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DIAGENETIC ALBITE IN ROTLIEGENDES SANDSTONES FROM THE INTRASUDETIC BASIN (POLAND)

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Abstract. The Rotliegendes sandstones from the Intrasudetic Basin exhibit intensive diagenetic albitization. Albite crystallized on highly dissolved feldspars and lithic grains. The habit of albite crystals differs in relation to their size. Diagenetic albite is characterized by pure chemical composition (very low content of Ca). Crystallization of albite took place during advanced diagenesis – after the dissolution of unstable grains and the formation of quartz cement. The origin of sodium-rich diagenetic solutions was related to alteration of highly albitized Lower Permian volcanic rocks and/or direct supply of post-magmatic hydrothermal solutions (which caused albitization of volcanic rocks) into the sedimentray basin. Decomposition of unstable components of sandstones was probably the secondary source of Na in diagenetic solutions.

Abstrakt. Piaskowce czerwonego spągowca w niecce śródsudeckiej wykazują intensywną diagenetyczną albityzację. Albit krystalizuje na silnie rozpuszczonych skaleniach i ziarnach litycznych. Pokrój kryształów albitu jest zróżnicowany zależnie od ich wielkości. Diagenetyczny albit odznacza się czystością składu chemicznego (bardzo niską zawartością Ca). Krystalizacja albitu miala miejsce w zaawansowanej diagenezie – po rozpuszczaniu ziaren niestabilnych i powstaniu cementu kwarcowego. Pochodzenie roztworów diagenetycznych bogatych w Na^+ jest związane przemianami silnie zalbityzowanych skał wulkanicznych dolnego permu i/lub bezpośrednim dostarczaniem pomagmowych roztworów hydrotermalnych (które powodowały albityzację skał wulkanicznych) do basenu sedymentacyjnego. Rozkład niestabilnych składników piaskowców był zapewne drugorzędnym źródłem Na^+ w roztworach diagenetycznych.

Key words: diagenesis, Lower Permian continental sandstones, albitization, Lower Permian volvanic activity, Lower Silesia.

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INTRODUCTION

The growth of authigenic albite during diagenesis of sandstones is related to two different processes – formation of overgrowths or fracture fills from a saturated solutions or replacement of detrital feldspar grains (Hirt *et al.*, 1993). The replacement albitization of detrital plagioclases grains (of anorthite-rich composition) starts at microfractures or cleavage planes (Ramseyer *et al.*, 1992). The mechanisms of both these processes are probably similar, *viz.* dissolution and precipitation. Słaby (1997) suggests that postmagmatic albitization is related more to decalcification than to real albitization.

The "albitization window" for plagioclases corresponds to temperatures 100–150 ^{0}C (Gold ,1987; Ramseyer *et al.*, 1992). The process of albitization of plagioclases rich in anorthite is geochemically important because during these reaction large quantities of aluminium and calcium are released (Land *et al.*, 1987; Morad *et al.*, 1990; Ramseyer *et al.*, 1992). Kaolinite has been often considered to be a by-product of plagioclases dissolution and albitization (Morad *et al.*, 1990). At shallow depths, however, where dissolution of plagioclases is often an effect of the flow of dilute, undersaturated (with respect to plagioclases) meteoric waters, kaolinite or other aluminosilicate by-products rarely occur (Bloch & Franks, 1993).

The diagenetic albitization of K-feldspars in deeply buried sandstones is relatively common (e.g. Middleton, 1971). Dissolution-precipitation related albitization of K-feldspars results usually in the occurrence of small (1–15 µm) euhedral albite crystals elongated parallel to each other and to the cleavage planes of the host (Morad, 1986). Diagenetic albite can occur as overgrowths on K-feldspar grains both on outer surfaces and intragranular dissolution surfaces (Strong & Milodowski, 1987). Albite overgrowths developed on earlier authigenic K-feldspar overgrowths on detrital K-feldspars were described by Strong and Milodowski (1987). Saigal *et al.* (1988) recognized that albitized K-feldspars grains at shallower depths (2.2–3.0 km) are often composed of numerous tiny albite crystals (1–30 µm in size) distributed along cleavage planes of the host. At greater depths (3.5 km) albitized grains are composed of blocky euhedral albite crystals (10–90 µm), forming pseudomorphs after detrital K-feldspars grains.

Albitization in the Rotliegendes sandstones has been noted in several locations. Lanson *et al.* (1996) found albite occurring locally as a diagenetic mineral in the Broad Fourteens basin (Southern North Sea). Early albite formed as overgrowths on detrital feldspars and as euhedral pore-filling crystals in sabkha or playa mud-flat deposits were described by Gaupp *et al.* (1993).

GEOLOGIC SETTING

Samples were collected from the Lower Permian Słupiec Formation sandstones in the Intrasudetic Basin (Fig. 1) which was filled by continental, mostly clastic, deposits ranging from Lower Carboniferous to Lower Triassic (Nemec, 1981). During the Stephanian and Autunian, three stages of basin development (from alluvial to lacustrine environment) are distinguished (Wojewoda & Mastalerz, 1989). In the third cyclotheme (the Słupiec Formation) volcanic and volcanoclastic rocks are voluminously important. The Lower Permian volcanic rocks are dominated by trachyandesites and rhyolites transitional between alkaline and subalkaline types; more mafic rocks are alkaline basalts but some of their features are gradational to tholeiitic or calc-alkaline basalts (Awdankiewicz, 1994, 1997). The Saxonian is represented by coarse-grained fanglomerates and pedogenic carbonates (Wojewoda & Mastalerz, 1989). The total thickness of the Lower Rotliegendes sediments in the Intrasudetic Basin is about 1300 m and of the Upper Rotliegendes about 200–300 m (Pokorski, 1997).

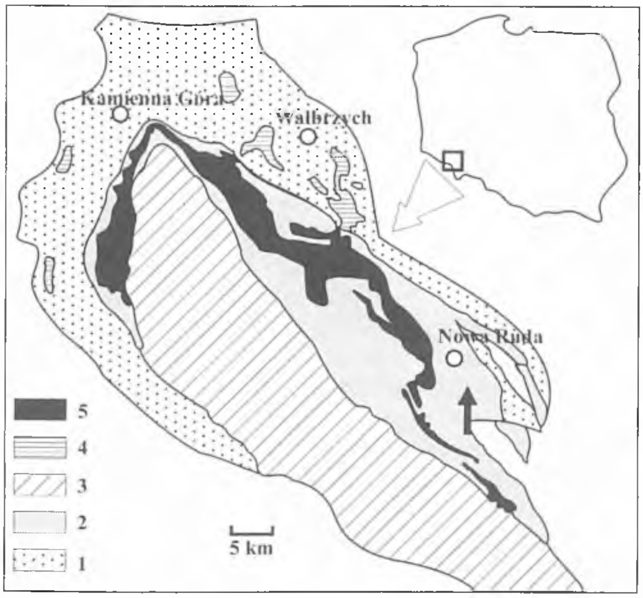

Fig. 1. Geological sketch-map of the Intrasudetic Basin. Sedimentary rocks: *1* – Carboniferous, *2* – Lower Permian, *3* – Post-Lower Permian; volcanic rocks: *4* – Upper Carboniferous, *5* – Lower Permian; *arrow* – sample site

Sandstones of the Słupiec Formation were exploited for building purposes (so-called "Building sandstone"). Sandstones from Słupiec quarries are characterized by the predominance of Na_2O over K_2O – 2.36% and 1.82% respectively (Kamiński & Kubicz, 1962). This ratio is typical of graywackes and of some lithic arenites (Pettijohn *et al.*, 1987).

ANALYTICAL MATERIALS AND METHODS

Samples of red coloured medium- to fine-grained sandstones have been collected from old quarries near Słupiec (Fig. 1).

Optical microscopy, scanning electron microscopy with energy dispersive spectrometry (SEM-EDS), and X-ray powder diffractometry (XRD) were used. JEOL 5410 electron microscope equipped with an energy dispersive spectrometer Voyager 3100 (NORAN) was used. Fresh surfaces of samples coated with carbon film were examined and the contents of oxides were evaluated according to the "standardless" procedure of calculation in Voyager software (i. e. using standards from the software library supplied by the manufacturer).

RESULTS

REVIEW OF DIAGENETIC PROCESSES

Numerous diagenetic processes have been recognized in the studied sandstones.

Dissolution of lithic grains and detrital feldspars is a very common diagenetic process. The resulting "skeletal" forms of the remains of feldspars (Fig. 2 & 3) exhibit almost exclusively pure K-feldspar composition, but with evident potassium deficiency (Table 1, GWS13, GWS15, GWS26, GWS29). The skeletal form are made of parallely oriented platelets and rods, less than 1–2 µm thick (Fig. 2 & 3). Dis-

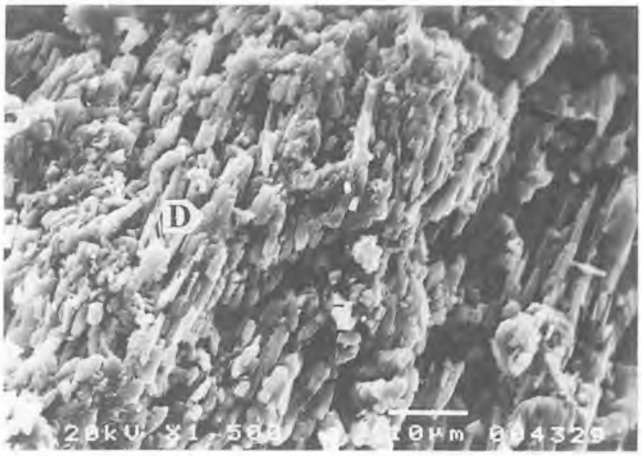

Fig. 2. "Skeletal" form of partly dissolved feldspar (D – point of analysis). SEM

Table 1

Chemical composition of some detrital and authigenic feldspars in the Lower Permian Sandstones
(A–N – point of analyses indicated in figures; "–" – non detected using EDS method)

	GWS10	GWS11	GWS12	GWS13	GWS14	GWS15	GWS16	GWS18	GWS21	GWS23	GWS25	GWS26	GWS28	GWS29
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Oxides (wt. %)														
CaO	–	–	–	–	–	–	0.12	0.17	–	–	–	–	0.47	–
K_2O	–	–	–	13.81	–	14.88	–	–	–	–	–	13.96	–	15.59
Na_2O	12.92	12.14	10.24	0.45	10.97	–	11.11	11.28	10.86	11.14	11.42	0.41	12.27	–
Al_2O_3	18.87	19.14	17.10	19.17	19.36	19.21	19.24	19.59	19.77	19.91	20.10	18.91	19.77	18.11
SiO_2	67.75	68.19	71.93	66.58	69.66	65.91	69.00	68.29	68.95	68.95	68.48	66.34	67.49	66.30
Fe_2O_3	0.16	0.53	0.72	–	–	–	0.53	0.66	0.43	–	–	0 38	–	–
CuO	0.09	–	–	–	–	–	–	–	–	–	–	–	–	–
SO_3	0.21	–	–	–	–	–	–	–	–	–	–	–	–	–
Number of cations (per 8 oxygen atoms)														
Ca	–	–	–	–	–	–	0.006	0.008	–	–	–	–	0.022	–
K	–	–	–	0.800	–	0.866	–	–	–	–	–	0.810	–	0.911
Na	1.100	1.031	0.860	0.039	0.924	–	0.939	0.955	0.916	0.940	0.965	0.036	1.044	–
Al	0.977	0.988	0.872	1.025	0.991	1.033	0.988	1.009	1.014	1.021	1.033	1.014	1.022	0.978
Si	2.976	2.988	3.113	3.021	3.026	3.008	3.008	2.984	3.000	2.999	2.984	3.018	2.961	3.038
Fe^{3+}	0.005	0.017	0.024	–	–	–	0.017	0.022	0.014	–	–	0.013	–	–
Cu	0.003	–	–	–	–	–	–	–	–	–	–	–	–	–
S	0.07	–	–	–	–	–	–	–	–	–	–	–	–	–

solution surfaces of feldspars correspond to "extensively but orderly dissolved surfaces" in the categorization of AlDahan and Morad (1987).

Crystallization of authigenic quartz. Authigenic quartz forms euhedral syntaxial overgrowths on detrital quartz grains (Fig. 4 & 5). Drusy crystallization of quartz crystals towards the centre of pore-spaces and random aggregates of quartz crystals in pore-spaces also occur (Fig. 6). Euhedral quartz crystals grow relatively rarely on partly dissolved feldspar grains.

Crystallization of hematite in the form of irregular or pseudohexagonal plates (Fig. 5) took part during relatively late diagenesis. Aggregates of hematite plates are often noted on authigenic quartz overgrowths (Fig. 5).

Crystallization of illite is widespread in the studied sandstones. Illite occurs as irregular flakes (Fig. 7). Authigenic illite often covers authigenic quartz overgrowths (Fig. 7). The filamentous variety is less common. It was noted that according to EDS analyses of some illites (mostly those which occur as smaller flakes) these are rich in iron, probably present in the form of dispersed oxides.

Crystallization of albite. Plagioclase cement rarely forms more or less continuous overgrowths on partly dissolved feldspar grains (Fig. 8, 9, 10, 11). These overgrowths are clear in contrast to mottled detrital core. A trail of hematite pigment often separates overgrowths from detrital cores (Fig. 8, 9, 10, 11). The overgrowths are in optical continuity with detrital feldspar grains. The continuity of twin lamellae in the overgrowths was also noted (Fig. 11). Diagenetic albite is present mostly as tiny dispersed crystals which can be

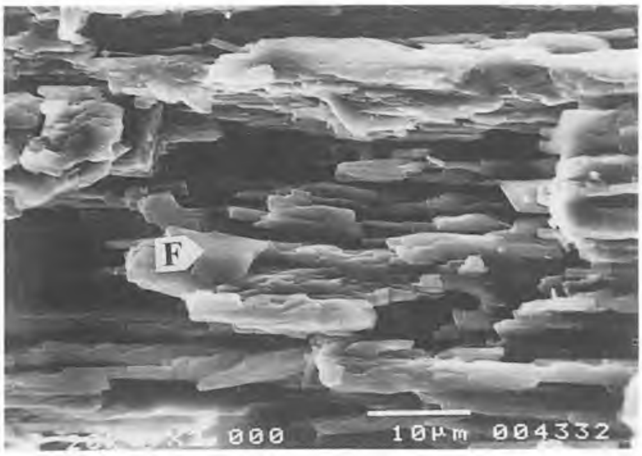

Fig. 3. Parallel laths of K-feldspar composition in "skeletal" form of dissolved feldspar (F – point of EDS analysis). SEM

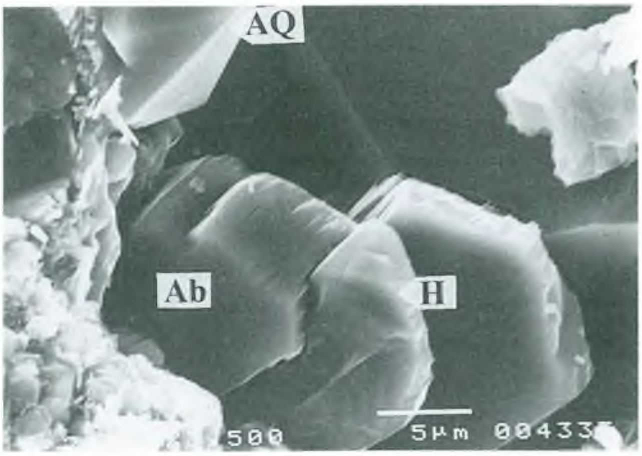

Fig. 4. Authigenic quartz (AQ) overgrowth on detrital quartz grain. The overgrowth is separated from detrital grain by thin layer of detrital clays (*arrow*). Authigenic albite (Ab; H – point of EDS analysis). SEM

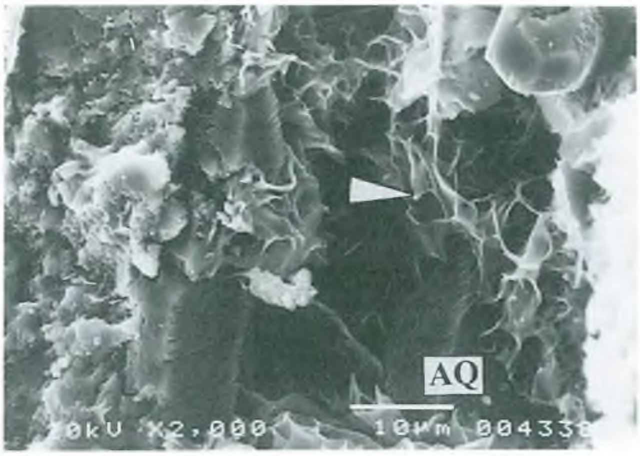

Fig. 7. Irregular flakes of authigenic illite (arrow) on authigenic quartz overgrowth (AQ). SEM

Fig. 5. Authigenic quartz (AQ) overgrowths on detrital grains. Aggregate of hematite plates (arrows) on authigenic quartz. SEM

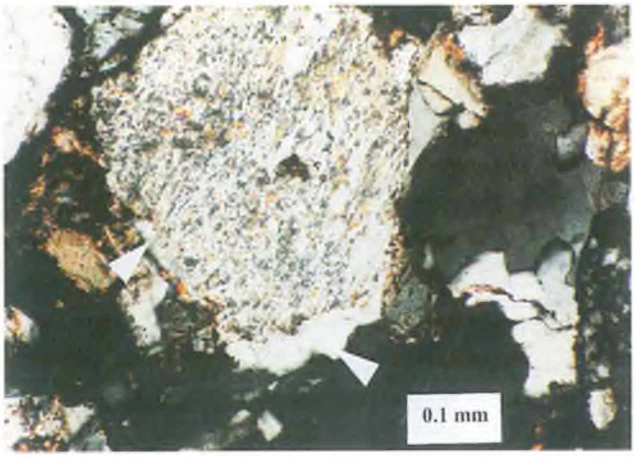

Fig. 8. Altered detrital feldspar with authigenic plagioclase overgrowth (arrows). Red pigment on the original surface of detrital grain. Crossed polars

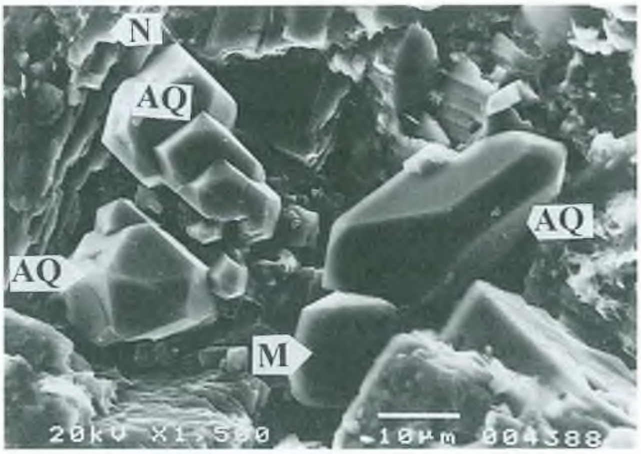

Fig. 6. Authigenic quartz (AQ) crystal in pore-space (right), authigenic quartz (AQ) on partly dissolved detrital feldspar (left; N – point of EDS analysis), authigenic albite (M – point of EDS analysis). SEM

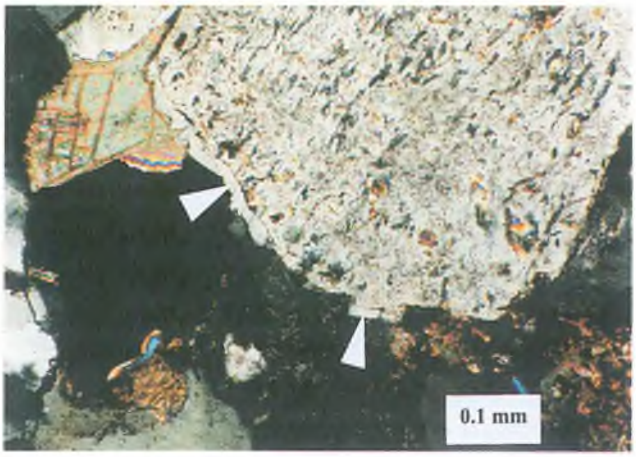

Fig. 9. Altered detrital feldspar partly overgrown by authigenic plagioclase (arrows). Coarse-crystalline calcite cement near feldspar grain. Crossed polars

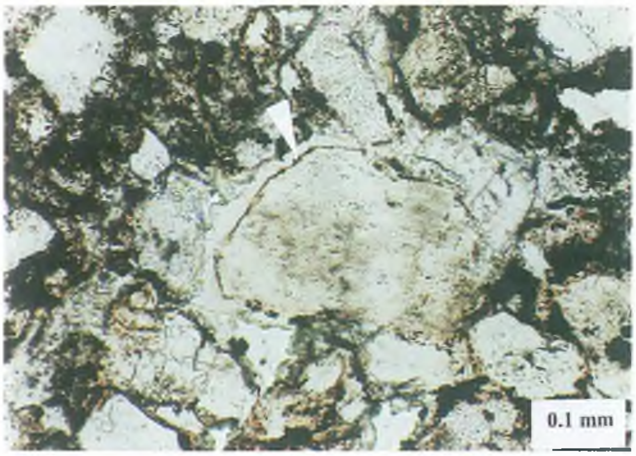

Fig. 10. Detrital feldspar and authigenic plagioclase overgrowth. Red pigment around original surface of detrital grain (arrow). One polar

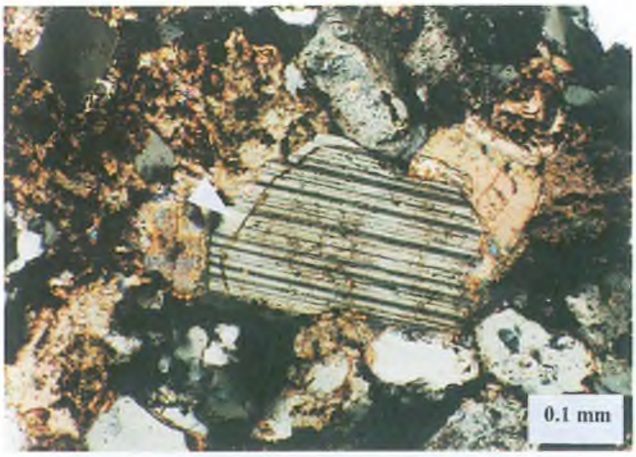

Fig. 11. Image from Fig. 10. Continuation of twin lamellae from detrital core into overgrowth (arrow). Clear coarse-crystalline and iron oxides stained calcite cement. Crossed polars

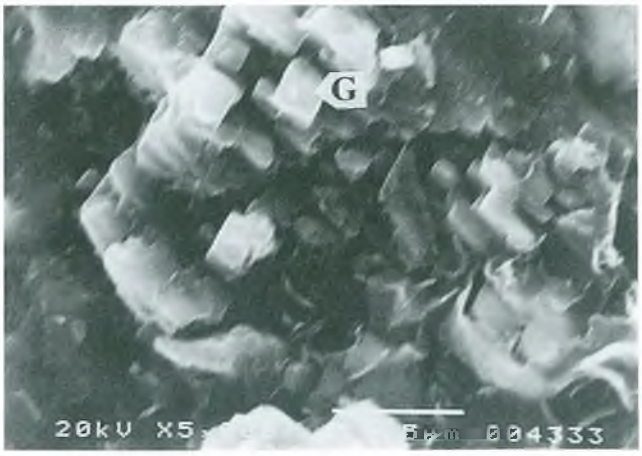

Fig. 12. Small rhombohedral albite crystals on deeply altered K-feldspar (G – point of EDS analysis). SEM

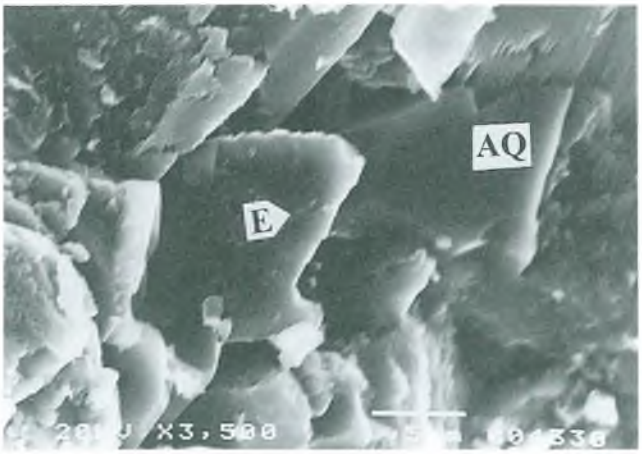

Fig. 13. Authigenic albite (E – point of EDS analysis) and authigenic quartz (AQ) crystals in overgrowth on detrital grain. SEM

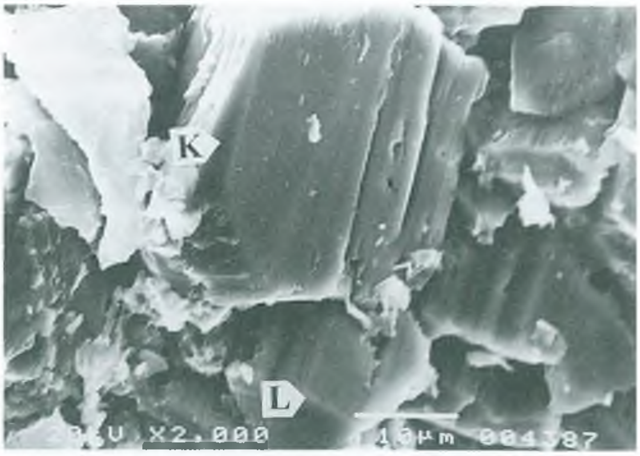

Fig. 14. Two authigenic albite crystals (K and L – points of EDS analyses) growing into pore space from altered detrital feldspar grain. SEM

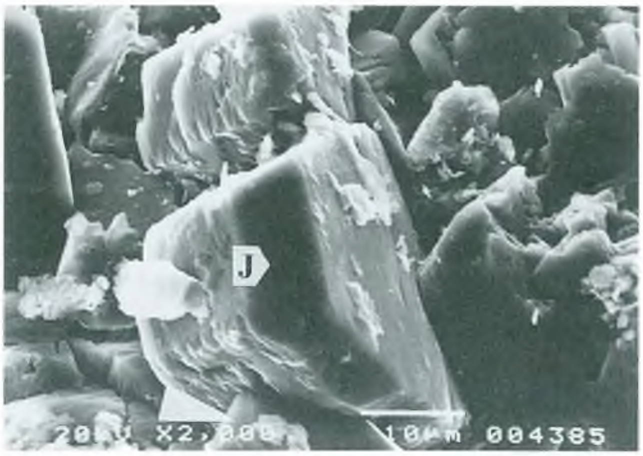

Fig. 15. Authigenic albite crystals parallely oriented in the pore space (J – point of EDS analysis). Termination of authigenic quartz (arrow) partly engulfed in albite crystal. SEM

recognized only in electron microscope. Albite crystals exhibit a broad spectrum of morphological forms (Fig. 4, 5, 12, 13, 14, 15). The morphology and chemical composition of authigenic albite crystals are presented in the next sections.

Crystallization of carbonates (calcite > dolomite) is relatively common in the studied sandstones (Fig. 9 & 10). *Gypsum* occurs sporadicaly.

MORPHOLOGY OF AUTHIGENIC ALBITE CRYSTALS

Tiny rhombohedral albite crystals (up to 1–2 μm in size) have been recognized on surfaces of partly dissolved feldspar grains (Fig. 12). Larger rhombohedral albites (Fig. 13) occur sporadically. Platy crystals of authigenic albite are also present, often in association with authigenic quartz (Fig. 4). Spatial relationships between both these minerals suggest that albite crystallized later during diagenesis. Different prismatic crystals are the most common form of occurrence of authigenic albite (Fig. 6, 14, 15), the size of elongated prismatic crystals often exceeding 20 μm. Albite crystals are parallel-arranged (Fig. 15) or randomly oriented. The crystal faces are uncorroded, with some irregular flakes of clay minerals present on crystal faces. Authigenic quartz terminations engulfed partly in prismatic albites (Fig. 15) indicate that quartz crystallization pre-dates the crystallization of albite.

CHEMICAL COMPOSITION OF AUTHIGENIC ALBITE CRYSTALS

Authigenic albites exhibit high degree of chemical purity (Tab. 1). The highest content of anorthite molecule determined in authigenic albite is below 2 wt % (Tab. 1; GWS28). Most albites are devoid of anorthite molecule or contain only low amount of it ($An_{0.0-0.5}$). In several albite crystals traces of iron occur (Tab. 1). Copper and sulphur (Tab. 1; GWS10) have also been detected in one of the examined albite crystals.

DISCUSSION

Occurrences of diagenetic albite in the Permian sandstones from Sudetic and Fore-Sudetic areas

The comparison of diagenesis of the Rotliegendes sandstones from the Intrasudetic Basin, North Sudetic Basin, and Fore-Sudetic Monocline is difficult. This is caused by lack of systematic studies of the Rotliegendes sandstones diagenesis in the Intrasudetic Basin. Studies of diagenesis in the North Sudetic Basin and Fore-Sudetic Monocline are concentrated on the uppermost part of Rotliegendes and on Weissliegendes sandstones. Albite has not been recognized among diagenetic minerals in the Fore-Sudetic Monocline (Grabowska-Olszewska, 1974; Grabowska-Olszewska *et al.*, 1974; Rochewicz, 1980; Muszyński & Rydzewska, 1986; Michalik, 1995, 1997) or other areas in Western Poland (Rochewicz, 1980; Rochewicz & Bakun, 1980). In the North Sudetic Basin, albitized plagioclases occur only rarely (Michalik, unpublished).

Assuming that total amount of Na_2O (see Kamiński & Kubicz, 1962) the Słupiec Formation is incorporated in albite (or albite molecule in plagioclases), it is possible to evaluate the albite content in sandstones from the environs of Słupiec as close to 20 wt %. The mean content of Na_2O in Fore-Sudetic sandstone copper ores (Weissliegendes sandstones) is 0.25 % (Konstantynowicz, 1971) which corresponds to 2.1 % of albite component in the rock.

Authigenic albite is commonly considered to be associated with sandstones of marine origin (Rasmussen & Glover, 1996) or invaded by marine brines. The opposite situation is in the case of the studied Rotliegendes sandstones. The Słupiec Formation sandstones have never been in close contact with marine sediments, but the uppermost parts of Rotliegendes sandstones from the North Sudetic Basin and Fore-Sudetic Monocline were "reworked" by Zechstein sea transgression and capped by Zechstein deposits. It indicates that Na^+ rich solutions of non-marine origin should be taken into account.

Source of sodium-rich diagenetic solutions

The growth of albite in quartz saturated systems is controlled by a_{Na}/a_H and a_K/a_H ratios (Helgeson *et al.*, 1969). It indicates that the availability of Na^+ ions in the solutions was a crucial condition for the diagenetic growth of albite. In the case of Rotliegendes sandstones from the Intrasudetic Basin, several sources of Na^+ can be considered: the liberation of Na^+ from diageneticaly altered unstable lithic grains and plagioclases, the influence of Na-rich hydrothermal solutions related to metasomatosis of volcanic rocks, the migration of Na-containing solutions squeezed from mudstones and claystones deposited in lacustrine environments in the central part of sedimentary basin.

It is possible that Na-rich composition of diagenetic solutions was the result of reactions of meteoric water with framework components (mostly unstable feldspars and lithic grains). The habit of skeletal forms of extensively dissolved detrital feldspars are related to the intensity of dissolution and to the mechanism of dissolution. It is possible that a surface-controlled mechanism (Berner, 1978) or more than one dissolution mechanism were involved (AlDahan & Morad, 1987). The role of each mechanism may be controlled by the composition of the solution, pH, and temperature (Chou & Wollast, 1985; Holdren & Speyer, 1985; AlDahan & Morad, 1987). Skeletal form of feldspars can be also related to selective dissolution of inhomogenous feldspar grains (e. g. perthites). More albite and anorthite rich lamellae are dissolving more easily than K-feldspar (Nixon, 1979; Al Dahnan & Morad, 1987). It is suggested that plagioclase dissolution and albite overgrowths formation may be correlated (Ayalon & Longstaffe, 1988). The dissolution of detrital plagioclases and K-feldspars with perthitic plagioclase lamellae may supply ions for albite authigenesis (Strong & Milodowski, 1987).

It is also possible that the composition of pore solutions in the Rotliegendes sediments was strongly influenced by Early Permian volcanism. The alterations of intensively albitized volcanic rocks (Dziedzicowa, 1958; Nowakowski, 1968; Ryka, 1981) and/or direct input of albitizing solutions probably resulted in the increase of concentration of Na^+

(and other components) in the diagenetic environment of sandstones. Dziedzicowa (1958) describes, beside albitized volcanic rocks, albite-containing veins crosscutting volcanics. Ryka (1981) suggests that intensive post-volcanic albitization of the Autunian volcanic, pyroclastic, and locally sedimentary rocks was related to some hot-spots from which Na-rich hydrothermal solutions migrated into the Permian volcano-sedimentary sequence.

Numerous occurrences of neoformed minerals in the Lower Permian sediments are often interpreted as a result of action of sodium-rich volcanic hydrothermal solutions. Śliwiński (1984) suggests that metasomatic influence of Permian volcanism was important in the development of continental carbonate-rich rocks (the Chełmsko Śląskie beds) in the Słupiec Formation. In his opinion, Na-hydrothermal autometasomatism of volcanic rocks caused migration of Ca and Mg containing solutions. Authigenic albite and analcite are considered to be the marker minerals of tuffaceous layers intercalated in lacustrine successions in Autunian sediments of Central and NE Bohemia (Skoček 1988). Johan and Povondra (1987) considered that analcite growth in red siltstones in the Lower Autunian deposits of NE Bohemia indicates a hydrothermal supply of Na^+ into the sedimentary basin.

According to present author's knowledge, there is no petrographic study of the sedimentary Rotliegendes sequence elucidating time relationships between albitization and sedimentation, *viz.* whether the volcanic rock clasts were deposited as albitized fragments or were albitized after deposition.

It is also possible to assume that the solutions relatively rich in Na^+ were squeezed from mudstones and claystones deposited in the central part of the sedimentary basin, but there is no evidence for such interpretation in this case.

A high percentage of volcanic rocks in the volume of the Lower Permian sedimentary basin and their wide spread postmagmatic alterations suggest that a hydrothermal supply of Na^+ containing solutions into the Rotliegendes sediments is most probable. This suggestion is in accordance with the opinions of other authors. In areas where, in the Rotliegendes sediments, the amount of volcanic rocks is lower, albitization is rather uncommon. Dissolution of feldspars or unstable lithic grains was the secondary source of Na^+ in the solutions (or may be without any importance).

Crystallization of diagenetic albite

The growth of authigenic albite is probably initiated in the form of numerous small (µm in size) rhombohedral crystals. Nucleation of these crystals took place on highly uneven surfaces of dissolved feldspars or lithic detrital grains. This is probably the reason for the isolated development of numerous discrete albite crystals. These albite crystals during further growth do not form more or less continuous overgrowths on detrital grains, similar to the model presented for authigenic K-feldspar by Worden & Rushton (1992). The growth of authigenic albite in the Intrasudetic Depression is not restricted to one type of "substratum". This is consistent with the data of Pittman (1988), who described authigenic albite on plagioclase as well as on K-feldspar grains. Authigenic albites (10–50 µm in size) were also noted on and within partly dissolved amphiboles (De Ros *et al.*, 1994).

Time of albite crystallization

The determination of time position of albite growth is unprecise in the case of the studied sandstones. The growth of albite started after intensive dissolution of unstable grains. Spatial relations with authigenic quartz indicate that quartz pre-dates albite formation in the diagenetic sequence. The lack of clear relations with minerals originating in later stages of diagenesis preclude the determination of an "upper" time limit of albite crystallization. In some cases albite is considered to be relatively late-diagenetic mineral. For example, albite overgrowths on authigenic kaolinite (Huggett, 1984) suggest late-diagenetic albite growth.

CONCLUSIONS

1. Albite cement is relatively common in sandstones from the Słupiec Formation. The content of authigenic albite cement in the Intrasudetic Basin is much higher than in the North Sudetic Basin.

2. Alteration of albitized volcanic rocks during Lower Permian clastic sediments diagenesis and/or direct supply in hydrothermal solutions were the most important sources of Na^+ ions for albite growth. Decomposition of detrital plagioclases and lithic grains was probably of secondary importance or totally negligible.

3. Albite growth was initiated by nucleation on strongly dissolved feldspars (K-feldspars) or on other detrital grains in the sandstone. It is possible that the form of albite crystals evolved during crystal growth (from rhombohedral to prismastic). Diagenetic albites exhibit high degree of chemical purity (very low content of Ca).

4. Albite crystallization took place at relatively late stage of diagenesis (later than intensive dissolution of unstable grains and crystallization of authigenic quartz).

5. A more detailed study of the Rotliegendes sandstones diagenesis in the Intrasudetic Basin is needed for the explanation of reletionships between volcanic rocks emplacement, post-magmatic hydrothermal activity and clastic diagenesis.

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Streszczenie

DIAGENETYCZNY ALBIT W PIASKOWCACH CZERWONEGO SPĄGOWCA Z NIECKI ŚRÓDSUDECKIEJ

Marek Michalik

W próbkach piaskowców czerwonego spągowca z Niecki Śródsudeckiej (należących do formacji ze Słupca), pobranych z nieczynnych kamieniołomów na Górze Wszystkich Świętych, stwierdzono powszechne występowanie diagenetycznego albitu. Proces albityzacji następował po okresie intensywnego rozpuszczania ziaren niestabilnych (ziaren litycznych oraz skaleni) oraz (przynajmniej częściowo) po okresie wzrostu cementu kwarcowego. Relacje czasowe innych wydarzeń diagenetycznych (krystalizacji hematytu, illitu i podrzędnie węglanów i gipsu) nie mogą być w sposób pewny określone.

Diagenetyczny albit, wykazujący znaczną czystość składu chemicznego (udział cząsteczki anortytowej najczęściej pomiędzy 0.0 i 0.5 % wag., najwyższa poniżej 2 % wag.; por. Tab. 1) krystalizował na nierównej powierzchni silnie rozpuszczonych skaleni najczęściej wykazujących skład skaleni potasowych (lub rzadziej ziaren litycznych). Małe kryształy albitu (1–2 μm) odznaczają się pokrojem romboedrycznym; większe (do ponad 20 μm) są słupkowo wydłużone i narastają bezładnie lub częściej równolegle do pewnych kierunków krystalograficznych w rozpuszczanym skaleniu tworzącym podłoże.

Główną przyczyną wzrostu znacznej ilości diagenetycznego albitu w piaskowcach z Niecki Śródsudeckiej (w porównaniu z piaskowcami z Niecki Północnosudeckiej i "płytszej" części monokliny przedsudeckiej) był wpływ przeobrażenia permskich skał wulkanicznych powodującego wzrost ilości Na^+ w roztworach diagenetycznych. Sód mógł być uwalniany z silnie zalbityzowanych skał wulkanicznych w trakcie ich zmian lub bezpośrednio dostarczany wraz z hydrotermalnymi roztworami pomagmowymi powodującymi albityzację. Uwalnianie sodu z "rozkładanych" w trakcie diagenezy skaleni detrytycznych było zapewne źródłem o drugorzędnym lub całkiem nieistotnym znaczeniu.