surface water and groundwater movement are of mountain characters, especially the surface water, which is very active in movement, being chief motive power to model Earth's surface into various landforms. Many natural factors, also due to distinct height different were characterized by vertical distribution, expressed by precipitation, temperature, vegetation, soil, fauna, even by sediment accumulation. In the plain area, the Yellow River plain was effected by flooding is the Yellow River, with river pattern, sediments, microrelief, surface water and groundwater forms all different from those of the Huai River valley floor and plain. Quaternary sediments are also not the same. Those of the Huai River valley floor were chiefly derived from the mountain areas in the west and south, with the mineral and chemical composition more complicated than these in the Yellow River plain. Genetic types are still diverse. Hence, these two areas each have their own distinguishing features and the natural environment of the Yellow River plain is of course not the same as that of the Huai River valley floor and plain. The Huai River area is more complicated than that of the Yellow River area in strata, fossils, water systems and Earth's surface development. Therefore, the Quaternary environments, hydrological characters and natural calamities of both areas are all not the same.

With the above-mentioned natural environments and natural resources, development of economy of this study area has its advantageous and disadvantageous factors. The advantageous factors are rich mineral resources, water power resources, industrial basis and agricultural base, which provides necessary conditions for economic development.

Especially, China's chief communication lines are passing through this study area, constituting the vital communication lines connecting with many areas at home and abroad. But there are some disadvantageous conditions. For example, the basis in the past is very weak; water resources have not been fully used, groundwater is still limited; agricultural production, industrial basis, financial resources and material resources can not catch up with those in coastal areas, thus having some influence on the social economic development at a high speed. However, the central plain area has a very long development history of human cultural, and in history, was for many times, the centre of China's politics, economy and culture. There are great numbers of labour forces and talent persons awaiting arrangement; and exploitation. If there are plans for macroscopic control and coordination, for giving full play to the market economy superiority and actively arousing all wisdom and strength, the economy of this area will be well carried out.

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