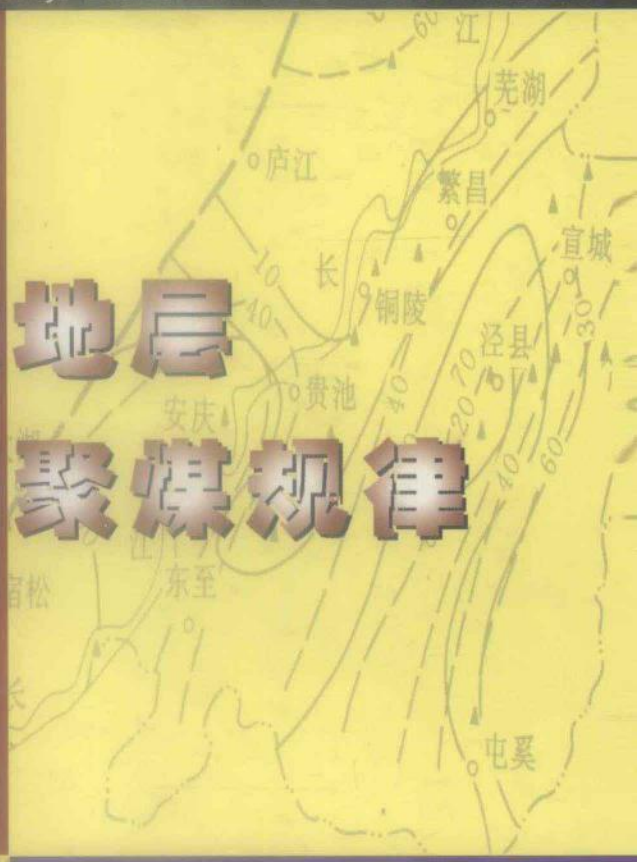
SEDIMENTARY ENVIRONMENTS AND COAL ACCUMULATION OF COAL-BEARING FORMATION, PERMIAN IN SOUTH ANHUI

皖南地区二叠纪含煤地层沉积环境与聚煤规律

吴基文　琚宜文　著



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吴基文　琚宜文　著
Wu Jiwen　Ju Yiwen

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内容提要

本书以层序地层学理论为指导，对皖南地区二叠纪地层进行了划分和对比；在系统分析总结二叠系各组的岩矿、沉积构造、地球化学、地球物理及生物特征的基础上，详细阐述了各组沉积相、沉积组合及其环境演化，对各阶地层的层序地层学特征及其与聚煤作用的关系进行了深入分析。采用单因素综合分析作图法，编制了皖南地区二叠纪各期的岩相古地理图。以沉积环境研究为基础，阐述了二叠系的含煤性变化并总结了聚煤规律，提出了四种聚煤模式。

本书可供从事煤地质学、沉积学及盆地分析有关的科研、教学和生产技术人员以及研究生、大学生参考。

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序

皖南地区二叠系属华南型沉积，为下扬子拗陷克拉通盆地的一部分。区内栖霞期和龙潭早期相对稳定，岩性岩相较单一，厚度变化不大。在茅口期和龙潭晚期至长兴期，盆地发生分异，构造活动强烈，岩性复杂，岩相相变显著，沉积厚度差异较大。研究这一地区含煤岩系的沉积学特征，开展含煤岩系岩相古地理研究与编图工作，无论是在沉积地质学的基础理论上，还是在煤田预测、寻找新的煤炭资源的实际工作中均具有重要意义。

著者有坚实的理论基础和丰富的科学实践经验，使本书在科学性、先进性和系统性方面做到了较完美的结合。本书具有以下特色：

(1)运用层序地层学原理，对皖南二叠系各阶地层进行了划分和对比，指出了在缺乏化石资料的情况下碎屑岩连续沉积区上、下统之间的界线以及硅质岩(或硅质灰岩)连续沉积区晚二叠世早、晚期沉积的分界线，为岩相古地理图的编制和聚煤作用分析打下了扎实基础；

(2)指出了晚二叠世含煤地层的发育受早二叠世晚期沉积作用差异形成的地势高差的制约，随着海侵作用的发展，同一地点的聚煤作用在垂向上有明显的变化。并对龙潭早期的聚煤作用进行了亚期划分，揭示出皖南地区聚煤作用的时空发展，对认识富煤带的分布有一定的指导意义；

(3)以层序地层学理论为基础，根据皖南地区二叠系钻孔、测井和露头剖面等资料，详细研究了该区二叠纪层序地层及海平面变化，划分了沉积层序和沉积体系域，探讨了界面性质、层序类型及层序特征，指出了研究区以海侵体系域中煤层发育最好；

(4)采用单因素综合分析作图法并结合剖面岩相分析，编制了皖南地区二叠纪各期岩相古地理图，阐述了陆源区、海侵方向及其变化规律，总结了聚煤期古地理格局及其演变史；

(5)对煤聚积环境进行了研究和分析，提出了四种聚煤模式；研究和分析了聚煤期皖南及邻区的构造特征及其演化，以及对煤系形成的控制作用，提出了富煤带的分布规律，为成煤预测提供了重要依据等。

总之，本书资料翔实、内容丰富、条理清晰、论述深刻，是一本具有一定理论基础和应用价值的优秀科技专著。它的出版是令人欣慰的，也是很有意义的，并具有较高的参考价值，特向广大读者推荐。

中国矿业大学教授
博士生导师　王桂梁

2001年2月于徐州

前　言

《皖南地区二叠纪含煤地层沉积环境与聚煤规律》是国家计委＜计国地[1992]761号＞及原能源部煤炭总公司下达的，由中国煤田地质总局主持的国家Ⅰ类项目和地质行业“八五”科技找矿项目《华南二叠纪含煤地层沉积环境与聚煤规律》（简称“华南课题”）的子课题（安徽部分）。该课题的目的是应用新理论、新方法、新资料对皖南地区二叠纪含煤地层的时代、划分、对比、沉积环境及聚煤规律进行研究，从而为第三次煤田预测提供依据。主要任务是：① 研究二叠纪含煤地层的发育类型及形成模式；② 研究含煤岩系及相关地层的岩性、岩相特征，建立岩相柱状剖面；③ 研究皖南地区聚煤期古地理概况及聚煤作用的空间变化，探讨富煤带分布及其控制因素，为煤田预测提供基础资料。

本书所指的皖南地区是指郯庐断裂带以东的安徽南部地区。区内二叠系发育较好，分布广泛，同时赋存有丰富的矿产资源，是一重要的含矿地层，数十年来，一直为地质学家所关注。此地区研究程度较高，积累了大量珍贵的地质资料，为本次研究奠定了良好的基础。

皖南地区二叠纪地层属华南型沉积，为下扬子拗陷盆地的一部分，位于克拉通盆地内。区内栖霞期和龙潭早期相对稳定，岩性岩相较单一，厚度变化不大。在茅口期和龙潭晚期至长兴期，盆地发生分异，构造活动强烈，岩性岩相复杂，沉积厚度差异较大。研究这一地区含煤岩系的沉积学特征，开展含煤岩系岩相古地理研究与编图工作，无论是在沉积地质学的基础理论上，还是在煤田预测、寻找新的煤炭资源的实际工作中均具有重要意义。

1990年，笔者在中国煤田地质总局和安徽省煤田地质局的资助下，承担了《皖南地区二叠纪含煤地层沉积环境与聚煤规律》这一科研项目，在3年多的研究工作中，我们先后进行了资料收集、野外地质和矿井地质调查、室内测试分析研究、成图和报告编写等工作，最后提交了主要图件28张和研究报告1本，完成的主要工作量如表0－1所示。

本项目主要研究成果为：

（1）在含煤碎屑岩中，粗碎屑岩（细砂级以上）的碎屑矿物成分、结构及沉积构造等方面，在皖南东部广德、宣城、泾县一带与西部贵池、安庆地区存在一定差异，明确了物源供应方向及东、西部沉积环境上的差异。

（2）尽管皖南地区二叠系，特别是早二叠世晚期以后的沉积层有不同的沉积类型，但按层序地层分析是可以对比的，以海水进退进行剖面上同期沉积层的划分较有效。这对编制岩相古地理图件是十分有利的。运用层序地层学原理，对皖南二叠系各阶地层进行了划分和对比，找出了碎屑岩连续沉积区和硅质岩（或硅质灰岩）连续沉积区的分阶界线，为岩相古地理图的编制和聚煤作用分析打下了扎实基础。

（3）晚二叠世含煤地层的发育受早二叠世晚期沉积作用差异形成的地势高差的制约，随着海侵作用的发展，同一地点的聚煤作用在垂向上是有变化的。聚煤作用的亚期划分对深化皖南地区聚煤作用的认识很有意义，并且对认识富煤带的分布也有指导意义。

表 0－1　　本课题研究工作量统计表

项　目	样品种类	研究目的	数　量
实测露头剖面(条)			2
实测矿井巷道剖面(条)			1
测制钻孔剖面(条)			6
岩石薄片(块)	灰岩、砂岩、粉砂岩、泥岩、煤	岩石学研究	400
粒度分析(个)	砂岩、粉砂岩	沉积特征研究	100
X－射线衍射分析(个)	泥质岩	粘土矿物鉴定及半定量	42
显微照相(张)	各种岩类		200
实物照相(张)	各种岩类		150
光谱分析	泥质岩	微量元素半定量	41
岩性岩相柱状图(张)		沉积环境分析	7
单因素图(张)		岩相古地理分析	13
岩相古地理图(张)			8
其他辅助图件(张)			100
表格(个)			20
研究报告(份)			1
相册(套)			1(三册)

(4)以层序地层学理论为基础,根据皖南地区二叠系钻孔、测井和露头剖面等资料,详细研究了该区二叠纪层序地层及海平面变化,划分了沉积层序和沉积体系域,探讨了界面性质、层序类型及层序特征。二叠系可划分出两个Ⅱ级层序和四个Ⅲ级层序,四个Ⅲ级层序分别对应栖霞阶、茅口阶、龙潭阶和长兴阶。栖霞阶和龙潭阶为Ⅰ类沉积层序,其底界为类型Ⅰ界面不整合;茅口阶和长兴阶为Ⅱ类沉积层序,其底界为类型Ⅱ界面不整合。两个Ⅱ级层序的时限分别对应早二叠世和晚二叠世,这与中国南方二叠纪构造旋回盆地变更时限相一致。区内低水位体系域不发育,沉积层序基本上由海侵体系域和高水位体系域组成。三个体系域中均有煤层形成,但以海侵体系域中煤层发育最好。

(5)将皖南二叠纪沉积岩系归属 3 大相区、8 个相组、25 种沉积相;采用单因素综合分析作图法并结合剖面岩相分析,编制了皖南地区二叠纪各期岩相古地理图,阐述了陆源区、海侵方向及其变化规律,探讨了聚煤期古地理格局及其演化史。

(6)用环境沉积学的观点,对煤聚积环境进行了研究和分析,提出了四种聚煤模式,即:三角洲体系聚煤模式、障壁—潟湖体系聚煤模式、滨海湖沼体系聚煤模式和滨海冲积平原体系聚煤模式。

(7)研究和分析了聚煤期皖南及邻区的构造特征、演化过程以及对煤系形成的控制作用,提出了富煤带的分布规律,为成煤预测提供了重要依据。

在工作过程中,得到了中国煤田地质总局和安徽煤田地质局及所属第二勘探队的领导和许多同志的关怀、帮助和支持,江汉铨、李东平、姜松、谢长仑、刘明真、吴成国等高级工程师参与了野外工作。淮南工业学院资源与环境工程系张文华、姚多喜、胡多朝、冯士安、葛逸芳、刘映鼎、赵志根老师,91 届毕业生郑翰、娄振中等同学参与了资料收集、野外地质调查及

室内测试等工作，并给予笔者很大帮助。同时还得到了中国矿业大学博士生导师刘焕杰教授、江西煤田地质局李文恒教授级高工的热情指导。陈资平教授自始至终对整个课题进行指导并参与了有关章节的编写，中国矿业大学博士生导师王桂梁教授在百忙中欣然为本书作序，谨此一并致以诚挚的谢意。

本书是《皖南地区二叠纪含煤地层沉积环境与聚煤规律》研究成果的主要部分，由八章内容组成。具体分工是：前言、第二、三、六、七章由吴基文执笔；第一、四章由吴基文、琚宜文执笔；第五、八章由陈资平、吴基文、琚宜文执笔。全书最后由吴基文统编、定稿。

由于笔者水平有限，时间紧迫，书中错误和不妥之处难免，敬请大家批评指正。

作　者

2001 年 1 月于淮南

ABSTRACT

In this book, guided by sequence stratigraphy theory, the division and correlation have been made for Permian strata in South Anhui. Based on systematically analyzing and summarizing rock and mineral, sedimentary structure, geochemistry, geophysics and organic features of different formations of Permian System. The book elaborates sedimentary facies, sedimentary assemblages and environmental evolution of different formations, and deeply analyzes the sequence stratigraphic features and its relation with coal accumulation of different stage strata. By using single factor analysis and compilation method, lithofacies – paleogeographical maps of different ages of Permian in South Anhui area were compiled. On the basis of the study of sedimentary environments, the book has set forth coal – bearing features change and summarized regularity of coal accumulation of Permian System, and has put forward four kinds models of coal accumulation .

Permian System in South Anhui belongs to sedimentary strata of the South China type. It is a part of the depression basin of the Lower Yangzi, located in Craton Basin. In the area, Qixia and early Longtan age remained relatively stable, lithology and lithofacies are relatively simple, and its thickness is almost uniform. From Maokou and late Longtan age to Changxing age, the basin differentiated, tectonic activity was intense, lithology and lithofacies are complex, and sedimentary thickness has varied greatly. Study on sedimentology characteristics, lithofacies – paleogeography and compilation of coal – bearing strata in the area, is of great significance, either basic theory of sedimentary geology or coalfield prediction as well as actual work of looking for new coal resources. Main results are indicated as follows:

1. In coal – bearing detrital rock, on the aspects of detrital mineral component, texture and sedimentary tectonics etc. of coarse detrital rock (above fine – grained grade), there are definite differences between Guangde, Xuancheng, Jingxian area in the east part of South Anhui and Guichi, Anqing area in the west part of South Anhui, the study ascertains providing direction of pass source and difference of sedimentary environments between the east part and the west part.

2. Though the sedimentary layers of Permian System in South Anhui, especially late Early Permian have different sedimentary types, they can be correlated according to the sequence stratigraphic analysis, and the division of the same age sedimentary layers of the section in accordance with marine transgression and regression are comparatively effective, this is also very beneficial to compiling lithofacies – paleogeographical maps. By using sequence stratigraphy theory, different stage strata of Permian System in South Anhui have been classificated and correlated, the boundary lines of different stages in successive sedimentary province of detrital rock and siliceous rock (or siliceous limestone) have been found. All of these researches have laid the strong foundation for compiling of lithofacies – paleogeographical maps and analysis of coal accumulation.

3. The development of coal – bearing strata of late Permian was subjected to limit of terrain surmount which was formed by sedimentation difference in late Early Permian. With the development of marine transgression, coal accumulation in the same place was vertically various. The sub – age division has the guiding significance not only for deeply realizing coal accumulation in South Anhui, but also for realizing coal – rich belts distribution.

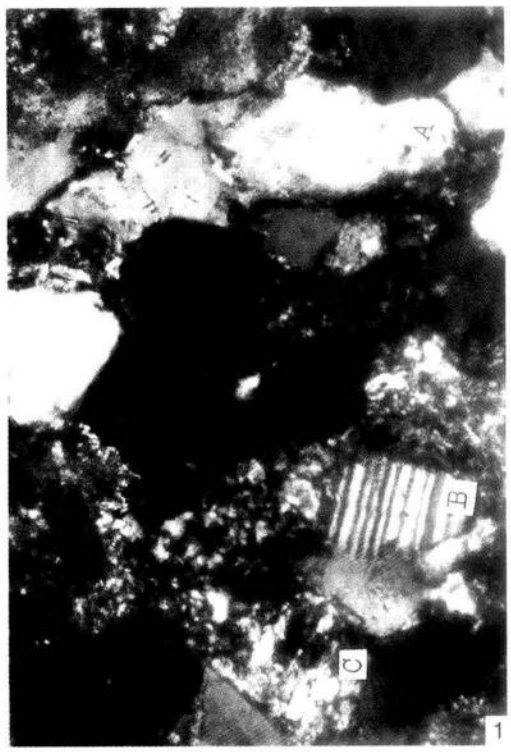
4. On the basis of theory of sequence stratigraphy, according to data of drill hole, well logging and outcrop section etc. of Permian in South Anhui, this book has studied the sequence stratigraphy and sea level changes, has divided sedimentary sequence and the depositional system tracts, and has discussed interfacial properties, sequence types and sequence features. Permian System can be divided into two Ⅱ – rank sequences, and four Ⅲ – rank sequences: Qixia, Maokou, Longtan and Changxing stages; Qixia and Longtan stages belong to Ⅰ type sedimental sequence, its bottom boundary is type Ⅰ interface unconformity, Maokou and Changxing stages belong to Ⅱ type sequence, its bottom boundary is type Ⅱ interface unconformity. Time domain of the two Ⅱ – rank sequences is respectively early Permian and late Permian, which is consistent with alternation time domain of tectonic cycle basin of Permian in South China. In the area, the lowstand system tracts hadn't well developed, so sedimentary sequence was mainly composed of marine transgression system tracts and the highstand system tracts. In the above three system tracts, there were coal seams, which are formed, but coal seams had developed best in marine transgression system tracts.

5. Sedimentary rock series of Permian in South Anhui can be divided into three large facies areas, eight facies groups and twenty – five sedimentary facies. Using the single factor analysis and comprehensive mapping method, and combining section lithofacies analysis, this book compiles different ages lithofacies – paleogeographical maps of different age of Permian, elaborates land – source area, marine transgression direction and change regularity, discusses paleogeographic framework and its evolution history of coal accumulation stages.

6. In terms of viewpoints of environmental sedimentology, coal accumulation environments have been studied and analyzed, and four kinds models of coal accumulation have been put forward, also. That is: coal accumulation model of the delta system, coal accumulation model of the barrier – lagoon system, coal accumulation model of the littoral lake – marsh system and coal accumulation model of the littoral alluvial plain system.

7. This book has studied and analyzed tectonic features, its evolution of coal accumulation stages in South Anhui and its adjacent area, as well as its controlling over formation of coal measures; has put forward the distribution regularity of coal – rich belts, which provides important evidences for coal formation predication.

CONTENTS



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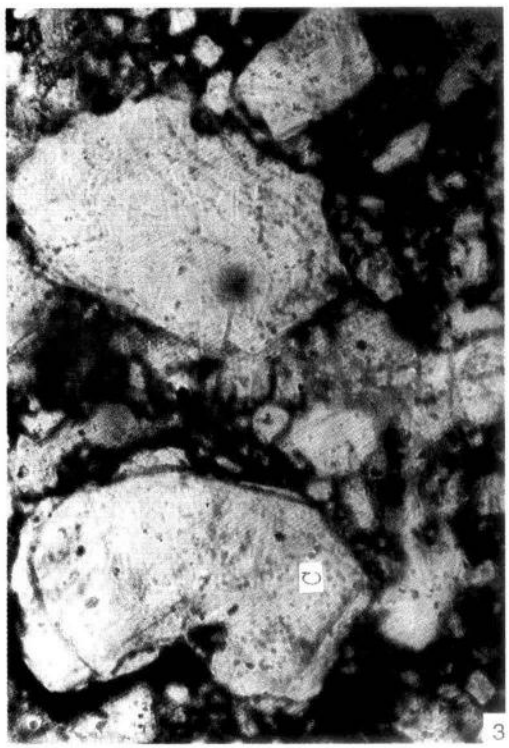

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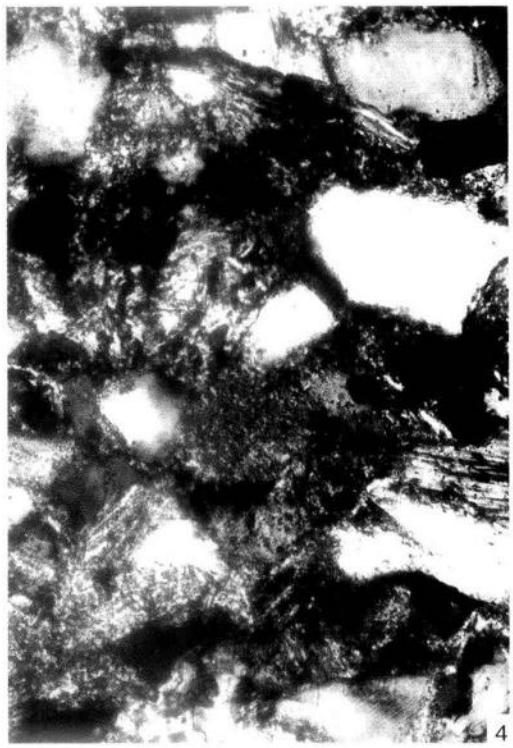
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图版 II


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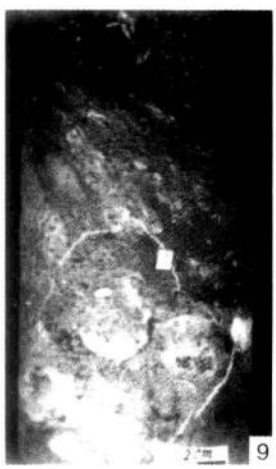
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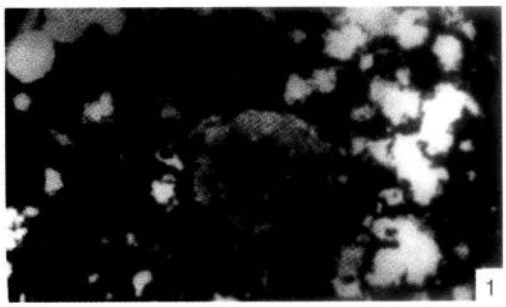
图版Ⅳ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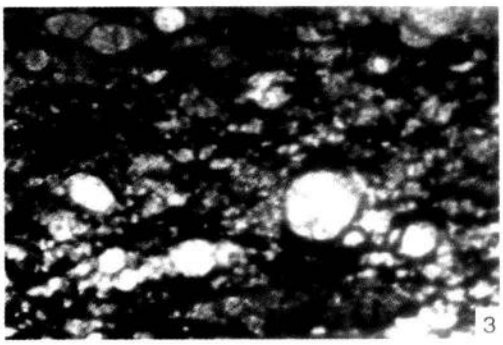
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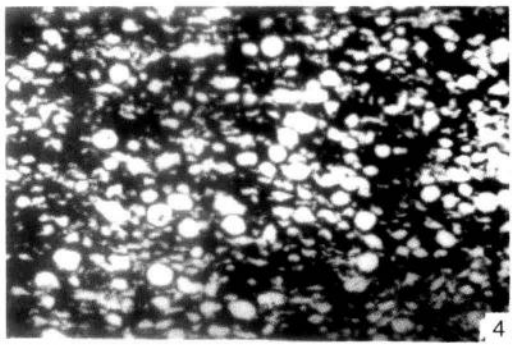
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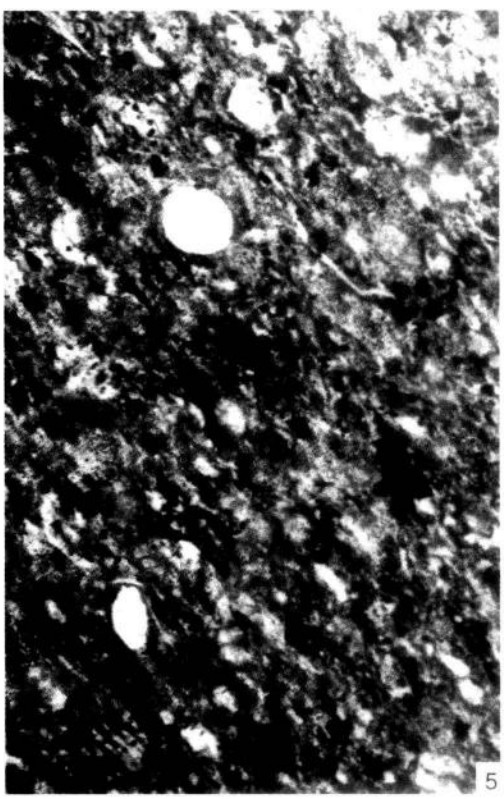
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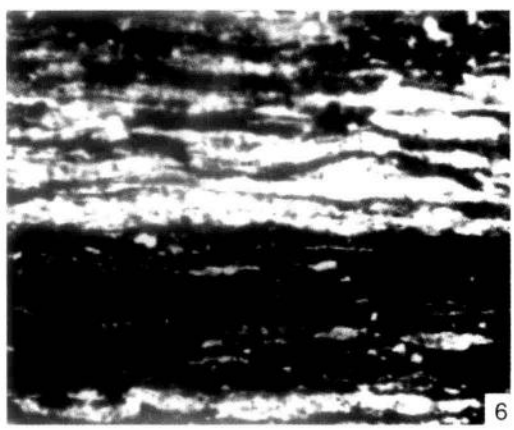
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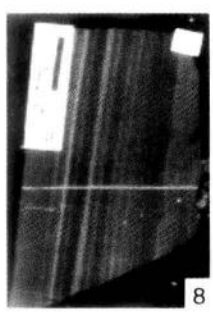
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