葉連俊文集

盧嘉錫題

科学出版社

1993

叶述俊教授近照

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1．从叶连俊教授已发表的一百余篇论文中选择三十篇汇集成本文集，已出版的专著没有收入。文集后附有叶连俊教授的全部论著目录。

2．收入文集的这些论文是在半个世纪期间先后发表的。编辑文集时尽可能保持文章的原貌，例如文种、计量单位、地层单位、地名、译名以及参考文献等。编辑时主要改正了少数过去印刷的错别字，另加了一点必要的注解，对编排格式作了必要的统一。

3．部分论文中图版、插图有删节。

1．承全国政协副主席、中国科学院前院长卢嘉锡教授为文集题写书名和作序，中国科学院副院长孙鸿烈教授对文集的编辑给予热情关注，仅借此机会一并表示感谢。

《叶连俊文集》编辑委员会

1992年5月18日

序

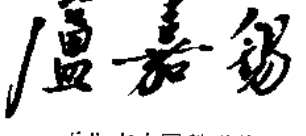
叶连俊同志是我的老同事、老朋友。在我主持中国科学院工作时，他当选为地学部常务委员和常务副主任，常常在一起研究工作，讨论推动地球科学发展的方方面面。他给我非常强烈的感受是对科学事业的高度责任心。他的一些重要意见反映出对于我国科学发展的独到见解。我和他是同一代人，我很怀念我们一起共事的那一段时光，尽管各自的学科专业不同，但在发展我国社会主义科技事业上是完全志同道合的。

叶连俊同志从事地质科学研究已经半个多世纪。他1933年入北京大学地质系学习，师从李四光、谢家荣和葛利普等著名地质学家，1937年毕业。大家都知道，那时是中国人民蒙受巨大屈辱的时代，大片国土沦丧，人民处于水深火热之中。那个时候，在中国发展科学很难，而发展地质科学更难，因为各处盗匪为患，社会不宁，交通不便，地质调查工作步履维艰。刚刚踏上工作岗位的青年叶连俊怀着一颗抗日救国的赤子之心，不避艰险，在中南、西北和西南地区，特别是在龙门山和秦岭山脉这样一些著名山系中，风餐露宿，攀山涉水，开始了他早年的、但却是取得卓越成就的地质调查和研究工作。1945—1947年，他赴美考察。1947年底，尽管当时神州大地上内战烽火弥漫，但在艰苦奋斗中的叶连俊看到了前途和光明的曙光，毅然放弃在美国的优越生活待遇和研究条件返回祖国，并以满腔热情迎来了新中国的诞生。

新中国给步入中年的叶连俊增添了新的活力。他满怀激情地承担了社会主义建设和地质科学发展的各种有关任务，创办了我国第一个沉积学研究室。他在四十多年的时间内足迹遍布全国各地和世界的许多地方；耄耋之年，仍深入到新疆北部山区以至百多岁乡僻壤从事地质观察。他对我国的锰矿、磷矿、石油、铀矿等资源作了大量卓有贡献的研究。他所提出的外生矿床陆源汲取成矿论、成矿时代的地史意义、华北地台沉积建造及沉积矿床机械富集成矿论等受到国内外科学家的重视。他现在年近八旬，仍亲自率领一批中青年学者开拓当代沉积学的前沿——生物成矿作用的研究，继续在科研第一线拼搏。

叶连俊同志对地质学和中国地球科学事业的发展作出了卓越的贡献。他在青年时期刻苦求知、勤于思考、扎实工作，以振兴中华科学为己任；在他取得杰出成就并享誉中外之后，依然孜孜不倦、持之以恒，不断地在科学上创新和攻坚，并以言传身教、严格要求的科学态度培养了一批又一批的中青年，其中有许多已成为优秀的学科带头人。叶连俊同志坚韧不拔的科学精神，在我们科技界当前正在进一步全面贯彻执行“经济建设必须依靠科学技术，科学技术工作必须面向经济建设”的战略方针和努力攀登科学技术高峰的总要求的重要时刻，特别值得提倡和学习。

《叶连俊文集》的出版，更便于读者们了解叶连俊同志对地质学的贡献，因而是一件可喜可贺的事。《叶连俊文集》编辑委员会的同志们要我为文集作序，我很高兴地应允下来并写了以上的话。明年适逢叶连俊同志八十华辰，我借此机会向他表示衷心的祝贺“老骥伏枥，壮心不已”，我想以此与叶连俊同志共勉。



于北京中国科学院

1992年8月

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（京）新登字 092 号

内 容 简 介

叶连俊教授是我国著名的地质学家和沉积学家，对地质学和沉积学的发展作出了杰出贡献。本文集由 30 篇有代表性的论文汇集而成，内容涉及沉积学、区域地质学、大地构造学等诸方面。这些论文反映了作者对中国沉积岩层和沉积矿层的形成与分布、演化与变革的自然规律的探索总结，从中可以看到老一辈地质工作者勤奋治学、勇于实践、锲而不舍的求实精神。本书可供地质矿产工作者及大专院校有关人员参考。

叶 连 俊 文 集

责任编辑 胡晓春

科学出版社出版

北京东黄城根北街 16 号

邮政编码：100707

北京市怀柔县黄坎印刷厂印刷

新华书店北京发行所发行 各地新华书店经售

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1993 年 3 月第 一 版 开本：787×1092 1/16

1993 年 3 月第一次印刷 印张：25 3/4 插页：13

印数：1—600 字数：597 000

ISBN 7-03-003334-5/P·651

定价：40.50 元

目　　录

THE NATURE OF THE LUNGSHAN MOVEMENT IN SOUTHERN KANSU PROVINCE*

INTRODUCTION

In the year 1920, while carrying out a reconnaissance in northern Kansu Province, Dr. W. H. Wong (1927) noticed in the field and later announced the importance of the diastrophism after the Tertiary red beds, to which the name Lungshan movement was first introduced. Although knowledge about the Mesozoic geology in China was meager in his time, Dr. Wong was able to describe vividly the nature of this crustal movement and correlate it with the post-Siwalik disturbance of India. But since then, this movement was scarcely referred to.

In the summer of 1940, we had ample opportunity to make critical observation on the geology of the Western Tsinlingshan in southern Kansu Province. Everywhere, when we travelled along the margins of the Tertiary red basins, we saw the red beds either used to be suddenly tilted up and dip away from the surrounding ranges or the latter bodily thrusted upon those red beds; to which a young Tertiary age was ensured by most of the Chinese palaeontologists and experienced field geologists.

We wish to express our gratitude and thanks to Dr. T. K. Huang for his illuminating criticism and suggestions. To Mr. S. H. Lee we are also much indebted for his criticism and careful reading of the manuscript.

In the following paragraph we wish to make a short account to the nature and distribution of the movement cited above.

STRUCTURAL AND SEDIMENTARY CONTROL OF THE TERTIARY RED BED (THE KWEITÉ SERIES) AND ITS GEOLOGICAL AGE

In the geological history of Kansu, especially southern Kansu, there is a very much pronounced crustal disturbance and igneous activity between Permian and the Mesozoic coal-bearing formations, the latter being known as the Mienhsien Series is determined as Rhaetic or Liassic in age(Chao and Huang, 1931). We term this

* Published in Bulletin of the Geological Society of China, Vol. XXII, Nos. 3—4, pp. [illegible] (1942)(With S. C. Kwan).

movement "the Kansu Revolution."[1] During this revolution all the Palaeozoic and older formations were undergone a thorough regional metamorphism, and being much compacted and distorted. Later on, intermontane basins were probably formed along structural weak zones. Into these depressions there were the Mesozoic and Cenozoic "molasse" deposited. To these, the best example is the Southern Kansu Basin[2], lying between the northern and southern Tsinling Range, which was already configured by Mr. Y.T. Chao and Dr. T. K. Huang in their Atlas for the geology of the Tsinlingshan and Szechuan (Chao and Huang, 1931), and had been steadily mapped by us. The other, and still the larger one, is the Central Kansu Basin[3], lying between northern Tsinlingshan and Chiliensban.

The Mesozoics can be divided into the Mienhsien Series of the Rhaetic Jurassic age and the Tungho Series of Jura-Cretaceous or upper Jurassic age(Chao and Huang, 1931).

The Tertiary Kweitê Series is widespread and uniform in rock character, in which in the Central Kansu Basin at Lihsien[4] we collected a beautifully preserved *Stegodon* cf. *orientalis* Owen[5], which indicates an upper Pliocene age. Almost the same kind of material was collected also by von Loczy in the same basin near the Tienshui[6] district and some dwarf-typed Ostracods were also collected by us in the latter locality. Besides these, vertebrate fossils which indicate a Pliocene age were collected by von Loczy in the Kweitê Basin (Loczy, 1898) and by P. L. Yuan between Kungchang[7] and Weiyuan[8] districts. In the Kaolan-Yungteng area C. C. Young and M. N. Bien collected a lot of Miocene-Pliocene vertebrate fossils in the Kweitê Series (Young and Bien, 1936—1937) and by aid of certain structural habits of different parts of the formation encountered in the field, Young and Bien were able to divide the Kweitê Series into two parts, the Kansu formation of upper Miocene to Pliocene age in the upper and the Kuyuan formation of early Tertiary in the lower.

The Mesozoic formations are all of river-flat or lacustrine environment of deposition. They are separated by unconformities which can be best observed in the Southern Kansu Basin.

The Kweitê Series lying unconformably upon the Mesozoics is composed of mainly breccia beds, loose sandstones, sandy loam, etc., all ill-cemented and reddish in color. The pebble constituents of the breccia beds are, without exception, subangular in form, different areally in rock composition, and the sandstones usually gritty. All of these indicates its piedmont or piedmont flat environment of deposition. Soluble as limestone, unstable as feldspars all can be found in it; hence it is probably

1) This movement is very important in the geology of the Western Tsinling region, it will be stated in a more detailed form by the same authors. 2) 陇南盆地。3) 陇中盆地。4) 礼县。5) Name due to Dr. C. C. Young。6) 天水。7) 武昌(陇西)。8) 渭源。

deposited under a somewhat arid or semi-arid climate. Their strata are usually lens in form. and all loosely arranged. The Kweitê Series usually rests directly upon its rugged floor surface of the Palaeozoic metamorphics, or we may say, they are dovetailing with each other. Sometimes, the Palaeozoics may be bulging out of the Kweitê Series and directly in contact with the younger formations like the eolian loess. Only to a very few occasions, are the Mesozoics present between the Palaeozoic and the Tertiary.

The thickness of the Kweitê Series varies from place to place, from less than 200 m to more than 1 000 m.

DESCRIPTION OF STRUCTURE ELEMENTS ACTUALLY OBSERVED

(a) Chulinkou[1] Chulinkou is a little village about 60 li SE of Liangtang[2] district at the southern margin of the Southern Kansu Basin. Here we saw the Permo-Carboniferous Liangchihszu Coal Series together with its granitic injections bodily thrusted northward upon the Tungho Series. The thrust plane is trending NWW-SEE, and has a plunge about 30°. Exactly along the fault plane there are beautifully feather joints developed. The dip strike of the Tungho Series is N 60° W; 35° S and that of the Liangchihszu Coal Series is N 60°E; 30°S. The extension of this structure can also be seen at Chiangchienchieh[3].

(b) Yangchiayen[4] Yangchiayen is a small hill spur just a little east of the Hengchuan village[5] which lies between Chenghsien[6] and Huihsien[7]. It lies also to the southern margin of the Southern Kansu Basin.

Here we saw the thin-bedded Permian limestone thrusted northward upon the flat-lying Kweitê Series. A small overturned drag-fold was resulted in the Permian limestone with its axial plane inclined to south. The thrust plane has a trend approximately E-W and a plunge more or less 10°.

(c) Chishan[8] Chishan is a small E-W range lying about 30 li south of the Chenghsien district. Here the Kweitê Series lies unconformably upon the Permian limestone. At the southern foothills of Chishan, this Permian limestone was bodily thrusted, together with its Tertiary cap, northward upon the Kweitê Series lying beside this transported block. The thrust plane is almost horizontal. Outliers of dissected remnants of this transported Permian limestone were seen at two places capped the Kweitê Series.

(d) Chianglowchen[9] Chianglowchen is a station of the Tienshuang highway[10], lying about 40 km NE of Huihsien. From Chianglowchen going northward about

1) 朱林沟。2) 两当。3) 将军石。4) 杨家岩。5) 横川镇。6) 成县。7) 徽县。8) 雉山。9) 江洛镇。10) 天双公路。

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3 li, we attained the foot of northern Tsinlingshan. There we saw, from a distance about 50m apart, the permian thin-bedded limestone thrusted northward upon the Kweitê Series, that in turn unconformable upon the former. The permian thin-bedded limestone yielded with north directed drag-folds. The thrust plane has a trend roughly E-W, and with a plunge about 30°.

(e) Yuantishan[1] Yuantishan is a small hill-spur lying about 5 li south of the Lihsien district. Here we saw a series of silicified limestone and green phyllitic schist series of probably Devonian age capped the vertical or even overturned Kweitê Series. The metamorphic series, although twisted at places, dip gently northward in roughly concordance with the plunge of the thrust plane.

(f) Hsiacheng[2] Hsiacheng is lying beside the upper Taoho[3], about 100km south of Lintao[4] district. Just beside the village there we saw the Permian limestone (with *Lophophyllum* and *Neoschwagerina*) repeatedly thrusted northward upon the Kweitê Series, which is gently folded between Tupai[5] and Hsiacheng. The thrust plane is also striking E-W and mylonitized rocks can be seen.

(g) Meichuan[6] Meichuan is a populous village lying about 20 li north of Minhsien[7]. Here, as outcropped along the river bank of Taoho, we saw the Kweitê Series folded together with its metamorphic basement to form a symmetrical syncline. Near the contact, in the two limbs of the syncline, the phyllites and slates of the metamorphic basement were twisted and drag-folded, and with their axial planes plunge toward the axis of the major structure.

NATURE OF THE MOVEMENT

From the descriptions made above, it would readily realize that, in spite of its flat-lying habit in the central part of the basins, the Kweitê Series is used to be tilted, folded, and thrust-faulted everywhere along the basin margins. The structure lines are all striking roughly eastwestward, and approximately in concordance with the longer axes of the basins. All of these "marginal thrust" is of the low angled type and all directed northward. Hence it is clear that the crustal deformation during that time was performed by a kind of tangential or compressive stress acted from the south. But, as what we have repeatedly declared, the thrust and tilting are always located near the basin margins, where the "rigid" rocks of the surrounding ranges are in intimate contact with the loosely cemented Kweitê Series. Now, if there be any radial or gravitational adjustment occurred in this case, the mass of the surrounding range would be slumping down and creeping over the formations in the basin, because of their difference in competency and potential energy. But if this be the case, it would be hard to interpretate the formation of the drag-folds as seen

1) 圆的山。 2) 硖城。 3) 洮河。 4) 临洮。 5) 土牌。 6) 梅川。 7) 岷县。

in the Meichuan section. Still, if slumping and creeping were the causes of formation of the marginal thrust, they should all invariably direct toward the center of the basin, instead of northward prevailingly. Hence we should naturally conclude at this movement, that the nature of the Lungshan Movement is of compressive or tangential, and not of gravitational adjustment. Although the compression may be strong yet the stress can be eliminated gradually by internal adjustment of the loosely arranged rocks like that of the Kweitê Series. Hence away from their margins, in the central part of the basins the Kweitê Series is used to be flat-lying irrespect to their highly disturbed correspondents near the basin margin, because there the stress is expressed only by dilatation. The Kweitê Series usually makes dovetail with its metamorphic basement and the strata, usually lens in form, are probably other obstacles to the propagation of the crustal stress.

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近世沉积学之领域及其演进*

——纪念朱森教授——

绪　言

贫困的中国科学界失去几个成熟的人才真是最不幸的事，最近的地质界可算正是遭逢了一个舛错的命运，连着折了数员大将！其中朱森先生及计荣森先生都曾带领作者作过长期的野外工作，受到教益非常大。两位先生治学都非常谨严，有汉儒之风，而朱先生之诲人不倦的精神，尤是推进中国地质科学不可少的一支柱石，谁知竟方在壮年便被恶劣的社会环境所吞食了，令人能不怆然而泣下！1939年入川之初，适逢先生将起身去川北研究龙门山之地质构造，常时黄汲清先生便派我随他去学习。在野外朝夕相处了四个月，朱先生之开诚施教，真是无以复加，尤其对于构造地层方面的许多基本原理，皆在这个地质胜地得到了实际的领悟。在江油县附近我们发现了下石炭纪的地层里面有一层砂岩，里面的砂粒都是圆形的，朱先生便藉以讲解其在地层上的重要性，谓其有两种可能：一为风成，一为海滨沙滩，因为其上下的岩层都有海产化石，故大半属于后者，并谓沉积学是最有发展希望的学问。我们坐在一家夕阳照着的村屋之外谈着，每个字都给了我很深的印象。后来离开江油搬往去城十里的窦团山工作，巍峨的山顶是由白垩纪城墙岩砾石层造成的，雄壮的地形使人于枯燥之中发生了兴趣，朱先生便命我作一次详细研究的试验。我于相当距离内各取一10平方公尺之面积作为研究的对象，详细记录它的胶结情形，砾石形状，成分排列，及砾石与胶结物之量比等等，所得之结论以为城墙岩为一湖滨沉积物，其沉积处所恰为古河的入口，并由之而推论城墙岩与其下面地层可能有不连续关系存在，觉得也许可以代表一个地壳运动（多半与黄汲清先生的意见相同），朱先生对于这个说法很赞同，这是我第一次对沉积学的试验观察。后来回到重庆，我仍随朱先生在重庆大学作室内工作，但是那时所做的是学习鉴定或描述腕足类化石。有一次到朱先生府上去玩，得知丁童豪富（Twenhofel）所著的《沉积论》是沉积学的一本重要典籍，后来回所后便总趁公余之暇把来细读，渐渐对沉积学多明白了许多，而知其重要之所在。这数年来每次见到关于沉积学的文章总拿来细读。而今朱先生竟倏然逝矣，思之汹涌。谁还是我释疑指迷的师表！

沉积学的定义

沉积学（Sedimentation or sedimentology）也称沉积岩理学（Sedimentary petrology），

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* 本文载于《地质论评》7卷（1942），6号，299—311页。

简单的说，就是以沉积物或沉积岩(Sediments, both lithified or in loose form)为研究对象的一门科学。它的研究范围大致可以分成三方面：即(一)环境，(二)年代，(三)领域或供给沉积物质之面积；或一切能籍以帮助了解沉积物或沉积岩之生成历史及其经济意义者皆得为研究之对象。Sediments 一字原来的意思是液体中悬浮物质沉后所成之固体物质。童豪富氏则将其字义略为引伸，将未经沉淀还在悬浮状态中的东西也算是 Sediments 之一种。

沉积学之演进

沉积学完全是一门新兴的科学，是随着近世纪石油工业的发达而蓬勃起来的。直到19世纪中叶梭尔博(Henry Clifton Sorby, 1826—1908)奠定了火成岩石学的基础以后，沉积岩才渐渐有人去注意，但是它的发轫却是很渺远的。胡腾(James Hutton, 1726—1797)、莱伊尔(Sir Charles Lyell, 1797—1875)的不变说(Doctrine of uniformitarianism)的基础即建筑在沉积学的上面，在那个时候已经知道地壳之主体是由沉积岩造成的，并且知道了几个造成沉积岩(Sediment or sedimentary rock)的重要因子是风、水、冰的搬运与侵蚀作用。

甲、启蒙时代

远在16世纪的初叶，意大利人维尔(Vinci, L., 1452—1519)已经知道河水在流速处为侵蚀，流缓处为沉积，携地面侵蚀之所得以沉积到海里。又知道泉水流地中，溶其盐，注于海，天长日久故海水为咸的。丹麦人史丹诺(Nicolaus Steno, 1638—1687)说明了使沉积物沉积下来一个最重要的因子是重量的关系。其在岩层中之相互关系皆应与重力定律(Law of gravity)相符合。史氏并已经知道作结晶之生长及形状的观察。物理学家波义耳(Robert Boyle, 1627—1691)告诉我们海底是宁静的，不受风浪之影响。约翰伍德华(John Woodward, 1665—1772)教授在他的名著《地球之历史纂录》(An essay toward a natural history of the earth, 1695, London)中告诉我们砂岩、页岩、石灰岩的关系，并且告诉我们沉积岩中所含化石之意义，是我们现在漫话沧桑的重要根据的启发。

由上面的叙述我们可以知道从16世纪到18世纪的期间里沉积学的研究多半是一种启发性质的事实之观察与解释，只有向大自然里去拾取，并没有谁再去用科学的工具去切切实实的寻根究底。所以这一段的时间可以叫做沉积学的启蒙时代。

乙、革新时代

到了18世纪的末叶一直到20世纪初年的一个期间里可以说是一个革新的时代。许多物理的、化学的知识，都被采用着，并且开始了定量的研究，显微镜的研究，同时试验的工作与技术也渐渐开始了。在这个时期内沉积学好象往两方面发展，在欧洲大陆方面，多半偏重于矿物方面的研究，象 Anten, Boswell, Brammal, Chelussi, Clerici, Deverin, Davies, Doyen, Fleet, Gilligan, Holmes, Milner, Rastall, Shannon, Versey, Wetzel 等等都是卓有贡献的。其中更重要的尤推 Boswell, Holmes, Hatch, Milner, Rastall 的工作，他们那些论文多半是在1915年以后才发表的。在新大陆方面的工作以

Goldman 对于 Maryland 的白垩纪的研究最为重要，此外 Edson，Reed 等人也都有重要的贡献。关于这一方面的研究无疑的还要推举梭尔博为奠基的人物，尤其是 1879 年及 1880 年他在英国地质学会的那两篇理事长演说更是重要。自此之后，薄片与利用显微镜的研究方法的便利及重要才渐渐被采用而普遍起来。其后关于沉积矿物的研究便如雨后春笋日有进展。到了 1902 及 1909 H.H.Thomas 博士所发表的工作对于研究方法及结果的解释都已有长足的进步，而颇现代化了。此外还有两篇划时代而不可不读的大文章：其一就是J.E.Marr教授在 1905 年伦敦地质学会宣读的理事长演说，题目是"沉积岩的分类"(Classification of sediments)。另外的一篇就是 1911 年 W.W.Watts 教授在该会的理事长演说，题目是"Geology as geographical evolution"。在美国或亚洲方面，则多偏趋于沉积历史及沉积环境的研究，从事的人往往不一定是地质家，许多工程师甚至军官也都参与其事。美国哥拉斯科大学的地质教授 Henry Darwin Rogars(1809—1866) 在 1840 至 1842 的三年中间发表了他对于阿帕拉契山煤层的研究的文章，他分别注意到烟煤与无烟煤。军官 William H. Side(1810—1873) 首次对密西西比河三角洲的地质现象加以观察。到了 1861 年英人 Andrew Atkinson Humphreys (1810—1833) 与美人 Henry Larcon Abbot(1831—1927)共同发表一篇文章，对密西西比河之搬运的能力作了定量的研究。他们的结论是：(一)所携带物质之重量与水之重量之比为1:1500。所携带物质之体积与水之体积之比为 1:2900。(二)设该河之年流量为 19.5 万亿立方英尺，则其每年所携至海峡之沉积物质为 8125 亿英磅，可沉积成面积 1 平方英里厚 241 英尺之沉积层。(三)除悬浮质外在河底滚动前进之物质亦占相当数字。英人 Everest, Robert (c. 1805—c.1875) 在印度居留了大半生，因地利之便他对河流搬量也作过定量的研究。喜马拉雅山的大高峰爱非勒士*便由此公得名。大生物学家达尔文(Charles Robert Darwin. 1809—1882)对于珊瑚礁及珊瑚岛的原始贡献最大，美人John Strong Newberry(1822—1892)最初作沉积轮回之观察与研究。万国地质学会的创始人大古生物学家郝尔(Joames Hall, 1811—1898) 告诉我们在古生代时的海洋的物理环境。德人 Carl Ochsenills (1830—1906) 对于岩盐成因的研究解决了地层上一个奥妙而有趣的问题。美国耶鲁大学农学教授 William H. Sidell (1810—1873) 由试验的结果告诉我们沉积物在盐水溶液中的沉积速率远较在普通天水中之沉积率为速，这是沉积学上一个很重要事实的发现。美人 Raphael Pumpelly(1837—1923) 在 1863 年受中国政府之委托调查北京以西一带之煤田，其后并往华北各地及蒙古、西伯利亚等地调查，他首先对中国华北最重要的黄土地层作实地的观察。但是他的见解是错误的，其后李希霍芬氏来华调查才正式的告诉我们黄土是风成的。其后杨钟健、袁复礼、维理士、巴尔博等对此皆有重要的观察。与溶之对于北京风尘的研究可以说是从另一方面去研究黄土，是一个重要的工作。最初大家多半以为黄土只分布于华北一带，最近连俊根据西秦岭的观察知道黄土确已越过秦岭了，并且知道黄土所达的高度，大半没有超过海拔二千公尺。

丙、蓬勃时代

由于上面的叙述我们知道在 19 世纪的末叶和 20 世纪的初年的一个期间里沉积学的

* 即珠穆朗玛峰。——编者

研究真是一日千里，主要的原因自然还要归功于显微镜的应用。那时候大家所注意的多半偏重在重矿物的研究或是沉积岩(即所谓水成岩)的研究。但是沉积岩的来源或成因是备极错综复杂，它不象火成岩之成因比较单纯是属于一元或二元的。沉积岩是由许多分离的分子、原子或颗粒聚集而成的，从颗粒的聚集到完全成为沉积岩，中间经过搬运、停积、细菌、渗透、压力、动力、热力、固结、天水沥滤等等物理的、化学的、生物的、地热的、风化的许多作用交织着。所以要单凭几个薄片的研究，或是一些重矿物的研究而希冀要明瞭某一种沉积物的历史或其经济意义，那真是难乎其难。而沉积学家开始觉到知识的贫困了。由于这种苦闷的结果，使许多沉积学家的研究的手段不得不重新估价一番，而对于近世沉积物(Recent sediments)的研究因以蓬勃发达起来，想着用新的道理去解释旧的事实。近五十年来关于这方面的著述真是多得不可胜计，除了地质的书籍以外，又多半分散在关于工程、物理、胶体化学、土壤、统计、陶瓷等的杂志中间。这种兴趣的广泛与著述的宏多，充分证明与沉积学有关的科学之多、与其应用之广。因其如是，所以沉积学发展到了现在这个阶段，虽然已经有特具的技术与方法，但还在日新月异朝变夕改的中间。譬如关于野外的采样，虽然苟德曼与海维(Goldman and Hewett)二氏所拟的步骤被采用很广，但那终究是手续太多，令人难于记忆。反正取样时只要记着我们的目的是要明白它的历史和经济意义也就够了。关于室内试验的步骤 Milner 的方法与 Krumbein 和Pettjohn 的方法都很好，但终究也不是一成不变的。

近二十年来沉积学的研究一方面因为技术的日臻完美，一方面受了石油地质之发达的影响，真是日新月异的发展着。尤其在美国更提倡不遗余力，石油界每年拿出一大笔钱费在这上面。石油地质学会(American Association of Petroleum Geologists)下面的经济古生物及矿物部(Society of Economic Palaeontologists and Mineralogists)在 1931年开始办了一个《沉积学杂志》(Journal of Sedimentary Petrology)，专载关于沉积学的文章。美国翰林院地质地理部下面的沉积学会(Committe on Sedimentation of the Division of Geology and Geography of the National Research Council)在 1920 年决定要编纂一本沉积论(Treatise on sedimentation)，结果推举老将童豪富氏主稿，初版在 1925 年问世。这是沉积学供给普通阅读的第一本书。现在已经出到第二版了。到了 1935 年的夏天，沉积学会又要起手编纂一本近代海洋沉积的杂集，于是组织了一个委员会，由 Carl W. Correns, Stina Gripenberg, W.C. Krumbein, Ph. H. Kuenen, Otto Pratje, Roger Revelle, F.P.Shepard, Henry C.Stetson, Parker D.Trask 九人组成之，Trask 为主席。结果在 1939 年出了一本《近世海洋沉积纂录》(Recent marine sediments)。里面所载的文字都是花了大钱所得到的实际记录，非常珍贵。

沉积学之领域及其应用

甲、关于纯学术方面的

我们知道某一种沉积就是某一种环境的产儿，所以沉积岩可以说是一部分地史的写照。它在地层学、地史学或古地理学方面的重要，虽然及不上化石定年代之准确，但整个说来是无可轩轾的。譬如孙云铸先生根据他二十年在北京大学的教学经验，最近把中国地层重新做了一番分层的工作，他的根据有二：即(一)沉积轮环，(二)地壳运动，

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