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DICKITE AND KAOLINITE IN PENNSYLVANIAN LIMESTONES OF SOUTHEASTERN KANSAS

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Abstract—Dickite and kaolinite are polymorphs of $Al_4(Si_4O_{10})(OH)_8$. Dickite traditionally is regarded as hydrothermal, based on field and laboratory evidence. Dickite and kaolinite occur in cavities in phylloid algal limestones, in interstices of biocalcarenites and sandstones, and along joints, fractures, and stylolites, in Pennsylvanian rocks exposed throughout 9600 square miles of southeastern Kansas. The stratigraphic interval of approximately 1100 ft extends from the Fort Scott Limestone (Desmoinesian) through the Lecompton Limestone (Virgilian). The best crystallized dickites are found in porous algal limestones as pockets of glistening white powder composed of well developed pseudohexagonal plates up to 40 μ across. Very well crystallized kaolinites occur similarly, except the crystals are much smaller. Less well crystallized dickites and *b*-axis disordered kaolinites occur in less porous rocks. Variations in crystal size and morphological development are genetically significant.

Dickite-kaolinite distribution is related to: (1) stratigraphic alternation of limestones and impervious shales; (2) gentle, westward regional dip; (3) thick, mound-like buildups of highly porous algal limestones, miles in length and width; (4) igneous intrusions (early Tertiary?) in Woodson and Wilson counties. Dickite is confined to an elliptical area 125 miles long northeast-southwest, extending 60 miles eastward from the intrusions. Dickite is associated preferentially with porous algal mounds. Kaolinite occurs in less porous rocks within the dickite area, and also is abundant well beyond. Heated groundwaters, possibly mixed with magmatic waters, moved readily up-dip and along strike outward from the intrusions through the conduit-like algal mounds; dickite was deposited from such solutions. Where water movement was restricted or where water had travelled tens of miles from the intrusions, water temperature fell below the limit for dickite crystallization, and kaolinite precipitated instead. Kansas dickite, unlike most other reported dickites, formed in rocks that were neither deeply buried nor extensively altered hydrothermally.

INTRODUCTION

DICKITE, nacrite, and kaolinite are polymorphs of $Al_4(Si_4O_{10})(OH)_8$. Differences in structure and symmetry result from different repetitive stacking sequences of kaolin-type structural unit layers (Bailey, 1963). Dickite is uncommon, nacrite is rare, and kaolinite is superabundant in the upper portion of the Earth's crust. Most dickites and nacrites are associated directly with hydrothermal alteration zones and veins of ore minerals; laboratory synthesis of dickite above 350°C confirms field observations (Ewell and Insley, 1935). Kaolinite, on the other hand, can form over a wide temperature range, as a result of weathering, diagenesis, or hydrothermal deposition and alteration. See Bailey and Tyler (1960) for further discussion and references.

A few problematical dickite occurrences bear no apparent relationship to sources of hydrothermal solutions. For example, Bayliss *et al.* (1965) described authigenic dickite in interstices of Triassic sandstones of Australia, and also presented an extended bibliography. Dickite in southeastern Kansas was first described by Hayes (1967) as a widespread and abundant void-filling mineral in algal limestones of the Lansing Group (Pennsylvanian). The limestones show no clear evidence of hydrothermal alteration and mineralization. The principal problem with Kansas dickite is to explain its distribution and genesis, which appear to be inconsistent with the traditional hydrothermal concept.

GEOLOGIC SETTING

The area of study includes 16 counties in southeastern Kansas and one county in Oklahoma, a total area of 9600 square miles (Fig. 1). Middle and Upper Pennsylvanian marine strata there consist of alternating thin limestones and shales, with some channel sandstones cutting across older beds. Individual units as thin as one or two feet can be traced up to 400 miles along strike from Iowa, through Missouri and Kansas, into

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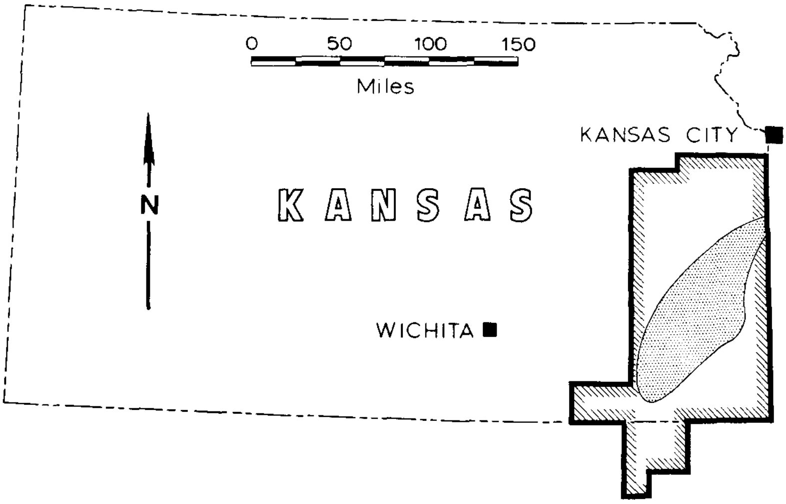

Fig. 1. Location map; heavy line is boundary of the area investigated. Dickite occurs within the stippled area.

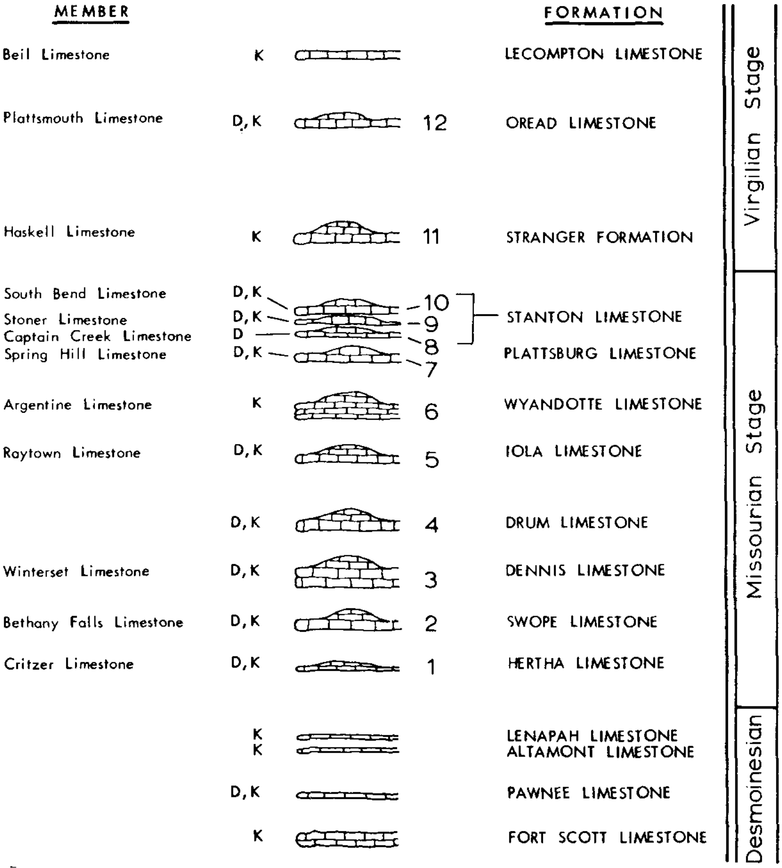

Fig. 2. Simplified stratigraphic column for southeastern Kansas to show occurrences of dickite and kaolinite (D and K). The numbered limestone units contain algal mounds sampled for this study. About 1100 ft of strata are represented; shale and sandstone units have been omitted for clarity.

Oklahoma (Moore, 1949, p. 9). Many beds are equally persistent in the subsurface. The strata dip gently to the west, forming cuestas with relatively steep east faces (Merriam, 1963, p. 103). Figure 2 is a greatly simplified stratigraphic column showing only those limestone units in which dickite and kaolinite were found.

Algal-mound complexes

Many of the limestone units swell to abnormal thicknesses over areas several miles in length along the eastern Kansas and Oklahoma outcrop; some have been traced into the subsurface to the west. Anomalously thick limestone members in the Plattsburg and Stanton limestones (7–10 on Fig. 2) were studied by Harbaugh (1959, 1960) and summarized in Harbaugh *et al.* (1965). P. H. Heckel and J. M. Cocke (Personal communication, 1966) have delineated several more thickened limestone units (Figs. 3 and 4), all of which display a distinctive facies. Those units sampled for the dickite study are numbered 1–12 on Figs. 2, 3 and 4.

Despite a wide range of size and shape, all the thickened limestones are composed of a suite of rock types containing abundant phylloid algae and reduced numbers of invertebrate fossils. Heckel (1966) used the terms algal mound and algal-mound complex, for these carbonate buildups. Abundant leaf-shaped blades and crusts of phylloid algae mostly are horizontal but range toward vertical. Horizontal and oblique blades protected void space beneath from being filled in by downward filtering carbonate mud.

Such primary void space was increased in some cases by early dissolution of the mineralogically unstable phylloid algal blades. During later diagenesis, sparry calcite predominantly, but also ferroan dolomite, barite, dickite, and kaolinite, were precipitated in the voids. Many voids were only partially filled, so that porosity and permeability of the algal limestones remain high even to this day, especially compared to non-mound calcilutites and biocalcarenites.

Igneous intrusions

Igneous rocks and metamorphosed sedimentary rocks in Woodson County and northern Wilson County have been known for decades (Merriam, 1963, pp. 152–157), some from surface exposures and others from wells (Figs. 3 and 4). Surrounding sedimentary rocks have been arched into domelike structures, presumably because of injection of igneous material. Rose Dome, Silver City Dome, and Neosho Falls Dome are the best known. Mica peridotite is the dominant rock type; contact metamorphism of the intruded Pennsylvanian sediments is evident. Hydrothermal veins of quartz, magnetite, and sulfides extend into the county rock.

A K/Ar age determination of Silver City peridotite gave 65 ± 5 m.y., placing the time of crystallization early in the Tertiary. Blocks of granite exposed on Rose Dome have been dated at 1220 m.y. by the Rb/Sr method. They are interpreted to be xenoliths of Precambrian basement carried upward with the peridotite (Merriam, 1963, p. 154).

RESULTS

Distribution of dickite and kaolinite

Dickite is confined to a crudely elliptical area 125 miles long northeast-southwest, extending 60 miles eastward from the igneous intrusions (Figs. 1 and 3). Dickite was found at thirty-five localities, almost exclusively in the several kinds of pores and voids so numerous in the algal-mound limestones (Figs. 2 and 3). Dickite is particularly abundant in highly porous, sparry calcite units of the algal mounds, where it appears as glistening white fluffy or compact powder filling voids up to 1 in. across. A readily accessible and productive collecting locality is in the Spring Hill Member of the Plattsburg Limestone, exposed along Kansas Highway 96, 3 miles west of Neodesha in Wilson County. Occasional small pockets of dickite are found along stylolites, in limestones adjacent to shale partings, in interstices of sandstones, and along joints and fractures, but never far from the algal-mound limestones.

Void-filling dickite and kaolinite in southeastern Kansas have similar modes of occurrence because of their similar origin, but kaolinite has greater areal and stratigraphic distribution than dickite (Figs. 2 and 4). Kaolin minerals were sought but rarely found in the poorly exposed younger Pennsylvanian rocks west of the intrusions. Kaolinite was found at fifty-seven localities in a wide variety of limestones and some sandstones. Kaolinite occurs within the dickite area, but only in less porous portions of the algal mounds and in non-mound rocks. Kaolinite is abundant well outside the dickite area in rocks with a range of porosity and permeability. The principal purpose of field work was to map the distribution of dickite; therefore, the maximum extent of void-filling kaolinite in southeastern Kansas was not determined.

Laboratory investigations

X-ray powder photographs of unground samples not only positively identified dickite and kaolinite and rare mixtures of the two minerals, but also revealed that dickites and kaolinites from different

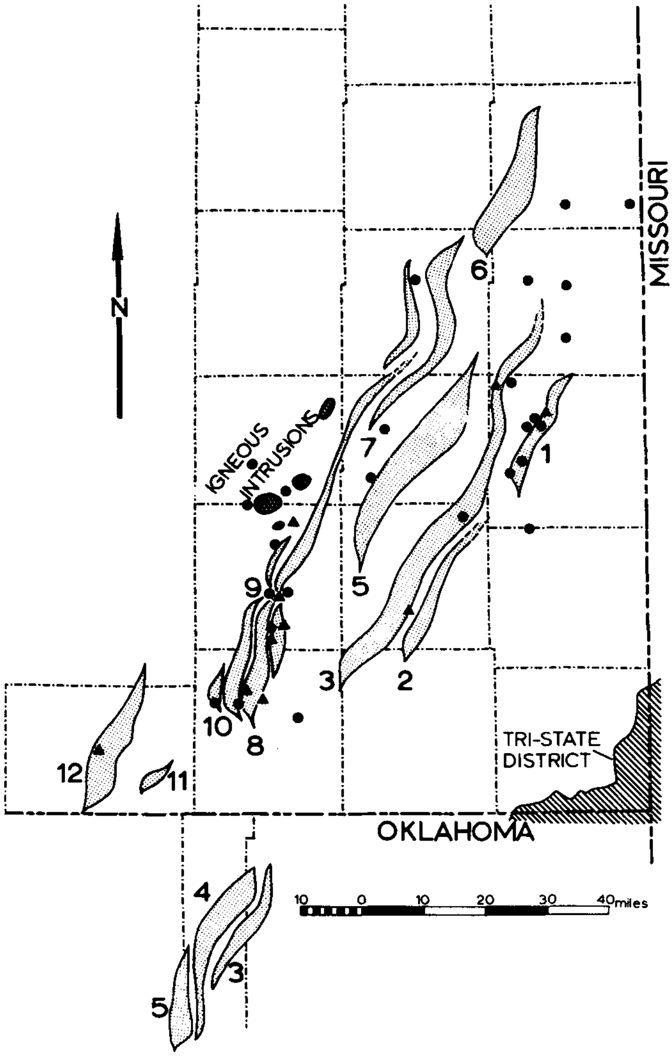

Fig. 3. Map of dickite localities (dots and triangles), igneous intrusions (cross-hatched), and outcrop patterns of algal-mound complexes (stippled and numbered as in Fig. 2) in southeastern Kansas. Association of dickite with algal mounds and intrusions is apparent. Triangles represent localities with abundant, well crystallized dickite in the highly porous, sparry calcite mound rocks.

localities exhibit different degrees of crystallinity. Kaolinite crystallinity mainly is a function of the degree of regular stacking of kaolin layers (Brindley and Robinson, 1946; Murray and Lyons, 1956; Hinckley, 1963). Increasing numbers of random layer displacements parallel to the b axis, of magnitude $b_0/3$, result in progressively disordered and poorly crystalline kaolinites. Weakened or missing reflections with $k \neq 3n$, broadened reflections, merged closely spaced reflections, darkened background, and faint, vague back reflections all are measures of the degree of disorder. In general, kaolinite crystallinity correlates well with crystal size and shape, the larger and more regular pseudohexagonal plates being better crystallized.

Kaolinites associated with Kansas dickite show a wide range of crystallinity, from material nearly as perfect as Keokuk geode kaolinite (Hayes, 1963; Keller *et al.*, 1966) to b-axis disordered examples with $k \neq 3n$ reflections missing. Crystal size and shape range from well defined, equant plates 10 μ wide to ragged, irregular grains less

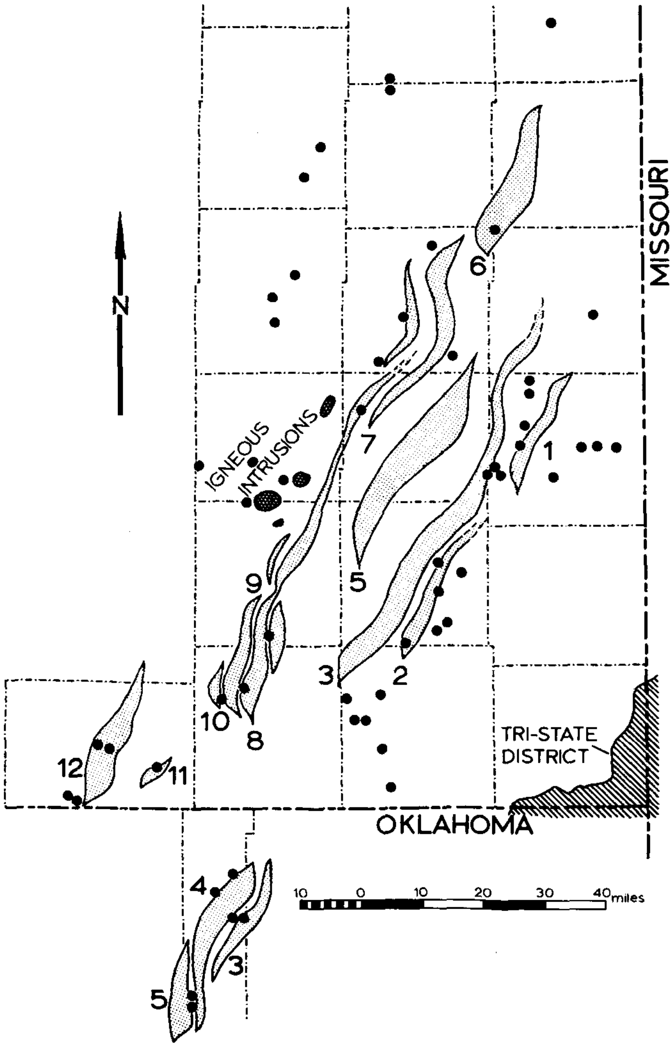

Fig. 4. Map of kaolinite localities (dots) in southeastern Kansas. Other symbols as in Fig. 3. Within the dickite area, kaolinite occurs mainly in non-mound rocks. Beyond the dickite area, kaolinite is abundant, and occurs in algal mounds in Oklahoma.

than 3 μ wide. Vermicular aggregates and books are common in the better crystallized kaolinites.

Variations in dickite crystallinity are not so well known. Indeed, most described dickites are very well crystallized, because of hydrothermal origin. Well formed crystals as large as 1 mm give sharp, clear X-ray patterns. Of special interest, then, are crystallinity variations among more than one hundred dickite samples from thirty-five Kansas localities (Fig. 3). Four representative patterns appear in Fig. 5. The range of variation is not as great as for associated kaolinites. Notably the back reflections progressively fade and merge. The front reflections remain fairly sharp, but become less intense, and certain weak reflections nearly disappear. Quality of dickite X-ray patterns correlates directly with morphological development, but less so with crystal size. The best crystallized appear as regular pseudohexagonal plates up to 40 μ wide (Fig. 6A) with abundant vermicular aggregates and rouleaux, whereas the less well crystallized are somewhat smaller plates with ragged outlines (Fig. 6B).

No specific reference to *b*-axis disorder of dickite could be found. However, dry grinding of Ouray dickite (McLaughlin, 1955) for more than 2 hr markedly reduced the number of X-ray reflections, with practically all remaining reflections having $k = 3n$. Perhaps crystallinity differences in Kansas dickites are more a function of slight compositional differences, mosaic domain sizes, or lattice distortions inherent in all layer silicates. In any event, this apparently is the first demonstration of dickite crystallinity variation on a regional basis.

Sparry calcite and ferroan dolomite typically accompany dickite and kaolinite in voids in the Pennsylvanian limestones (Fig. 7). Thin sections stained with potassium ferricyanide and alizarin red-S (Dickson, 1965) revealed a sequence of crystallization for the several void-filling minerals. (1) The first generation of calcite formed early in the history of the sediment (Harbaugh, 1961, p. 125), and incompletely filled voids. (2) Aggregates of typically curved ferroan dolomite crystals (about 15 mole per cent $FeCO_3$) grew into voids not completely filled by calcite, and marginally replaced some of the earlier calcite. (3) Either dickite or kaolinite was deposited after ferroan dolomite in every case. No example could be found of dolomite incorporating dickite or kaolinite. Moderate corrosion and etching of the carbonates suggest that dickite and kaolinite precipitated from acid solutions. (4) Another period of calcite growth followed dickite deposition. Several milky white calcite scalenohedra yielded dickite residue after HCl dissolution. Calcite ingested Kansas dickite in the same way it incorporated Keokuk geode kaolinite (Hayes, 1963).

GENESIS OF KANSAS DICKITE

All evidence strongly suggests that dickite in southeastern Kansas formed as a result of emplacement of intrusive igneous rocks (early Tertiary?) in Woodson and northern Wilson counties. Distribution of dickite and kaolinite (Figs. 3 and 4) is related to: (1) location of the intrusions; (2) distribution of the several algal-mound complexes; (3) stratigraphic alternation of porous and permeable limestones with impervious shales; (4) gentle, westward regional dip.

On the Silver City Dome, peridotite cut across and locally metamorphosed rocks of the Douglas Group (Virgilian), which are younger than most of those containing dickite. The dickite-bearing strata must have been pierced, also. Though only a few such intrusions are known in southeastern Kansas, Merriam (1963, p. 154) expressed the opinion that several more probably exist. Merriam (1963, p. 157) also stated that, "...a few hundred feet of Cretaceous sediments may have been the only cover originally above the intrusions, and igneous material may even have reached the surface."

With only a few hundred feet of overlying strata, the Pennsylvanian rocks probably contained meteoric waters. Such waters were heated by circulating near the intrusions and possibly by mixing with magmatic waters. These presumably acidic heated waters moved readily under pressure up-dip (east) and along strike (north–south) outward from the intrusions through the conduit-like algal mounds, which are embraced by impervious shales. Abundant, well crystallized dickite was deposited in the algal limestones and other closely associated porous rocks. Apparently the high porosity and permeability of the algal-mound limestones permitted solutions to travel many miles before they cooled and also before they became alkaline from dissolving the limestones. Younger Pennsylvanian rocks west of the intrusions lack dickite because they were not cut by the intrusions, and because they contain numerous shale layers which inhibited the stratigraphically upward movement of solutions to the west.

Where heated waters had travelled tens of miles from the intrusions, water temperature fell below the limit for dickite crystallization, and kaolinite precipitated instead. A striking example of this is seen in algal mounds in Washington County, Oklahoma (Fig. 4). The mound rocks there are virtually identical to those in Kansas, with high porosity, sparry calcite, ferroan dolomite, and abundant white powder in voids. All the white clay is exceptionally well crystallized kaolinite, not dickite. The Oklahoma mounds are so far from the igneous intrusions that even with high porosity and easy movement of solutions, the water temperature fell too low for dickite to form.

Within the dickite area (Fig. 3), the distribution, quantity, crystallinity, crystal size, and crystal morphology of dickite and kaolinite are related to porosity and permeability of the host rock. Already mentioned was abundant, very well crystallized dickite (kaolinite in Oklahoma) in the most porous rocks of the algal-mound complexes (Figs. 5A, 6A and 7). In contrast, less well crystallized dickites (Figs. 5C, 5D and 6B) and disordered kaolinites occur in small amounts, in small voids in less porous mound and non-mound rocks. The lower degree of crystallinity is related in part to restricted space for growth in small voids. More important, though, was cooling of solutions migrating along restricted paths in the less porous rocks. With progressive cooling, less well crystallized dickite was formed first; then kaolinite crystallized with earlier dickite to give rare mixtures; and last, kaolinites with various degrees of disorder precipitated from the cooler solutions. Such is the nature and origin of kaolinite within the dickite area.

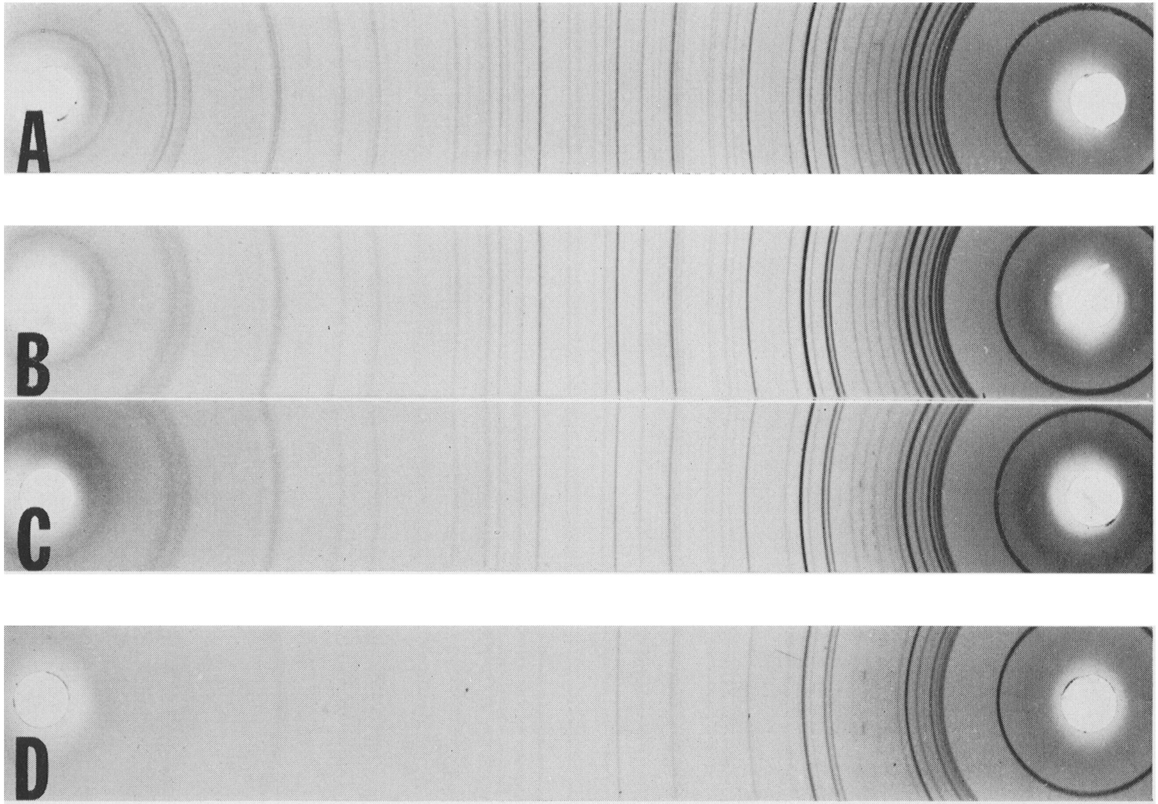

Fig. 5. X-ray powder photographs of a series of unground dickites from southeastern Kansas, to show the range of crystallinity (FeKα, 114·6 mm Debye-Scherrer camera). A. Very well crystallized dickite from porous limestone of algal mound (cf. Fig. 6A). B. Dickite from along a fracture. C. Dickite from interstice of biocalcarenite. D. Dickite from along a joint in fine-grained limestone (cf. Fig. 6B).

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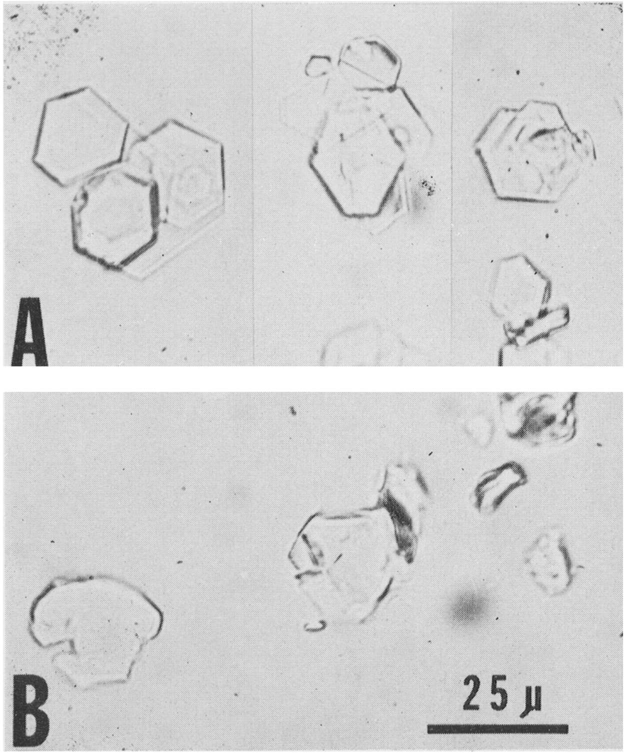

Fig. 6. Photomicrographs of dickite, plane polarized light. A. Very well crystallized dickite (cf. Fig. 5A). B. Not so well crystallized dickite (cf. Fig. 5D).

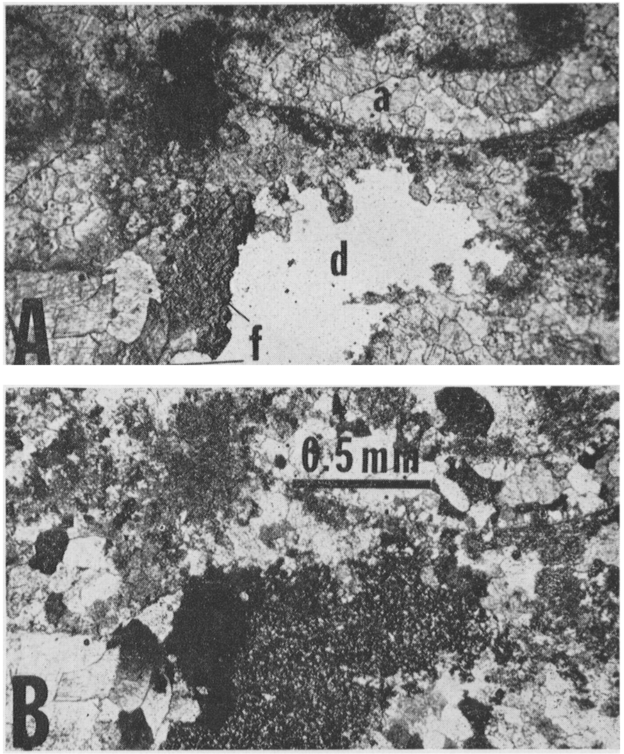

Fig. 7. A photomicrograph of thin section of coarsely crystalline algal limestone from Spring Hill Member. Void-filling dickite (d) in typical association with ferroan dolomite (f) in cavity under recrystallized algal blade (a). A. Plane polarized light. B. Same, except polarizers crossed.

Because ferroan dolomite and subsequent dickite are intimately associated, Hayes (1967) suggested that the two minerals are related genetically, that is, deposited during the same episode. After mature reflection, the authors no longer support this. It is difficult to imagine how large volumes of alkaline solutions of negative Eh necessary for precipitation of ferroan dolomite could all at once become acidic for dickite or kaolinite crystallization. A better explanation is that the algal-mound rocks have been highly porous and permeable from the time of deposition up to the present day. Thus, they have been the easiest avenues of migration for any and all solutions. Ferroan dolomite was the result of one set of events and conditions, whereas early in the Tertiary, dickite and kaolinite were produced under quite different circumstances. Dolomite with kaolinite in the algal mounds in Oklahoma, and identical dolomite with dickite in Kansas, suggest also that ferroan dolomite is unrelated genetically to dickite and kaolinite, and therefore, unrelated to the igneous intrusions.

An initial question posed by the authors was the relationship of dickite to extensive mineralization in Mississippian rocks in the Tri-State zinc–lead district, the northwestern margin of which is in Cherokee County (Fig. 4). Apparently there is no genetic relationship, for, if the dickite-forming solutions were the same as those that precipitated the Tri-State ores, the solutions would have had to travel upward stratigraphically across numerous impervious shale beds. The several kaolinite localities (Fig. 4) between the Tri-State district to the east and the dickite area to the west also reject an easterly source of solutions for dickite. Dickite has yet to be found in the Tri-State district (Hagni, 1962).

Wheeler (1965) suggested that the igneous rocks in Kansas are klippen of a late Permian thrust sheet which originated in the Ouachita geosynclinal belt. However, the early Tertiary age and the distribution of dickite and kaolinite strongly support intrusive magmatic origin for the southeastern Kansas igneous rocks.

Kansas dickite, unlike most other dickites reported around the world, formed in rocks that were neither deeply buried nor extensively altered hydrothermally. The Kansas dickite is unusual, in that the origin is related in part to igneous activity, but its distribution is regional rather than local.

Acknowledgments—The writers are indebted to P. H. Heckel of the State Geological Survey of Kansas for guidance in the field, for suggestions about the manuscript, and especially for permission to use his unpublished data on the areal and stratigraphic distribution of the algal-mound complexes, as seen in Figs. 3 and 4. D. F. Merriam and W. E. Hill of the Kansas Survey kindly provided other necessary information and facilities, for which the writers are most grateful.

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Résumé – Le dickite et le kaolinite sont des polymorphes de $Al_4(Si_4O_{10})(OH_8)$. Le dickite est traditionnellement considéré comme hydrothermique, fondement qui s'appuie sur une évidence réelle et expérimentale. Le dickite et le kaolinite se trouvent dans des cavités des calcaires phylloïdes gonimiques, dans les interstices des biocalcarénites et des grès, et le long des joints, des cassures et des stylolites, dans les rocs de Pensylvannie qui s'étendent sur 25.000 km² dans le sud-est du Kansas. L'intervalle stratigraphique d'environ 1000 m. s'étend des calcaires de Fort Scott (dans le Desmoine) à travers les calcaires de Lecompton (en Virgilie). Les dickites les mieux cristallisés ont été trouvés dans les calcaires poreux gonimiques en poches poudre d'un blanc étincelant composée de plaques pseudohexagonales bien développées de jusqu'à 40 μ de large. Du kaolinite très bien cristallisé s'est trouvé de façon similaire, mais les cristaux étaient beaucoup plus petits. On trouve des dickites bien moins cristallisés et des kaolinites (axe *b* désordonné) dans des roches moins poreuses. Les variations dans la grandeur du cristal et le développement morphologique sont significatifs au point de vue génétique.

La distribution du dickite-kaolinite est liée à: (1) l'alternance stratographique du calcaire et des argiles schisteuses imperméables; (2) une dénivellation douce vers l'ouest; (3) des monticules épais de calcaires gonimiques fortement poreux, s'étendant sur des kilomètres en longueur et en largeur; (4) des intrusions ignées (du début du terciaire) des les provinces de Woodson et de Wilson. Le dickite est confiné dans une zone elliptique de 200 km de long, nord-est-sud-ouest, s'étendant sur 100 km à l'est de la zone des intrusions. Le dickite est associé de préférence aux monticules gonimiques poreux. Le kaolinite apparaît des roches moins poreuses à l'intérieur de la zone de dickite, et aussi abondamment à l'extérieur de cette zone. Les nappes souterraines d'eau chaude, mélangées sans doute aux eaux magmatiques, s'est élevée des dénivellations et le long des minerais vers l'extérieur à partir des intrusions à travers les monticules gonimiques en forme de conduit; le dickite a été déposé par de telles solutions. Quand le mouvement de l'eau était restreint ou quand l'eau avait parcouru des dizaines de kilomètres à partir des intrusions, sa température tombait au-dessous de la limite pour la cristallisation du dickite et c'est le kaolinite qui fut précipité à la place. Le dickite du Kansas, au contraire de la plupart des autres dickites, s'est formé dans des roches qui n'étaient jamais profondes et qui n'avaient pas subi d'altérations thermiques.

Kurzreferat – Dickit und Kaolinit sind Polymorphe der Zusammensetzung $Al_4(Si_4O_{10})(OH)_8$. Auf Grund praktischer sowie laboratoriumsmässiger Erfahrungen wird Dickit üblicherweise als hydrothermal angesehen. Dickit und Kaolinit kommen in Aushöhlungen von blattähnlichen Algalkalksteinen, in den Ritzen von Biocalcareniten und Sandsteinen und entlang der Spalte, Risse und Styloliten, freiliegend in den pennsylvanishen Felsen über 9600 Quadratmeilen im südöstlichen Kansas vor. Der stratigraphische Zwischenraum von etwa 1100 Fuss erstreckt sich von dem Fort Scott Kalkstein (Desmoinesian) bis zum Lecompton Kalkstein (Virgilian). Die best kristallisierten Dickite werden in den porösen Algalkalksteinen in der Form von taschenartigen Einschlüssen eines glänzenden weissen Pulvers, das aus gut ausgebildeten pseudohexagonalen Plättchen von bis zu 40 μ Breite besteht, vorgefunden. Sehr gut kristallisierte Kaolinite kommen unter ähnlichen Bedingungen vor, die Kristalle sind aber hier viel kleiner. Weniger gut kristallisierte Dickite, und im Hinblick auf die *b*-Achse unregelmässige Kaolinite, kommen im weniger porösen Gestein vor. Unterschiede in Kristallgrösse und morphologischer Entwicklung sind von genetischer Bedeutung.

Die Dickit-Kaolinit Verteilung steht im Zusammenhang mit (1) dem stratigraphischen Wechsel von kalkstein und undurchdringlichen Schiefern; (2) den sanften westlichen Bodensenkungen; (3) den mächtigen, hügelförmigen Gebilden von hochporösem Algalkalkstein von Meilenlänge und -breite; (4) den eruptiven Intrusionen (frühes Tertiär) in den Woodson und Wilson Kreisen. Dickit ist begrenzt auf ein ellipsenförmiges Gebiet von 125 Meilen Nordost/Südwest Länge, das sich 60 Meilen östlich der Intrusionen erstreckt. Dickit ist vorzugsweise mit porösen Algalhügeln assoziiert. Kaolinit kommt in weniger porösen Gesteinen innerhalb der Dickit Gebiete vor, ist aber auch darüber hinaus an zahlreichen Stellen vorzufinden. Angewärmte Grundwässer, möglicherweise vermischt mit Magmawässern, bewegten sich ohne weiteres an der Bodensenkung aufwärts und entlang der Streichrichtung auswärtz von den Intrusionen zu den kanalartigen Algalhügeln. Der Dickit lagerte sich aus derartigen Lösungen ab. Wo die Bewegung des Wassers behindert war, oder bei Bewegungen des Wassers über eine beträchtliche Entfernung von den Intrusionen hinweg, sank die Wassertemperatur unter die Kristallisationsgrenze des Dickits, und es kam anstatt dessen zu einem Niederschlag von Kaolinit. Der Kansas Dickit, im Gegensatz zu den meisten anderen bekannten Dickitvorkommen, bildete sich in Gestein, das weder tief vergraben noch weitgehend hydrothermal verändert war.

Резюме—Диккит и каолинит это полиморфные вещества $Al_4(Si_4O_{10})$ $(OH)_8$. На основании полевых и лабораторных показаний принято считать, что диккит является гидротермическим материалом. Диккит и каолинит встречаются в полостях филоидных водорослевых известняков, в расселинах биокалькаренитов и песчаников, а также вдоль соединений, трещин истилолитов в пенсильванских породах, которые обнажены по всем 9600 квадратным милям юго-восточного Канзаса. Стратиграфический интервал в прибл. 1100 футов (335 метров) простирается от известняка форт Скотт (де-Мойн) до известняка Лекомптон (Вирджилия). Наилучшие кристаллизованные диккиты находятся в пористых водорослевых известняках в виде залежей блестящего белого порошка, состоящих из хорошо развитых псевдошестиугольных листов шириной до 40 μ. Очень сильно кристаллизованные каолиниты встречаются сходно, но с той разницей, что кристаллы значительно меньше. Слабее кристаллизованные диккиты и беспорядочные по оси b-каолиниты находятся в менее пористых породах. Изменения в размере кристалла и в морфологическом развитии имеют генетическое значение.

Распределение диккита-каолинита зависит (1) от стратиграфической перемежаемости известняков и водонепроницаемых сланцев; (2) от пологого местного падения в западном направлении; (3) от толстых наращиваний в виде бугров высокопористых водорослевых известняков длиной и шириной по несколько километров; (4) от интрузий вулканического происхождения (ранее третичного периода?) в графствах Вудсон и Вилсон. Местонахождение диккита ограничено в эллиптическом участке длиной прибл. 200 km (125 миль) с северо-востока на юго-запад и простирающемся на 96 km (60 миль) на восток от интрузий. Диккит предпочтительно ассоциируем с пористыми водорослевыми буграми. Каолинит встречается в менее пористых породах в районе диккита, а также в крупном количестве за его пределами. Нагретые грунтовые воды, вероятно смешанные с магматическими водами, легко движутся по восстанию и наружу по простиранию от интрузий через трубоподобные водорослевые бугры; диккит был отложен из таких растворов. Там, где движение воды ограничено или где вода прошла десятки километров от интрузий, температура ее падает ниже уровня для кристаллизации диккита и вместо этого осаждался каолинит. Канзасские диккиты, в отличии от большинства иных известных диккитов, образовываются в породах, которые не были глубоко засыпаны или-же не были в значительной степени изменены гидротермически.