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GYPSUM OOIDS FROM THE MIOCENE DEPOSITS OF THE VICINITY OF STASZÓW

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In 1980–82, the Holy Cross Department of the Geological Institute in Kielce led an investigation of the southern slopes of the Holy Cross Mountains, Central Poland. Bore-holes were distributed throughout an area placed along the northern extent of the Middle Miocene (Badenian) evaporites. In the vicinity of Staszów in the bore-hole Wiśniowa-1 at the depth 22.80–23.08 m (Fig. 1) gypsum ooids (**gypsolites:** 2) were found within the sulfate sediments. The layer which comprises the ooids reaches 28 cm in thickness and it lies directly on the laminated gypsum containing gypsum crystals growing upward (Fig. 2).

The gypsum crystals, which attain several cm in length, have grown simultaneously with deposition of finegrained, laminated gypsum. Rod-like algal filaments (0.05–0.06 mm in diameter and to 0.7 mm in length) are poikilitically enclosed and arranged in layers in the gypsum crystals. The filaments are incrusted with calcium carbonate crystals. Such a structure indicates that algal mats participated in the formation of described deposits (similar filaments are shown in 1: Fig. 5 and 2: Fig. 2).

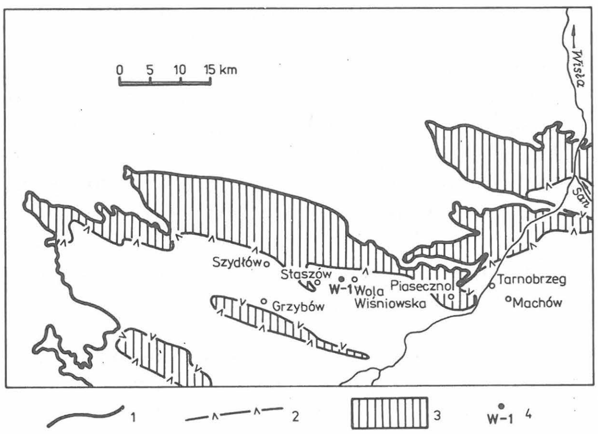

Fig. 1. Location of the bore-hole Wiśniowa-1 against the extent of the Miocene sulfate formation on the southern slopes of the Holy Cross Mts (after T. Osmólski: 4, supplemented).

1 – extent of Miocene deposits, 2 – extent of the sulfate formation, 3 – areas devoid of sulfates, 4 – bore-hole Wiśniowa-1.

Ryc. 1. Lokalizacja wiercenia Wiśniowa-1 na tle zasięgu formacji siarczanowej miocenu południowych stoków Gór Świętokrzyskich (wg T. Osmólskiego: 4, uzupełnione).

1 – zasięg osadów miocenu, 2 – zasięg formacji siarczanowej, 3 – obszary pozbawione siarczanów, 4 – otwór wiertniczy Wiśniowa-1.

The overlying oolitic sediment has distinctly detrital character (Fig. 2). Besides the ooids, thin crumpled gypsum crystals (sometimes greater grains, rounded by abrasion

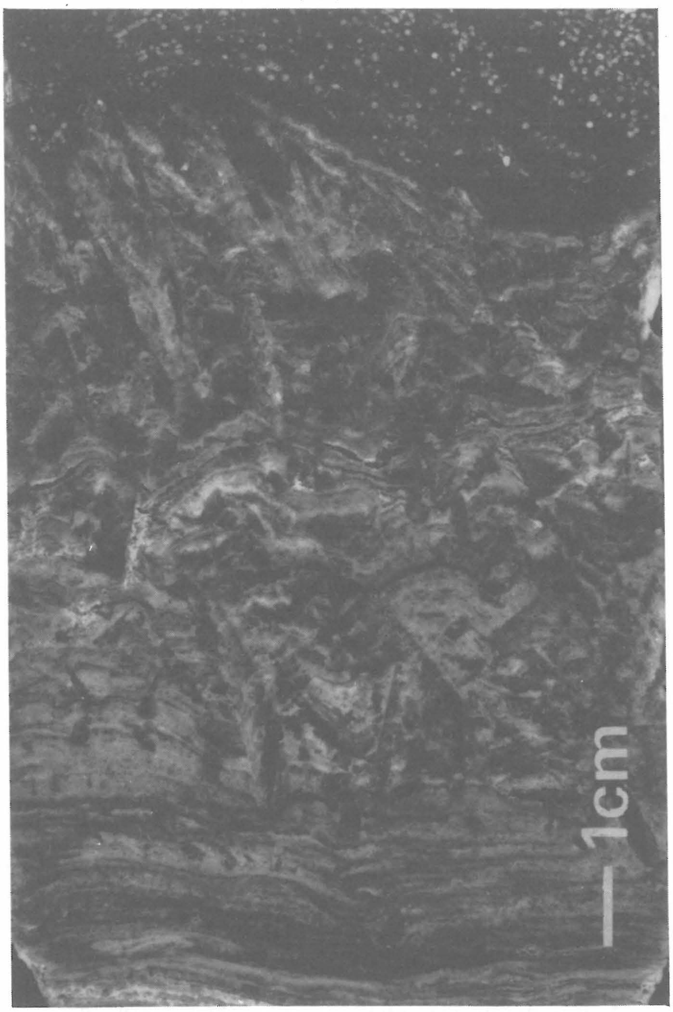

Fig. 2. Polished surface of the core fragment from the bore-hole Wiśniowa-1. At the bottom: laminated gypsum with gypsum crystals growing upward. At the top: detrital, finegrained gypsum with numerous gypsum ooids filling a primary hollow on the sea bottom. Photo by B. Drozd.

Ryc. 2. Zgład fragmentu rdzenia z wiercenia Wiśniowa-1. U dołu: laminowany gips z rosnącymi ku górze kryształami gipsu. U góry: klastyczny, drobnoziarnisty gips z licznymi ooidami gipsowymi, wypełniającymi pierwotne zagłębienia morskiego dna. Fot. B. Drozd.

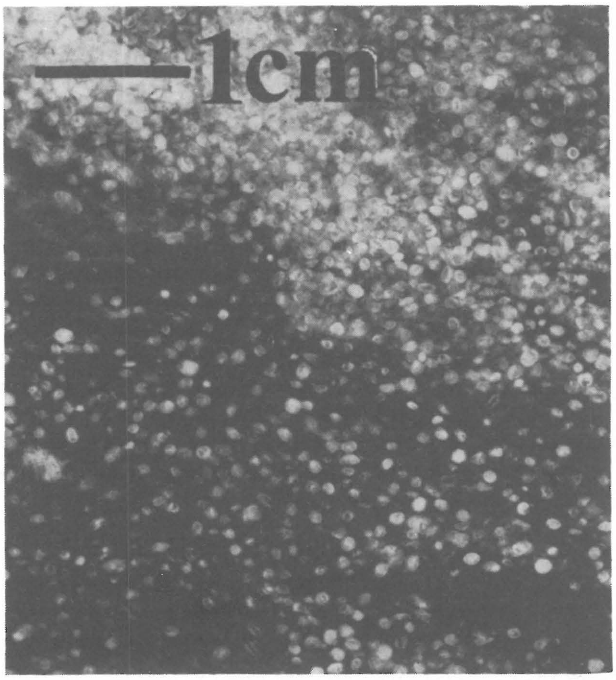

Fig. 3. Gypsum ooids within finegrained gypsum and clay. Photo by B. Drozd.

Ryc. 3. Ooidy gipsowe wśród drobnoziarnistego gipsu i iłu. Fot. B. Drozd.

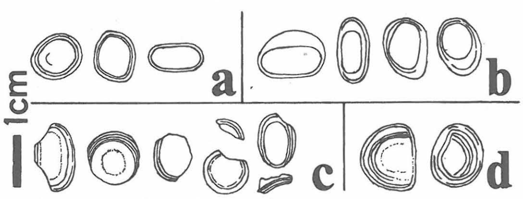

Fig. 5. Types of gypsum ooids: **a** *– with concentric cortex,* **b** *– with eccentric cortex,* **c** *– broken, abraded and corroded,* **d** *– regenerated.*

Ryc. 5. Typy ooidów gipsowych: **a** *– ze współśrodkowymi powłokami,* **b** *– z niewspółśrodkowymi powłokami,* **c** *– połamane, zabradowane i skorodowane,* **d** *– zregenerowane.*

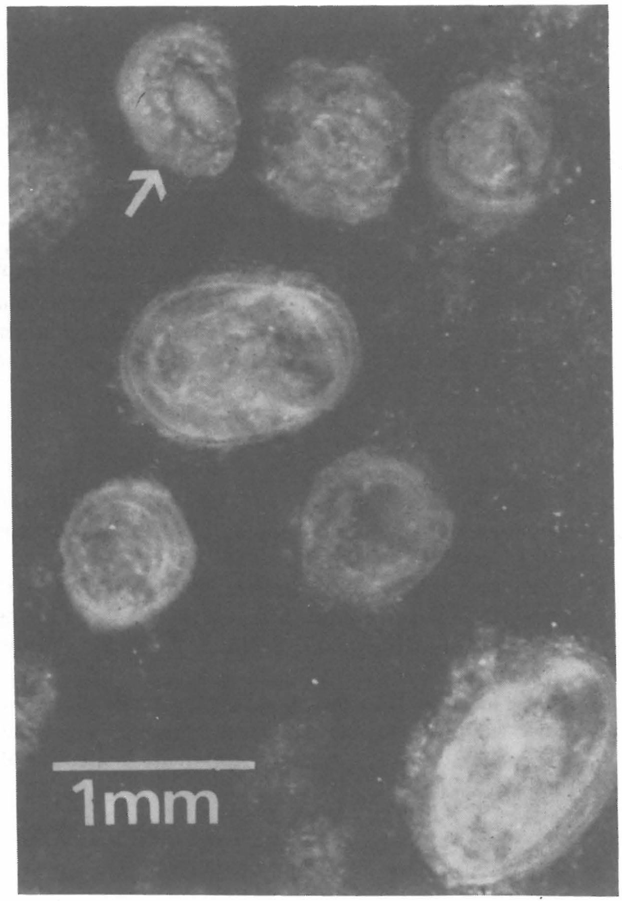

Fig. 4. Gypsum ooids within finegrained gypsum and clay. Arrowed is a broken, abraded and corroded ooid. Photo by B. Drozd.

Ryc. 4. Ooidy gipsowe wśród drobnoziarnistego gipsu i iłu. Strzałka wskazuje połamany, zabradowany i skorodowany ooid. Fot. B. Drozd.

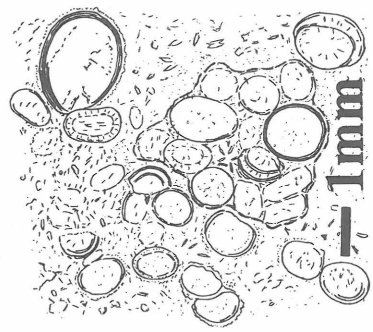

Fig. 6. Gypsum ooids within finegrained gypsum and clay. In the middle: a grapestone built of gypsum ooids.

Ryc. 6. Ooidy gipsowe wśród drobnoziarnistego gipsu i iłu. Pośrodku: grudka groniasta zbudowana z gipsowych ooidów.

and corrosion, to 3 mm in diameter) and aggregates of clay minerals occur there. In the upper part of the layer the gypsum ooids dominate (Fig. 3). The detrital material is mixed, and the layering is visible merely as a wavy streaking (Fig. 2 and 3). The oolitic sediment fills the pocket-like hollows between the gypsum crystals (Fig. 2). The crystals are slightly erroded and corroded. The sediment resting underneath the bottom of the hollows preserves continuity of lamination and was not destroyed. The detrital material containing the ooids was evidently carried from the nearest vicinity and deposited at one sedimentary act.

Commonly, the gypsum ooids are about 1 mm in diameter but maximally they reach 2 mm (Fig. 4). Their nuclei are formed by the larger gypsum crystals rounded by abrasion or corrosion, and occurring either singly or as aggregates. Most often the cortexes of the ooids are eccentric (Fig. 5). Microscopic observations testify that the cortexes are built of many thin gypsum crystals creating units in which the crystals show nearly parallel orientation. These crystals have grown in crystallographic discontinuity or, in places, in continuity with the crystal forming the nucleus. Frequently an overgrowth rim of the gypsum crystals is developed around the cortex. Inclusions of the calcium carbonate crystals arranged concentrically occur in the ooids. Many ooids are broken (Fig. 4, 5, 6); some of them are often abraded and corroded, some others are regenerated (compare 5). Sometimes aggregates of the ooids which show a character of grapestones (3: Fig. 5) are visible (Fig. 6). They indicate that the partly lithified oolitic sediment was destroyed and redeposited.

Gypsum ooids have rarely been described in the literature. They occur in the Upper Miocenian of the Central--Southern Apennines in Italy (1, 2, 6, 7). From the ancient evaporites also anhydrite ooids from the Upper Jurassic of the Netherlands are known (8). Halite ooids (**halolites:** 9) and mirabilite ooids (Dr Jose Pueyo Mur – oral information 1985) were noted in recent sedimentary environments.

The discussed gypsum ooids have been formed probably nearby the shore in such places where the wave base exerted its influence on the bottom sediments and brine attained saturation allowing the gypsum to precipitate. The ooids were accumulated as the beach ridges similarily to the halite ooids from the coast of the Dead Sea (9) or as subaqueous dunes and shoals (see 7 p. 109). The beach ridges and the shoals were washed away by storm waving and the oolitic sediments were transported and deposited in an offshore area.

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STRESZCZENIE

W środkowomioceńskich (badeńskich) osadach gipsowych południowych stoków Gór Świętokrzyskich, w okolicach Staszowa, znaleziono gipsowe ooidy. Występujący w cienkiej warstwie oolitowy osad jest interpretowany jako redeponowany przez sztormowe falowania z wałów brzegowych lub przybrzeżnych mielizn w strefę bardziej oddaloną od brzegu.