

区域矿产资源开发利用的 路径创新与协调机理

■ 任建雄 著



ZHEJIANG UNIVERSITY PRESS

浙江大学出版社

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图书在版编目(CIP)数据

区域矿产资源开发利用的路径创新与协调机理 / 任建雄著. —杭州: 浙江大学出版社, 2010.6
ISBN 978-7-308-07721-7

I. ①区… II. ①任… III. ①区域—矿产资源—资源开发—研究—中国②区域—矿产资源—资源利用—研究—中国 IV. ①F426.1

中国版本图书馆 CIP 数据核字(2010)第119348号

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责任编辑	杜希武
封面设计	刘依群
出版发行	浙江大学出版社 (杭州天目山路 148 号 邮政编码 310007) (网址: http://www.zjupress.com)
排版	杭州彩地电脑图文有限公司
印刷	杭州半山印刷有限公司
开本	710mm × 1000mm 1/16
印张	14.5
字数	203 千字
版次	2010 年 6 月第 1 版 2010 年 6 月第 1 次印刷
书号	ISBN 978-7-308-07721-7
定价	29.00 元

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浙江大学出版社发行部邮购电话 (0571) 88925591

内容摘要

矿产资源是国民经济与社会发展的物质基础，是实现可持续发展的根本条件。矿产资源的开发利用与社会发展紧密联系、相互促进又相互制约。由于矿产资源具有不可再生性、有限性和稀缺性的特点，从长远来看难以实现可持续开发利用。我国作为一个发展中国家，正处于工业化发展时期，对矿产资源具有高度依赖性，经济增长依赖于矿产资源消费同步增长，随着今后工业化的快速发展，大量消耗矿产资源是必然趋势，资源供需矛盾将日益突出，矿产资源能否可持续供应已成为我们面临的严峻问题。据国家发改委对我国 21 世纪初期 45 种重要金属和非金属矿产资源可供储量的保障程度测算，在现有已探明的 45 种主要矿产资源中，到 2020 年后，除稀土等有限资源保障程度为 100% 外，其余矿产资源均大幅度下降，有 19 种矿产资源将出现不同程度的短缺，其中 11 种为国民经济支柱性矿产资源，特别是石油、铁、铝、硫、磷等重要矿产资源缺口将持续扩大。在如此严峻的形势下，合理开发利用矿产资源将对我国的工业化建设起着关键性的作用。我国的基本矿情是，矿产资源总量大，但人均少、禀赋差，大宗支柱性矿产资源不足，尤其是在许多资源型地区矿产资源开发利用中存在着许多深层次问题，长期形成的粗放型增长方式和结构性矛盾尚未根本改变，因资源粗放开发，低效利用，导致矿产资源供应的瓶颈约束和生态环境的严重破坏。如何适应建设资源节约型社会的要求，破解资源开发利用的“困局”，探索资源型地区矿产资源开发利用的内

在规律性，保障矿产资源开发利用与生态环境相协调，是实现矿产资源可持续开发利用的迫切需要。这既是当前我国亟待解决的区域现实问题，也是资源型地区落实科学发展观要解决的重要课题之一。

本书试图依托可持续发展理论、复杂系统理论和产业组织等相关理论研究基础，从区域矿产资源开发利用的基本规律性入手，在分析我国区域矿产资源开发利用现状的基础上，立足于我国资源型地区的现实出发，提出区域矿产资源开发利用的路径创新的必要性及其本质内涵，从系统学角度解释区域矿产资源开发利用的内在联系及应协调的各种关系。基于系统熵机理，运用系统熵的边际效应，分析区域矿产资源开发利用的相变和临界突变调控机理与调控时机选择。最后，选取我国西部具有典型代表的矿产资源优势地区青海进行实证分析。本书取得的研究成果对我国资源型地区合理开发利用矿产资源，探索资源开发利用与经济发展、和环境保护相互融合的协调方式，提升资源型地区可持续发展能力，具有重要的理论依据和决策参考。本书的主要研究内容和章节如下：

第一章：首先，阐述了本文的研究背景和选题意义，界定了本文的研究对象。其次，就国内外矿产资源可持续开发利用的相关研究进行了系统的文献回顾，分析了这一领域研究的发展趋势和存在的问题。最后，提出了论文的研究内容框架、研究方法和创新点。

第二章：对相关理论进行评述，这些理论主要包括可持续发展理论、复杂系统理论和产业组织理论，通过梳理这些理论的发展演变、研究进展和基本观点，重点从不同角度揭示这些理论对协调机理的研究，为本论文研究建立理论基础。

第三章：首先阐述区域矿产资源开发利用的基本规律。

其次,通过分析我国矿产资源开发利用现状,从资源型区域角度出发,指出区域矿产资源开发存在问题的根源,在于长期以来我国沿用粗放型的矿产资源传统开发利用路径,导致资源短缺和生态环境恶化,以及因地区经济严重依赖地区资源优势所引发的“资源优势陷阱”,提出解决这些矛盾的根本途径必须进行矿产资源开发利用的路径创新。

第四章:重点揭示了区域矿产资源开发利用路径创新的本质内涵、特征和内容。指出路径创新是实现矿产资源开发利用与资源型地区生态保护有机统一与协调发展的根本途径。从多学科角度分析,路径创新过程也是一个系统结构协调、动态有序发展、资源合理分配、资源依次替代的协调发展过程,目的是为了促进矿产资源开发利用方式从无序向有序转变,从粗放失衡向集约协调转化,从重资源开发、轻环境保护向资源开发与环境保护协调发展转变。同时还指出,在该过程中,必须始终要以科学发展观为指导,符合科学发展观的要求,符合走新型工业化道路的要求。基于不同的演进研究视角,提出区域矿产资源开发利用的路径创新内容,主要包括生态创新、模式创新、产业创新和制度创新等四种方式。

第五章:首先,指出协调是科学发展观的一个重要内容,只有协调发展,才能实现地区可持续发展,并提出区域矿产资源开发利用的协调内涵,就是一个融协调与发展为一体的系统概念,由此构建了区域矿产资源的协调系统。对于区域矿产资源系统存在的问题,一旦系统行为偏离了可持续发展目标,都应协调为手段进行调节和控制。其次,提出系统协调是进行资源型地区矿产资源开发、利用、治理、保护等活动而确立的行为规范、基本依据和应遵循的一般准则。立足于系统学角度,探讨区域矿产资源开发利用应协调的关系,主要包括生态协调、利益协调、产业协调和

代际协调等问题。就区域矿产资源系统所处的某具体状态而言，它们是系统内部以及系统内外中应协调的薄弱环节、难点问题和关键因素，并应重点对这些问题进行协调。基于系统熵理论，分析了系统熵增、熵减的边际效应，确定系统相变和临界突变调控的基本思路和时机选择，依据协调的重点方向，可综合运用经济、法律、行政和科技手段进行必要的调控。

第六章：本章选取我国西部的资源型地区青海进行实证分析。作为我国重要的矿产资源富省之一，青海在区域矿产资源开发利用中具有非常重要的地位和典范作用，在过去的60年中，为国家及地区经济建设中做出了巨大的贡献。基于青海矿产资源开发利用历史现状，分析青海矿产资源开发利用过程中存在的各种协调问题，提出为实现矿产资源可持续开发利用，青海应从生态创新、环境创新、产业创新、技术创新和政策创新等方向进行努力。

第七章：总结全文，指出了本书的主要结论和研究中存在的不足，并对书中今后有待进一步研究的问题进行了展望。

研究区域矿产资源开发利用的路径创新与协调机理，涉及面广，内容及内涵丰富，要考虑的因素多而复杂，需要融合可持续发展理论、复杂系统理论、产业组织理论和创新理论等多学科知识。在依据有关理论的基础上，研究过程中综合运用了规范研究和实证分析相结合、系统分析与演化分析相结合、定性分析与定量分析相结合的方法。在大量收集调研资料的基础上，综合运用本书取得的研究成果进行了实证研究。总结全文，本书的主要创新有三点：

一是提出了区域矿产资源开发利用路径创新的指导思想、内涵和内容，指出路径创新是通过矿产资源合理开发和综合利用，实现矿产资源开发利用与资源型地区生态保

护有机统一与协调发展的根本途径。只有资源合理开发利用与生态保护协调发展,才能推动区域资源开发利用路径从传统、粗放、横向、不可持续的资源开发利用模式向现代、集约、竖向、可持续的资源开发利用模式转变。其中,路径创新主要包括生态创新、模式创新、产业创新和制度创新等四种基本方式,这些观点为资源型地区实践和探索可持续发展提供了新思路。

二是提出了区域矿产资源可持续开发利用过程的系统协调观和演化观。运用系统理论的思想,从协调的内涵出发,揭示了区域矿产资源开发利用的协调内涵,以及系统内部的相互关系和作用。在区域矿产资源开发利用过程中,应协调好系统内部以及系统内外中的薄弱环节、难点问题和关键因素,并重点把握矿产资源开发利用的生态协调、利益协调、产业协调和代际协调等问题。

三是提出通过分析熵增、熵减的边际效应,为区域矿产资源开发利用的相变和临界突变调控思路和时机选择提供依据,从理论上为区域矿产资源开发利用的路径创新和有序演化路径提供新的研究思路和方法。这从理论到方法都是一种尝试和探索,对今后指导类似问题研究具有积极指导和借鉴作用。

由于本书研究中涉及因素多而复杂,加之作者能力水平及资料数据的局限性,本书取得的成果只是初步的,本书中还存在有一些不足之处,许多问题有待今后在理论和实践研究中深化并逐步完善,并欢迎各位专家学者提供宝贵意见。

关键词：区域矿产资源 开发利用 路径创新 协调机理

ABSTRACT

Mineral resources are not only the material basis for the national economy and social development, but also the fundamental conditions for achieving sustainable development. The development and utilization of mineral resources is closely contact to social development and promote mutually, and make a direct impact on socio-economic sustainability. Mineral resources cannot be utilized sustainability in a long-term because of their nonrenewability, scarcity, and limit. But as a developing country, it is an inevitable trend that substantial consumption of mineral resources in China, is going through period when the rapid development of industrialization is supported by the massive consumption of its mineral resources. Therefore resource constraints will become a long-term bottleneck to our country's economic development as the rapid population growth, industrialized country's rapid development, resources supply and demand contradiction too increasingly overhung. According to the estimate of the National Development and Reform Commission for the level of protection for the reserves of the forty-five kinds main metal and non-metallic mineral resources of our country in early stage on the 21st century, by 2020, there only with the exception of rare earth, which will be reached the 100 percent level of protection, the others will be fallen substantially. There will have different degrees of shortage for nineteen mineral resources, and eleven of them are the basic mineral resources for the national economy, especially oil, iron,

aluminum, sulfur, phosphorus and other essential minerals gap will continue to expand. In such a grim situation, it will promote the level of industrialization construction if we can rational exploit and utilize mineral resources with decision-making. The basic characteristics of mineral resources in China are that there is a fairly complete variety of minerals, but the per-capita quantity of the resources is small, and there is an imbalance between supply and demand for some of the resources. Especially, there are still some contradictions and imbalance between regions with resource-based regions, serious waste and environmental pollution still exist in the mineral resources exploitation and utilization, and the consumption of resources is still serious waste. In order to adapt to the construction of resource-saving society and to break the predicament, it is the urgent need for sustainable development of mineral resources that how to explore the inner regularity, and how to protect mineral resources exploitation and utilization in harmony with the ecological environment. It is not only to be settled urgently for the current realities of the region in our country, but also this is to be solve one of the important issues of implementing the scientific development concept in resource-based areas.

Based on the theories of sustainable development, systematic, and industrial organization, the author explains the rule of the consumption circle of mineral resources in different stages of industrialization, discusses the development of mineral resources in our country, analyzes the urgent situation of an innovation path for mineral resources exploitation and utilization in the resource-based regions, researches on the coordination meaning of regional mineral resources exploitation and utilization, expounds the relationships which should be coordinated. And then, the author

try to put forward a way of using the marginal effect of entropy, to analyze the control mechanism and to determine when and how to control a path of mineral resources exploitation and utilization. At last the paper take a practical analysis regarding Qinghai as an example at last. For the results of this research has an important theoretical and practical meaning in the fields where can promote the rational exploitation and utilization of mineral resources in resources-based region, and improve its the capacity of sustainable development, research the coordination mechanism for exploitation and utilization of mineral resources, economic development, and environmental protection. The detailed structure of this paper is arranged as follows:

The first chapter introduces the significance and background of the paper, and the research object has be defined strictly in this chapter. Then based on a retrospect about the sustainable development of mineral resources in china and foreign countries, this chapter analyzed the direction of the future research and the shortage at present. It brings forward the content, the research methods and the innovation of this paper at last.

The second chapter reviews the related theories, which include sustainable development, systematic, industrial organization, and so on. It tries to reveal the coordination mechanism of these theories from different angles and to set up the theoretical foundation, by summing up the evolution, research progress, and the basic opinion of these theories.

In the third chapter, the paper firstly interprets the basic law of mineral resources exploitation and utilization, indicates its different characteristic that economic growth and consumer demand of mineral resources in different stage. Secondly, through

analyzes the development history and current status of mineral resources exploitation and utilization in China, the author analyzes the root of the problem exist in resources-based region, is that there follow a traditional path of mineral resources development and utilization with serious waste, leading to shortage of resources and deterioration of ecological environment, as well as heavy dependent on resources, and arising from the “resource advantages traps” in the end. So it is the fundamental that there should be carry out in an innovation path for approach to resolving these contradictions.

The fourth chapter reveals the essential connotation, feature and content of an innovation path among the regional mineral resources exploitation and utilization, and indicates that an innovation path is the fundamental approach to achieving the coordinated development between it with ecological environmental protection in resource-based areas. From the multidisciplinary perspective, it is a process which has a coordinated system structure, a dynamical and orderly development, a rationally allocated and alternated resources coordinately. Its intention is to change the mode of mineral resources exploitation and utilization, whose form from disorderly to orderly, transformation from extensive imbalance to intensive coordination, conversion from pay more attention for resources exploitation and pay the light of environmental protection, to persist in balanced development and coordination between mineral resources exploitation with environmental protection. At the same time, it also pointed out that in the process everything should always to be in line with the requirements of the scientific concept of development, to be taking a new road to industrialization. Based on the evolution of different theories, the innovation path in four ways is be proposed, including

eco-innovation, mode innovation, industrial innovation and system innovation.

The fifth chapter firstly points out that the coordination is an important element for the scientific concept, only the coordinated development of the region can be achieved sustainable development. Then it puts forward the ideal that coordinative connotation also means coordinative development for mineral resources exploitation and utilization, and there established a regional system model of mineral resources. For the system, once the system behavior deviated from the goals of sustainable development, it should be regulated and controlled by means of coordination. Secondly, it proposes that system coordination is the development direction and the stage target. It is also the conduct code, the fundamental basis and general guideline, which for mineral resources exploitation and utilization, and protection activities. At the establishment of the general principles of system coordination, those should be coordinated the relationship among it are mainly include ecological coordination, benefit coordination, industry coordination and inter-generational coordination problem. For there have the weak links, difficult issues and key factors, which should be the coordinated the system both inside or outside in regional mineral resources system, and should also be focus on coordination. Based on the control objectives, it should delay or reduce the entropy in the course of evolution by the control norms and the control regulation.

Qinghai Province, which is one of the resource-richest region in western China, is select for a case study in the sixth chapter, this chapter make a experiment on Qinghai area in its mineral resources exploitation and utilization, focusing on the coordination from the system. For it has played an important position and role

model for regional economic development in the past 50 years. The part introduces the history review and the basic status of mineral resources exploitation and utilization in Qinghai area, analyzes its problem where exist the coordination problems and the evolution problems in the progress. The author points out that Qinghai, is still in the evolution of low-level stage, has the traditional system characteristics. Around a system self-organization evolution path and the regulate ideas in order to achieve the sustainable development for mineral resources exploitation and utilization. Qinghai should make efforts to control a path from direction of eco-innovation, environmental innovation, industrial innovation, technological innovation, and policy innovation.

Based on summarising the central content of this paper, the seventh chapter outlines the main results and the problems, and briefly puts forward the direction of the future research in this paper.

It needs involved in wide range, rich content, and many complex factors, when study on an innovation path and coordination mechanism of regional mineral resources exploitation & utilization, among which should be integrated in many theories, such as sustainable development, complex system, industrial organization, and innovation theory. According to those relative theories, the scientific methods applied synthetically in the research, include the combining normative and empirical analysis, the systems analysis and evolution analysis, the qualitative and quantitative analysis. Then it applied synthetically research on the basis of a great amount of field survey. Summary of the full dissertation, the innovation reflects in the following mainly:

Firstly, the essential connotation and the content of an

innovation path among regional mineral resources exploitation and utilization is revealed, the author presents that an innovation path is the fundamental approach to achieving the coordinated development of mineral resources exploitation and ecological environmental protection in resource-based areas. And there has proposed an innovation path in four ways, including eco-innovation, mode innovation, industrial innovation and system innovation, which may provide a new idea for the practice and the exploration of sustainable development.

Secondly, in the part the system coordination concept and the system evolution concept are to be presented for the sustainable development of regional mineral resources exploitation and utilization. By using the ideal of system theory, a regional system model of mineral resources is established, form which reveals the coordinative connotation for mineral resources exploitation and utilization, and finds the mutual relations in an inner system. Those should be coordinated among mineral resources exploitation and utilization, are the weak links, difficult issues and key factors, which should be the coordinated both inside or outside the system, and it also should be focus on coordination of these issues, include ecological coordination, the relationship benefit coordination, industry coordination and inter-generational coordination.

Thirdly, the paper explained the control entropy and negative entropy for regional mineral resources system based on system entropy theory, the magrginal utility of the entropy and negative entropy is proposed, by which can provide a way how and when to choose a path. It can also provide a new research idea and method for study a innovation path and the orderly evolution path for regional mineral resources exploitation and utilization. It is an

attempt from theory to methods to study, and it will have a positive role of guidance and reference in the future research when meet the similar questions.

At the end of the dissertation, the main results, and the problems necessary for more explored are summarized. Because it involved in many complex factors, coupled with data limitations, as well as the limitation of the author's professional knowledge, some faults and deficiencies are inevitable, so any suggestion and valuable advice is welcomed from experts.

Key words: regional mineral resources exploitation and utilization innovation path coordination mechanism

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