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董申保文集

北京大学出版社

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谨以此书献给北京大学校庆100周年

《北京大学院士文库》编委会名单

序

最近，北京大学出版社告诉我，北京大学资源集团设立出版基金，资助出版一套《北京大学院士文库》，为北京大学的中科院院士和工程院院士每人出一本学术专著或学术论文集，以记载他们为祖国的科学技术事业所作出的贡献。北大出版社邀我为这套书写个序。

考虑到我较长时间在中国科学院工作，为科学家树碑立传，把他们的伟业记载下来并留传给后人，自然是我应该大力支持的事情。同时，我也曾在北大学习过，这些院士中有的就是我过去的老师，他们对我精心培育的情景，使我终生难忘；有的曾是我的同学或同事，我们之间有着非常深厚的友谊，他们为科学事业无私奉献的精神，给我留下了极为深刻的印象，至今历历在目。无论从工作上考虑还是从师生、同事情义出发，我都愿意为这本书写个序。

我认为，北京大学出版社出版《北京大学院士文库》这套书，是一件非常有意义的事。

首先，《北京大学院士文库》将为我国科学技术文献宝库增添新的内容。北京大学是我国一所著名的高等学府，也是世界上一所有影响的大学。它不仅为国家培养了大批栋梁之材，而且为国家提供了大批重要的科技成果，成为我国一个重要的科学中心。在这所大学里聚集了一批我国最著名的专家和学者，其中仅就自然科学而言，就有中科院院士和工程院院士 30 人。他们中既有学识渊博、造诣精深、蜚声中外的老专家、学者，也有一批成绩卓著，近年来为祖国科学技术事业作出过重大贡献的中年学者。他们在我国科学技术发展史上占有重要的地位，是我国科技大军中的中坚力量。现在，北大出版社把他们的科学技术著作收集起来，集中出版，无论是他们当年成名之作，还是新发表的学术专著和学术论文，都将为我国科

学技术文献宝库增添重要的内容。

其次，《北京大学院士文库》还将为我国科学技术事业的发展提供宝贵的经验。这套学术文库不仅完整地记载了这些学术大师的发明和创造，而且还生动地描绘了他们在不同历史时期为科学事业奋斗的历程。他们以亲身的经历、丰富的史料、独特的见解，深奥的思想，总结了科学技术发展的规律。例如，科学家最需要什么样的支持，在什么样的条件下最容易出成果等。这里既有成功的经验，也有失败的教训；既有成功的喜悦，也有受挫的苦恼。有的院士还从他们的切身感受出发，对我国科技人才的培养，科技体制的改革提出了很好的建议。这些都为我们科技管理部门和科技管理工作者，特别是为我国制定有关的科技政策，提供了很好的经验和借鉴。

第三，《北京大学院士文库》不仅是一套科学技术著作，而且是一套富有教育意义的人生教科书。这套文库详细地记载了这30位科学家的学术成就，也如实地记载了他们的人生经历。他们不仅学问好，而且人品好。他们的一生是在爱国主义旗帜下，为科学事业奋斗的一生。他们通过自己的勤奋努力，走了一条成功之路。他们的成功经验无论对年轻人，还是对一切有志于献身科学事业的人，都有极好的教育意义。

最后，我向这30位院士为祖国科技事业作出的贡献表示衷心的感谢！对《北京大学院士文库》的出版表示热烈的祝贺！也希望能有更多的科学家的学术著作和传记问世，因为科学是推动我们社会发展的强大动力。

中国科学院院长

周光召

1996年10月

序

北京大学出版社决定编辑出版《北京大学院士文库》，这件事情很有意义，我非常赞成。

从世界高等教育的发展看，教师是大学的核心，他们构成学校的基调。世界一流大学都具有很强的教师阵容，拥有一批世界公认的学术权威和知名学者。正是他们能够培养出世界公认的优秀人才。其中一部分毕业生能够成为当代世界政治、经济、文化、科学领域里的杰出代表。同时，他们能够取得重大的科研成果，特别是在基础研究方面，能取得具有划时代意义的科研成果。

在中国科技、教育界，院士是最高学术水平的象征。他们对国家科学技术的发展起着相当重要的作用。北大是拥有院士最多的大学，北大人一直为此而自豪。北大的几十位院士可分为两部分，一部分是老院士，他们在中国科学院成立之初就因为各自取得的成就而成为最早的一批院士（当时称学部委员）。这些老院士德高望重、学风严谨、蜚声国内外，为北大乃至中国的科学技术和文化事业的发展作出了奠基性贡献。他们当中有理科的王竹溪、叶企孙、江泽涵、许宝騄、周培源、胡宁、段学复、饶毓泰、黄昆、张青莲、黄子卿、傅鹰、汤佩松、李继侗、张景钺、陈桢、乐森珚等教授。北大的盛名，在很大程度上是与这些堪称大师的第一代院士的名字联系在一起的。这一长串院士名单，奠定了北大在中国学术界、科学界的地位。谈起他们，像我这样的后辈无不怀有敬仰之情。他们像一块块强力磁铁，吸引着一代代中华学子到燕园求学，在他们的教诲、指导、影响下，新中国急需的大批优秀人才源源不断地从北大培养出来，成为社会主义建设的栋梁之材。当院士文库推出的时候，这些老院士当中已有不少人离开了我们，但他们为北大、为国家建立的功勋，他们的英名将永远为人们铭记！

北大的学术生命是长青的，继第一批院士之后，80年代、90年代，北大又一批理科教师，其中许多是建国以后培养出来的，成为中

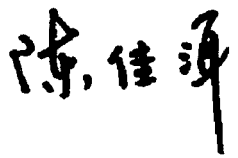
国科学院院士和中国工程院院士，他们可以说是北大那些与新中国风雨同舟、不畏清贫、不怕艰险、为教育和科学事业执着奉献的中年教师的代表，是今日北大的骨干依靠力量、学术中坚。

人类就要进入21世纪，北大也即将迎来建校100周年，当此世纪交替之际，北大雄心勃勃地提出：到21世纪初叶建成世界一流的社会主义大学。这是一个需要为之付出极其艰苦努力的、振奋人心的目标。以院士为代表的一流教师队伍是我们实现这一目标在学术上的最重要依托。有这样一支老年、中年教师队伍，再加上我们正在迅速成长起来的生气蓬勃、富有想象力和创造力、奋发向上、成为北大未来希望所在的青年教师，我们的目标是一定能够达到的。

院士们的工作成就，有很多都是在相当困难的条件下取得的，他们的奋斗精神和他们的成果一样，都是我们建设世界一流大学的宝贵财富和源泉。为院士出版文集，将他们的代表性学术成果或成名之作结集出版，是对院士们成就的肯定，也将使人们从他们的奋斗足迹中，得到某种启迪和鼓舞。院士文库将为我校的学术宝库增添重要的内容，成为哺育青年学生成长的极好教材。

北大出版社的决定得到了北大资源集团的热情支持，他们出资建立北大资源集团出版基金，资助院士文库的出版。我作为北大校长和一个院士、一个教师，要向北大出版社和北大资源集团为学术专著的出版和学校建设所作的努力表示敬意！

北京大学校长
中科院院士



1997年1月

MINERAL ABBREVLATIONS

Ab	albite	Gln	glaucophane
Act	actinolite	Gra	graphite
Acm	acmite	Gre	greenalite
Aeg-Aug	aegrine-augite	Grt	garnet
Alm	almandine	Gru	grunerite
Amp	amphibole	Hbl	hornblende
An	anorthite	Hem	hematite
And	andalusite	Heu	heulandite
Arg	aragonite	Hyp	hypersthene
Aug	augite	Ill	illite
Bar	barroisite	Ilv	ilvaite
Bt	biotite	Jd	jadeite
Cc	calcite	Jd-px	jadeitic pyroxene
Chl	chlorite	Kfs	K-feldspar
Cld	chloritoid	Ky	kyanite
Coe	coesite	Lmt	laumontite
Cpx	clinopyroxene	Lws	lawsonite
Crd	cordierite	Mag	magnetite
Cro	crossite	Mic	microcline
Czo	clinozosite	Min	minnesotaite
De	deerite	Mrb	muscovite
Di	diopside	Ms	magnesioriebeckite
Dol	dolomite	Na-amp	sodic amphibole
Ep	epidote	Omp	omphacite
Fe-gln	Ferro-glaucophane	Pie	piemontite

Phn	phengite	Stp	stilpnomelane
Pl	plagioclase	Tc	talc
Pmp	pumpellyite	Tr	tremolite
Prp	pyrope	Tur	tourmaline
Qtz	quartz	Wai	wairakite
Rbk	riebeckite	Win	winchite
Spn	sphene	Zo	zoisite
Sps	spessartite	Zus	zusmannite
St	staurolite		

目　录

THE METHODOLOGY OF THE RESEARCHES OF GEOLOGICAL SCIENCE—PETROLOGY AS AN EXAMPLE[①]

Abstract: Geological phenomenon represents a kind of eternal motion of matter in nature that embodies different geological processes with immense space and eternal flux of time and shows inter-connection with each other. Being controlled by this uniqueness, the study of geological science belongs to a higher form of motion of matter with its own geological constraints, and cannot be replaced by the lower form of motions, yet, their physico-chemical constraints are necessities to reveal the innate nature of geological process.

The study of geological process relies fundamentally on the observation in nature, whereupon the method of approximation is generally admitted as the working principle, which constitutes the alternations from inference to observation in approaching the truth. Herein, the abduction adopted by Peirce. C. S. as the inference to the best explanation both by inductive and deductive methods, is best suited to this approach.

In the history of the investigation of geological science, the controversy of the conceptual idea generally presents among the important topics with vigour. In reality, this debate largely images the opposites of the contradiction of the geological process, and proceeds to elaborate them to a new unity for further debate until reaches its verity. It is considered as the impetus in promoting the development of geological science. Some examples of petrology are also discussed.

Key words: motion of matter, petrology, law of unity and opposite, method of approximation, uniformitarianism.

I. PREAMBLE

The researches of geological science aim at the elaboration of the geological processes in nature, the investigation of their inter connections and mutual constraints in order to guide the necessity of the existence and the

① Published in *Proc. 30th Intern. Geol. Congr.*, Vol. 26, pp. 225~235.

living conditions of human being throughout the whole world.

Geological science is a kind of natural science wherein theories and practice are closely connected. Its researches can only be done by bearing in mind that they belong together and supplement each other. Since the very beginning of the historical records of mankind, narrations on the floods, earthquakes, volcanic eruptions as well as ore findings had abounded in various countries and became one of the pillars of the antiquities with pristine simplicity in dialectics notably in Greek's philosophy. These are the vivid streams converging into the founder of geological science that Lyell (1830) first brought sense into the forbidden zone enmeshed in theology by substituting the realistic principle for a slow transformation of the earth.

As a whole, feedbacks of practice-theory-practice prevail alternatively through the progress of the history of geological science since the Lyell's time in the establishment of diverse branches of geological science during the lower half of nineteenth century up to the modern researches on the dynamic perspectives of the inter-connection between different spheres of the earth. The repeated processes of observation and inference, analysis and synthesis, induction and deduction, all reverting to practice and theory, invoke the recognition of change and transformation of quantity and quality of each geological process at a comparative high stage of development, and will attain the full development from casuality to causality of theory of knowledge in the future. If we make a survey on the development of history of geological science, we may find that there has been a great progress in a broad field encountered from the surface features to the nature of mantle and their crust-mantle action; from continental crust to oceanic crust and their interaction as to form the theory of global tectonics; from temperature and pressure evaluation of the origin of rocks to the thermal perturbation and relaxation of heat flow under depth with the initiation of grand tectonics; from static observation mainly qualitative to quantifying geodynamic processes, thus leading to the gradual approach to the very essence of the geological processes in nature. The mighty advance of the mode of geological thinking during century has hitherto been the guide of ever-increasing welfare of nations and averting the unduly loss of people's lives. If a nation that wants to keep pace with

modern industry cannot possibly manage without geological theories flourished from its own land.

Ⅱ. THE FORM OF MOTION OF MATTER OF GEOLOGICAL PROCESS

Geological science embodies the totality of earth as its object. The main objective reality of the investigation lies upon the geological processes operated within the accessible part of the earth from lithosphere to atmosphere. By geological process, it is understood as the natural process operated by the motion conceived as the inherent attribute of inorganic matter. It comprehends various modes of action, broadly named as endogenic and exogenic actions that exist through immense space and endless flux of time showing multiple geological constraints from each other and passing away as eternally moving and ever-changing matter in accordance with some natural laws. Based on this uniqueness, studies can only be done through observation in nature in attempting to understand the scattered geological records performed by the grand laboratory of Nature that exists only as the ancient relics partly disintegrated by the successive geological events and obliterated through weathering. The inadequacy of observation is then supplemented by experiment and relevant principle to form inference and is returned as feedback to nature to verify the results for further investigation. Thus the method of approximation that represents the gradual passage for the recognition of the nature of geological processes is generally adopted as the working method that essentially differs from those of basic sciences.

Geological process is characterized as the higher form of motion of matter in a series of forms of action such as magmatic, metamorphic, diagenetic, orogenic, weathering etc. Each of them possesses its own inherent attribute, that forms bodily the geological science as a whole, and that interacts with each other during the ceaseless motion. The geological process expressed as the higher form of motion of matter is obviously different from the simple or lower form of motion of physics and chemistry, and can neither be treated explicitly as the functional relations of physical variables nor replaced by the latter. Geological constraints have became