THE STORY OF THE JURASSIC TERMITE NESTS

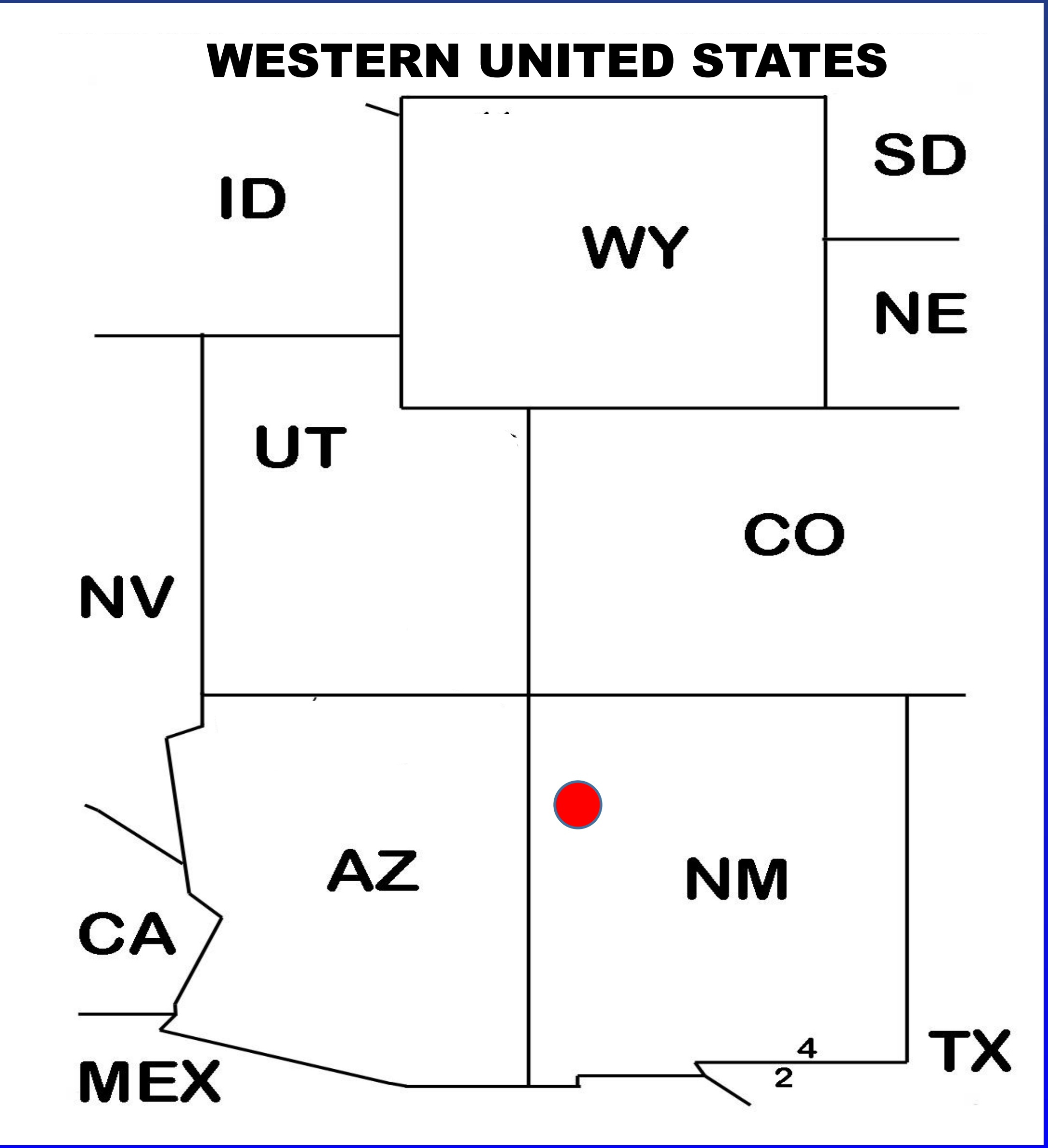
Ariel A. Roth, 2022
www.sciencesandscriptures.com

THE CONTROVERSY

Fossil termite nests have been reported in the fossil record. The presence of these nests is presented as evidence challenging the biblical account of beginnings; specifically the one year Genesis Flood as the cause for much of the fossil record. The model of slow evolutionary development of life over millions of years provides the time necessary for the gradual growth of termite nests. On the other hand, the biblical account does not accommodate for these termite nests that take several years to be built. This is a time issue that engenders questions about the authenticity of these termite nests.

Iconic putative Jurassic termite nest (arrow)

The “nests” are located 5 miles east of Gallup, NM



The putative nests are concentrated on either side (arrows) of the Navajo Church spires in the Jurassic Morrison Formation

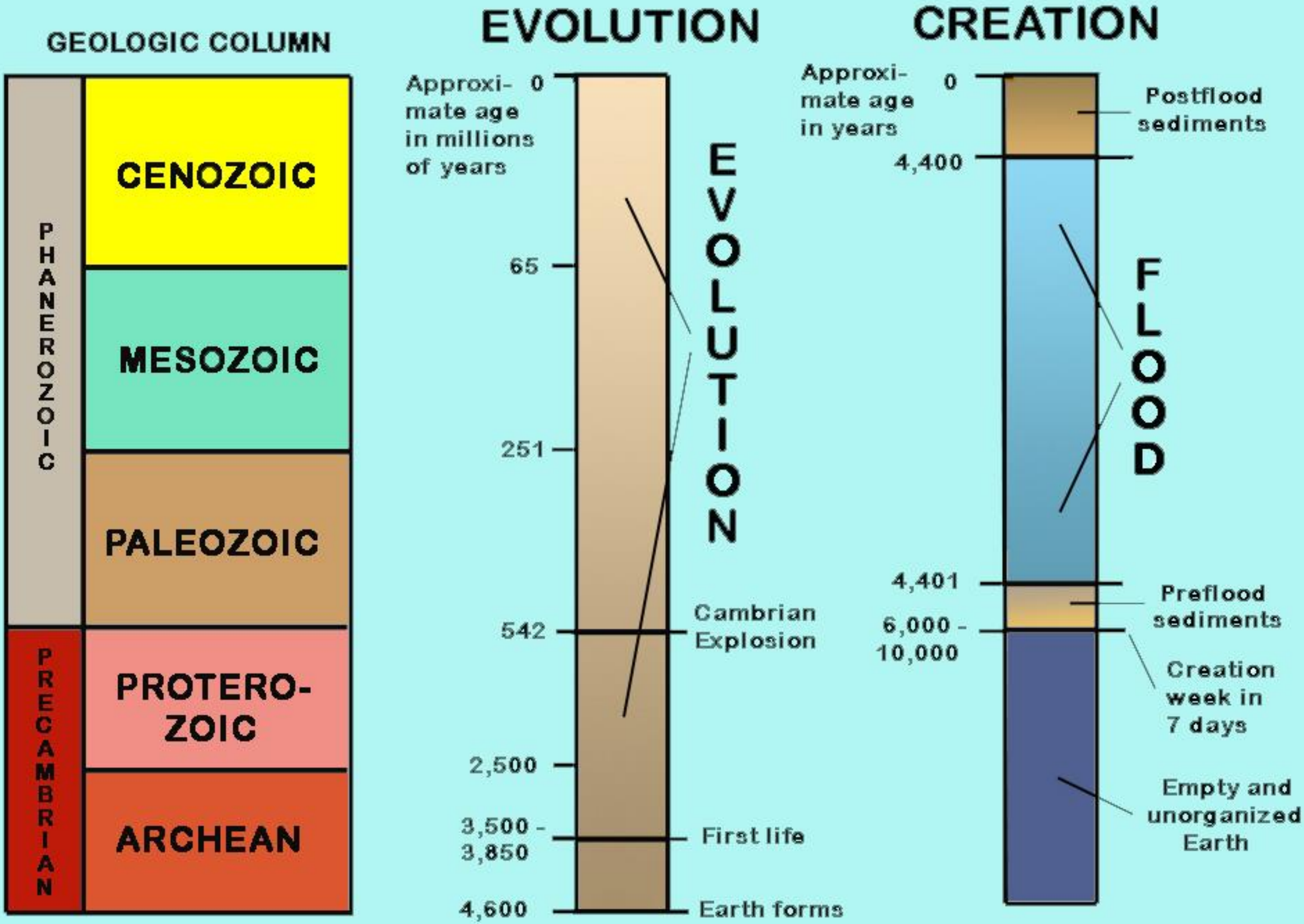
AN EXTANT TERMITE NEST FROM NIGERIA

It takes 3-5 years to build a nest this size.

RELATION TO GEOLOGIC COLUMN

The proposed Jurassic fossil termite nests under discussion here lie in the middle of the Phanerozoic portion of the geologic layers, with abundant fossils above and below. In the next slide, they lie in the middle of the Mesozoic of the left column. In the middle column they lie at the same level. In the right column, they lie at the same level in the middle of the Genesis Flood. Note that the time scale for the middle column is in millions of years for evolution, while only in years for the right column for creation. Up and down distances not at the same scale.

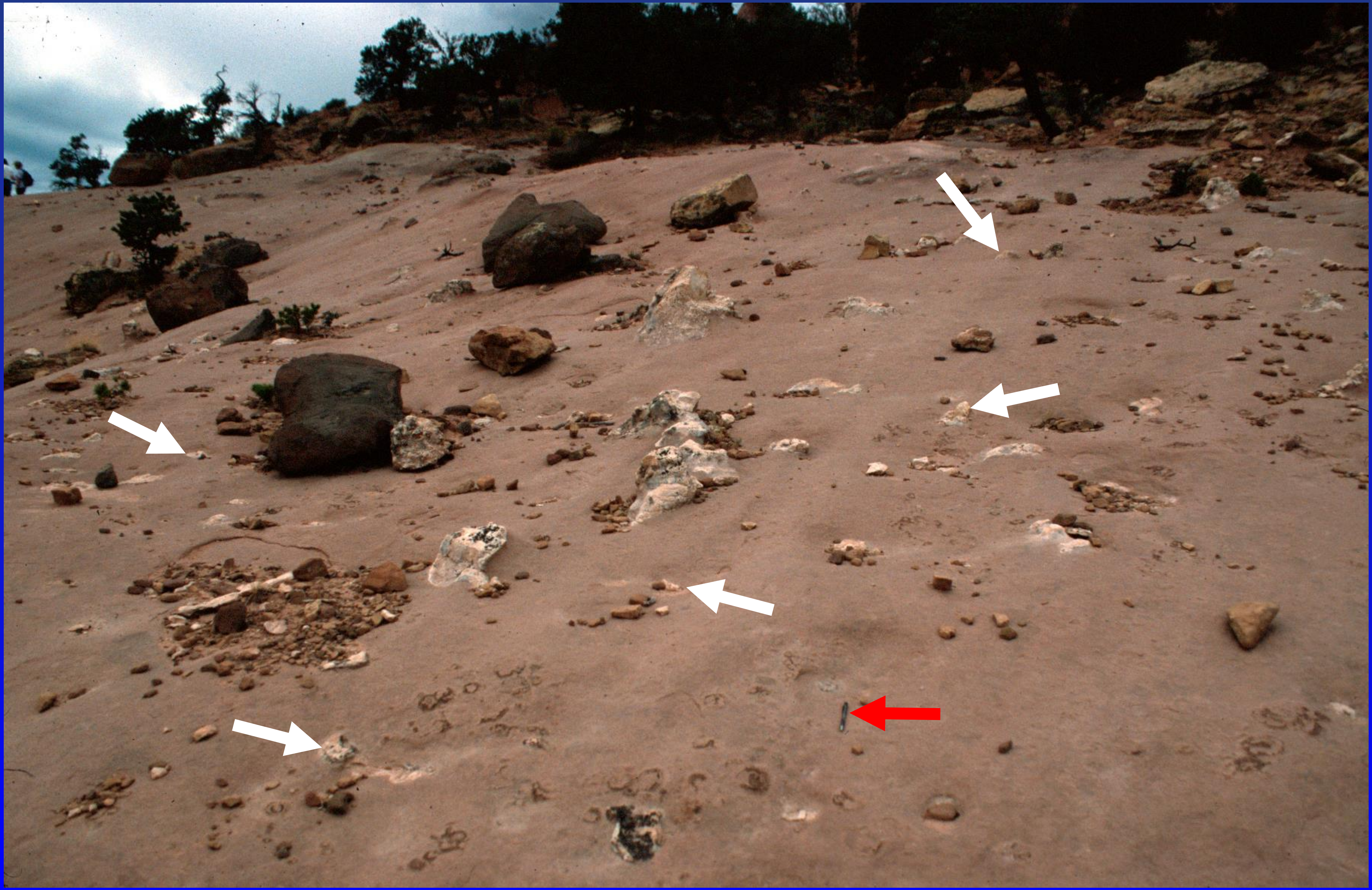
TWO MODELS FOR THE GEOLOGIC COLUMN



Suggested termite nests (arrows) on east side of Navajo Church, New Mexico. Tallest one is 2 meters high.

Suggested termite nests, i.e. concretions (arrows), on west side of Navajo Church. Tallest ones, 1 meter high.

There are many smaller “nests,” white arrows. Pen, red arrow, is 14 cm long.



DEEP INTEREST IN TERMITES IN 1997

Interest was likely stimulated by an abstract presented that year at the Geological Society of America annual meeting, proposing that these intriguing structures were termite nests.

The next few slides discuss this.

SOME 1997 COMMENTS ABOUT FOSSIL TERMITE NESTS

Hasiotis, ST et al. 1997. GSA Abstracts A-461

"Enormous pillars … are interpreted as … subterranean termite nests in alluvial and eolian deposits … composed of thousands of simple and compound galleries … 0.15 to 0.5 cm in diameter … to "pan sized" chambers … preferentially preserved because of the organics used in their construction."

GSA Annual Meeting Press Release, 1997

Nests "… appear to reach 120 feet below the ground … some types of termites construct their nests around dead and dying tree stumps and root systems …"

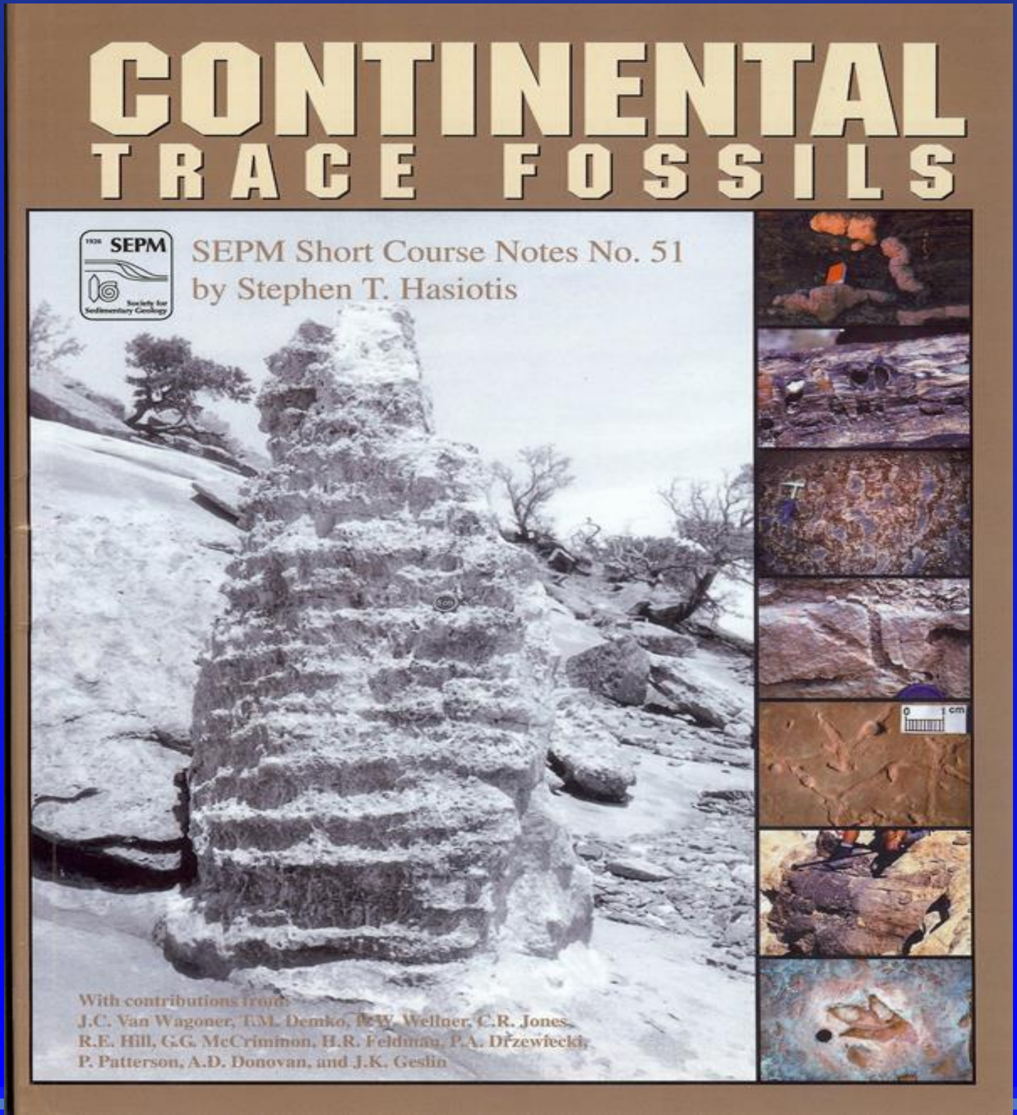
USA TODAY, Internet, updated 1998 (2000 download)

"The insects used saliva, feces and partly digested wood to glue sand grains together … Their height may have served to protect the termites from carnivorous dinosaurs seeking high-protein snacks."

ACCEPTANCE OF FOSSIL TERMITE NEST INTERPRETATION

- Hasiotis is credited with discovering the world's oldest crayfish fossil as well as the oldest bee, ant, and termite nests
- Children's Web pages talked about this
- Interpretations of ancient ecosystems include these
- The author of this presentation (Roth) has seen at least four anti-Biblical Flood web pages that present termite nests as evidence that most of the Phanerozoic part of the geologic column could not have been deposited during the Genesis Flood.
- Course syllabi included these
-

Cover of a geology short course manual, advocating termite nests interpretation. The large iconic "nest" from Navajo Church is pictured on the cover..



OF INTEREST:

- There is a report of the "earliest" termite nests in the fossil record found in the Triassic Chinle Formation (Hasiotis and Dubiel, 1997). That formation lies below the Jurassic. However Labandeira (1998) suggests that this finding awaits confirmation, and Thorne, et al. (2000) state that this identification can be "dismissed with almost complete certainty." Identification of fossil termite nests is too often subjective.

WHY THIS STUDY?

- In the late 1990s, there were discussions about time in the fossil record at meetings of the Biblical Research Institute Science Council (BRISCO) held in Loma Linda, CA. Some leading participants referred to fossil termite nests as evidence against a Genesis Flood interpretation of the fossil record.
- Small termite nests, less than a meter in height can take several years to be built. It does not seem possible to grow significant termite nests during the year of the Genesis flood described in the Bible.
- In 1997, in the halls of a Loma Linda University science department, there appeared a picture of a huge Jurassic fossil termite nest that would take years to be formed. Interest in fossil termite nests was growing.
- Were fossil termite nests going to become a “Mecca” for those seeking to challenge the Genesis Flood, as was the case for the “superimposed” fossil forests of Yellowstone National Park whose total age seamed to far exceeds the constraints of biblical chronology?

WHY THIS STUDY? (Continued)

- When the author of this presentation (Roth), saw the posted picture, he immediately decided to investigate these structures and see if they were really termite nests.
- Studies soon showed that the nests were not made of the same composition as the host rocks, while termites generally use host rock and local loose sediments to build their nests. Some other external source seemed involved.
- At a later BRISCO meeting, a repeat suggestion that termite nests challenge the Genesis Flood was summarily dismissed by many. It did not appear that the termite nest interpretation was being generally accepted by this group.
- The data showing the difference between the host rock and the purported termite nests was secured in the scientific literature in a GSA poster/abstract (Roth, et al., 2006), and in details in the peer reviewed journal, Sedimentary Geology (Roth, et al., 2019). Samples follow:

COMPLEX CONCRETIONS IN THE JURASSIC MORRISON FORMATION

Ariel A. Roth, Dwight Hornbacher, and Tom Zoutewelle

Geol. Soc. Am. Abstr. Programs 38:7, 2006

ABSTRACT

Complex concretions found in bedded sandstones of the Recapture Member of the Morrison Formation near Church Rock, NM are often large, resistant to erosion, and frequently display an abundance of 4-10 mm diameter branches. A common form is a vertical cylinder in the meter range, protruding and/or imbedded in the country rock, which consists of a hard core that often encloses an internal soft core. Frequently branches protrude from the hard core into the country rock and/or form irregular complexes. Cores or branches may be missing, and simple to compound bizarre shapes abound, including rare horizontal cylinders of core with small protruding branches.

On a microscopic scale the contact between concretions and country rock is dominantly irregular and gradational. Thin section point count comparisons of eight concretions with eight samples of country rock show significantly more cement ($P < 0.001$) and fewer primary pores ($P < 0.001$) in the concretions; also significantly fewer grains and more IGV ($P = 0.014$ for both) in the concretions. SEM of the concretions shows dominant pore-filling microcrystalline quartz, including intergrowth with illite/smectite. The country rock shows variable amounts of pore linings and local pore fillings composed of chlorite, kaolinite, illite/smectite, hematite, and microcrystalline quartz. Comparisons by XRF shows significantly more Si ($P < 0.001$) and less Al, Fe, Na, K, Mn, and Mg ($P \leq 0.003$) in the concretions. NA shows significantly less Na, Fe, Rb, Sb, and La ($P \leq 0.007$) in the concretions; Si and Al were not tested by NA. These data suggest that silica is added to the country rock to form the concretions.

Petrographic analysis seems to invalidate the suggestion of a fulgurite origin. Thus far, we have not found a convincing termite nest architecture or termites, and this brings into question the fossil termite nest interpretation. The rhizoconcretion interpretation also appears to be problematic due to general morphological factors and a paucity of ramifications. It may be that the concretionary process follows in part the pattern of the abundant "tubes," of organic or inorganic origin, that are already present in the country rock. It is hoped that the data presented above will help elucidate the origin of these intriguing structures.

Sedimentary Geology 392 (2019) 105526

Contents lists available at ScienceDirect

Sedimentary Geology

journal homepage: www.elsevier.com/locate/sedgeo

Complex siliceous concretions in the Jurassic Morrison Formation, Church Rock, New Mexico, USA: Implications of inorganic factors in ichnological interpretations

Ariel A. Roth [a,b], Kevin E. Nick [a], Tom Zoutewelle [c,*], Dwight Hornbacher [d,1]

[a] Department of Earth and Biological Sciences, Loma Linda University, Loma Linda, CA 92350, USA
[b] Geoscience Research Institute, Loma Linda, CA 92350, USA
[c] P.O. Box 309, 3940AH Doorn, the Netherlands
[d] Integrated Ocean Drilling Program, College Station, TX 77845, USA

ARTICLE INFO

Article history:
Received 4 June 2019
Received in revised form 30 August 2019
Accepted 1 September 2019
Available online 9 September 2019

Editor: Dr. Catherine Chagué

Keywords:
Microcrystalline quartz
Sandstone
Silcrete
Burrows
Termitarium
Rhizocretion

ABSTRACT

Complex concretions in the Jurassic Morrison Formation in New Mexico, USA, were studied to elucidate their enigmatic origin. The concretions, mostly in the 0.1–2 m height range, are characterized by a microcrystalline quartz matrix and many tiny (4–8 mm diameter) cylindrical protrusions. A common architecture revealed by weathering is a vertical, cylindrical concentric casing around a homogenous core. Concretion morphologies include irregular bodies and larger horizontal cylinders with surficial protrusions. Sometimes cores and/or protrusions are absent. Micromorphological data and open grain packing indicate concretions formed in unconsolidated sediments. Light and scanning electron microscopy shows gradational contacts between the siliceous concretions and host sandstones. Point counts of concretions and host rock show more cement and intergranular volume in the concretions, but fewer grains and primary pores. Most concretions are cemented by microporous, microcrystalline quartz, chlorite, kaolinite, and illite-smectite. X-ray fluorescence and instrumental neutron activation analyses indicate that silica was added to form the concretions. Previous models for the concretions include burrows, termite nests and rhizocretion. However, these interpretations are challenged by geochemical, macromorphological and micromorphological data presented in this study. Infiltration, possibly due to hydrothermal activity, may have added silica, but explanations for several morphological details remain elusive. These data imply that inorganic diagenetic factors can be important in ichnological interpretations.

1. Introduction

Several interpretations of the complex concretions found in the Upper Jurassic Morrison Formation near Church Rock, New Mexico have been advanced. The enigmatic structures weather differentially from the host rock and project out of the outcrop in a variety of shapes and orientations ranging in height from decimeters to meters. Concretion shapes vary, but show a common architecture of vertically oriented, cylindrical, casings surrounding a softer homogenous core. Under close inspection, the exteriors generally show abundant, surficial (4–8 mm diameter) cylindrical protrusions. Saucier (1967) described the concretions as a maze of intertwined tubules that appear similar to bleached tree stumps.

Various interpretations have been proposed for the origin of these concretions. Saucier (1967) and Condon and Peterson (1986) suggest burrowing. Hasiotis (1997) mentions a fulgurite interpretation. A subterranean termite nest origin for the concretions was proposed (Hasiotis, 1997; Hasiotis et al., 1997). Later, Hasiotis (1999) suggested that these termite nests follow the rhizoliths of trees and small shrubs. Three subsequent publications by Hasiotis (2002, 2003, 2004) provided additional data and interpretation. Roth et al. (2006) presented that the controversial structures at Church Rock had significantly more microcrystalline quartz between the grains of the concretions than in the host rock and expressed concerns about morphological differences from termite nests and rhizoliths. Bromley et al. (2007) expressed doubts about the termite nest origin and concern regarding poor documentation and incorrect stratigraphic association for termites. Hasiotis (personal communication, 2007) proposed that hydrological and hydrothermal activity might have cemented pre-existing structures that are problematic to interpret. A simple rhizolith interpretation for these concretions, that is roots without termites, has also been proposed (Alonso-Zara et al., 2008). They suggested that the giant cylindrical structures of the Navajo Church concretions resemble megarhizoliths formed by preservation patterns much larger than the causative roots.

* Corresponding author.
E-mail address: tomz@planet.nl (T. Zoutewelle).
[1] (Deceased).

https://doi.org/10.1016/j.sedgeo.2019.105526
0037-0738/

NOTE ABOUT TERMINOLOGY AND REFERENCES

- The anomalous structures at Navajo Church have been identified as "termite nests" (Hasiotis et al. 1997). This new study uses the broader term "concretion" for designation.
- A concretion is defined as "a hard solid mass formed by the local accumulation of matter, especially within the body or within a mass of sediment."

- References in this PowerPoint text are in the traditional author date text format. For complete references consult the comprehensive article:
- Roth AA, Nick KE, Zoutwelle T, Hornbacher D. "*Complex siliceous concretions in the Jurassic Morrison Formation, Church Rock, New Mexico, USA: Implications for inorganic factors in iconological interpretations*" Sedimentary Geology 392 (2019) 105526

  https://doi.org/10.1016/j.sedgeo.2019.105526 .

THE CONCRETIONS ARE NOT EPIGENOUS

- Epigenous refers to growing from a surface, like a tree grows up from the surface of the ground.
- The concretions appear to have formed in the host sedimentary layers after they were laid down, not above them.
- The sedimentary layers appear to be continuous around or even through the concretions, indicating that they were laid down before the concretions were present.
- This implies that the concretions would not represent typical extant termite nest mounds built above the surface of the ground as now found in Africa. At best they would represent underground termite structures. But underground termites are not known to build vertical concentric cylindrical structures as these are.
- The next few slides illustrate the continuity of the sedimentary layers next to the concretions.

CONTINUITY OF THE LAYERS AROUND THE CONCRETIONS

The layers (arrows) appear undisturbed near the concretions, indicating the concretions were not there when the host sediments were laid down.

CONTINUITY OF HOST ROCK LAYERS AROUND CONCRETIONS (Continued)

Note parallel layers of host rock almost up to concretions indicating deposition before concretion emplacement

CONTINUITY OF HOST ROCK LAYERS AROUND CONCRETIONS (Continued)

Sometimes the layering in the host rock appears reflected in the concretions (arrow).

CONTINUITY OF HOST ROCK LAYERS AROUND CONCRETIONS (Continued)
Some thin sedimentary layers (arrows) continue undisturbed through the concretions. It appears that the sediments were laid down before the concretions were there, hence concretions formed underground.

DISTRIBUTION

The exposed concretions at Navajo Church are concentrated on the east and west shoulders, but are not in the same sedimentary layers. Other similar concretions are found at other levels. There appear to be many more concretions than the few now exposed.

Concretions (arrows) in layers below the main groups as seen exposed on the south side of Navajo Church

THE "WALL"

Several concretions aligned to form a wall. Pen in center-right is 14 cm long.

Two “nests,” i.e. concretions (arrows), on west side of Navajo Church. Tallest is 6 m high.

MACROMORPHOLOGY

SIZE DISTRIBUTION

While there is a continuum of different sizes, the concretions exposed at Navajo Church can be generally classified into three groups.

Large, > 1 m high; about 6 samples exposed

Medium, 30 cm to 1m; about 180 samples

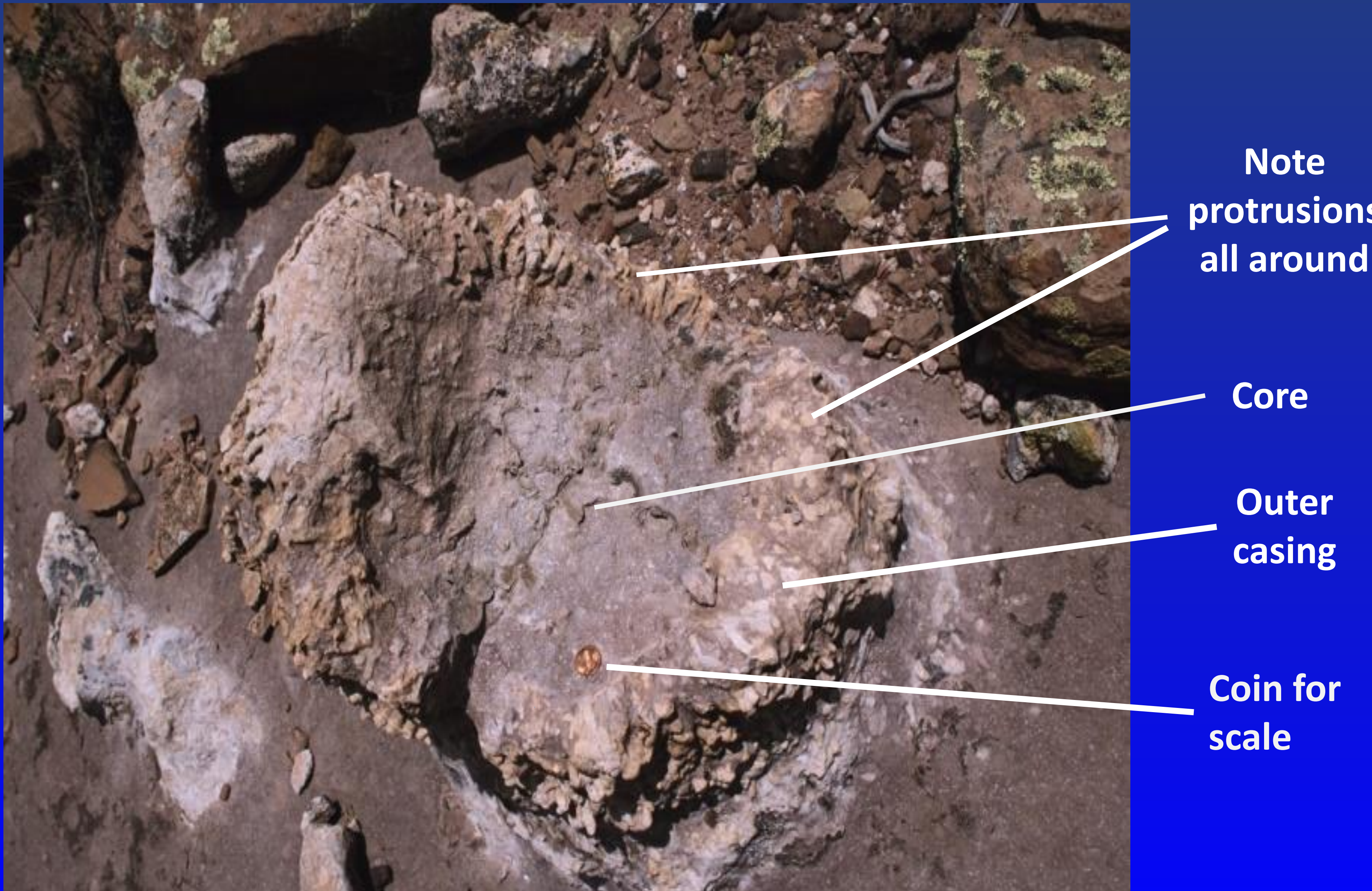
Small, < 30 cm high: > 2000 samples

GENERAL STRUCTURE

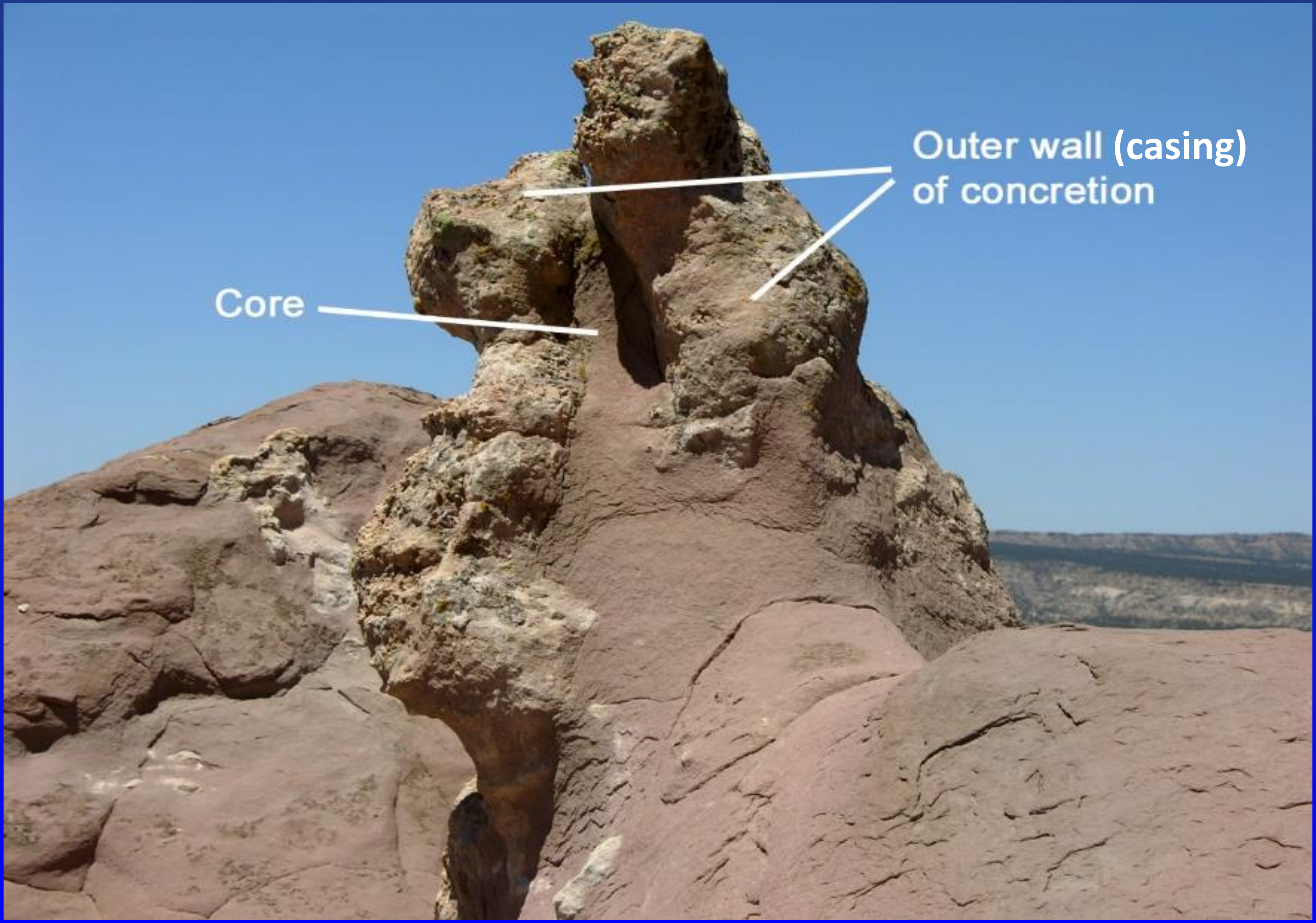
Many of the concretions have the general shape of a vertical cylinder, consisting of an outer resistant casing on the outside, and a softer core on the inside. The core appears to consist of host rock. The outer casing often consists of many smaller 4-8 mm diameter "branches" we call protrusions.

It must be kept in mind that there are an abundance of concretions that do not fit the structure suggested above.

CROSS SECTION OF A TYPICAL CONCRETION



A LARGE CONCRETION. It is about 2 m high

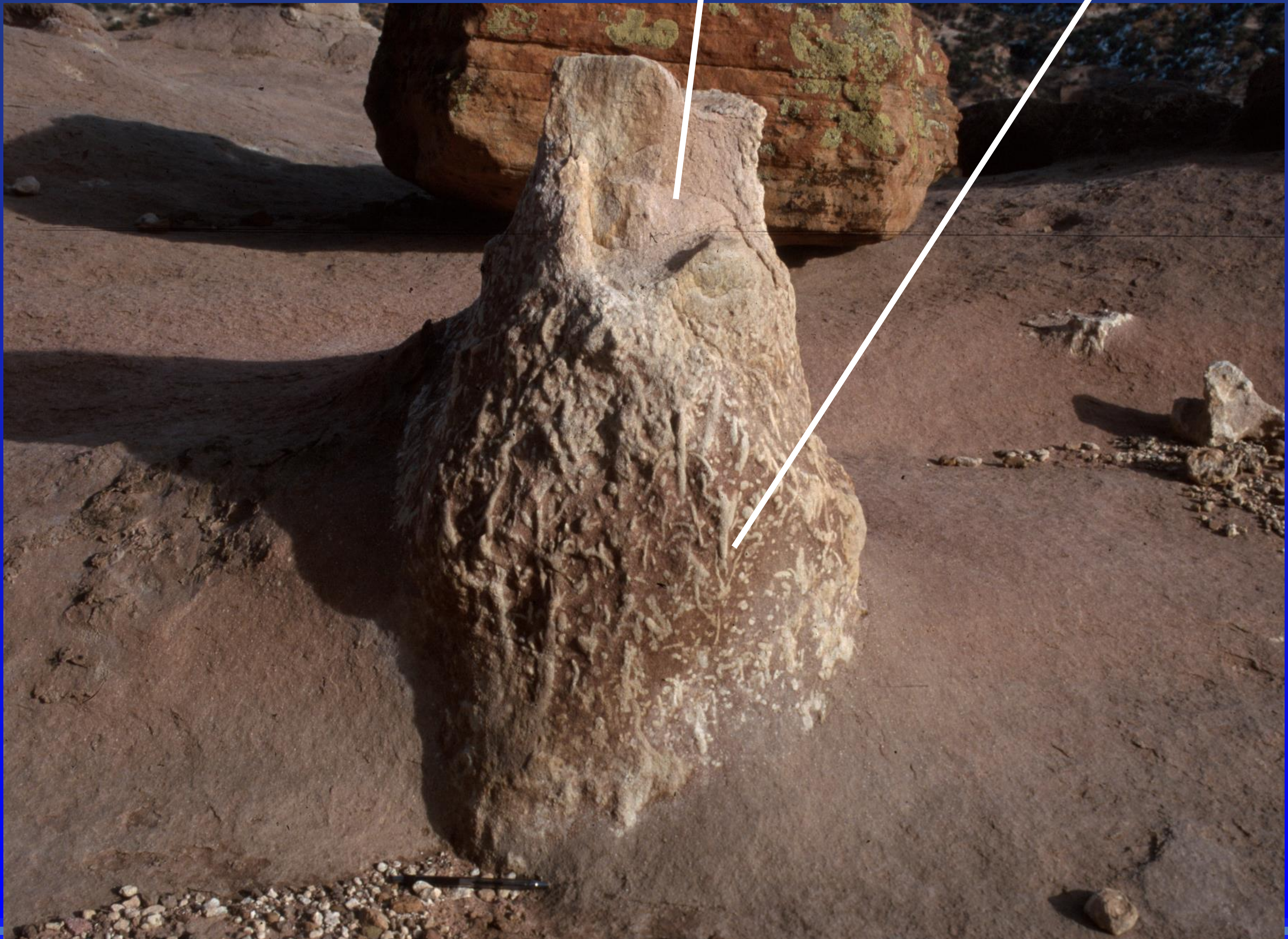


CONCRETION WITH FLAT BOTTOM. **Pen is 14 cm long**

VARIATION IN PROTRUSION SIZE

While the protrusion's diameters are usually in the 4-8 mm range, sometimes, as illustrated below, there can be considerable variation.

Another example. Pen at base is 14 cm.



Protrusions on “back” side of the large iconic “nest”

Protrusions on surface of a slanted medium size concretion

Branching protrusion

BIZARRE MORPHOLOGY

While many concretions have a vertical cylindrical shape, many others are very different


Contorted morphology
Note protrusions into host rock
Core

Irregular concretion

Core

Very few protrusions

A thin walled (casing) concretion

Thin outer casing Protrusions Core Pen is 14 cm

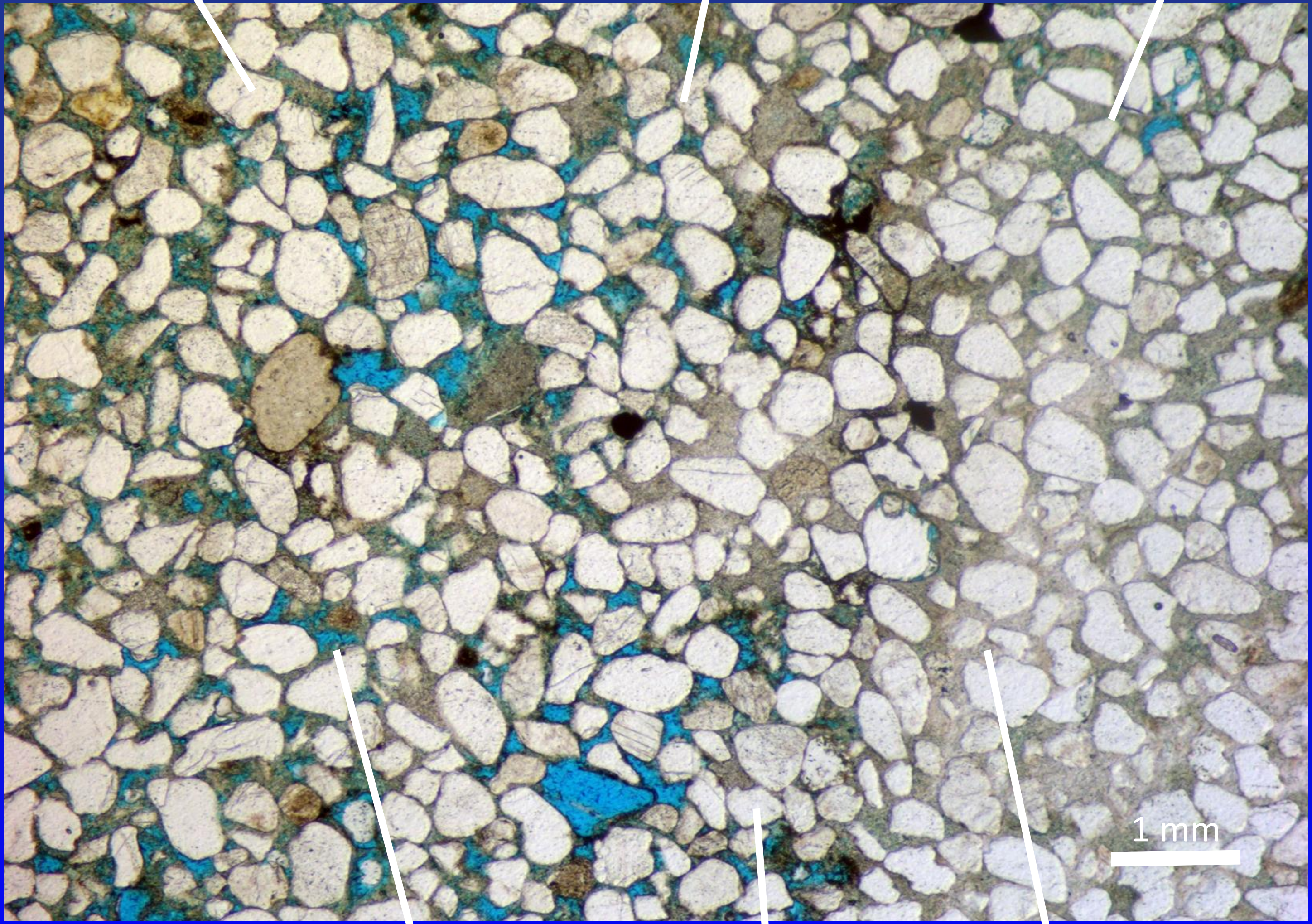
"Stringers" rich in microcrystalline quartz, as for concretions, suggest infiltration

Horizontal layers in casings of some protrusion usually do not go all around. Concretion is about half a meter high.

MICROMORPHOLOGY

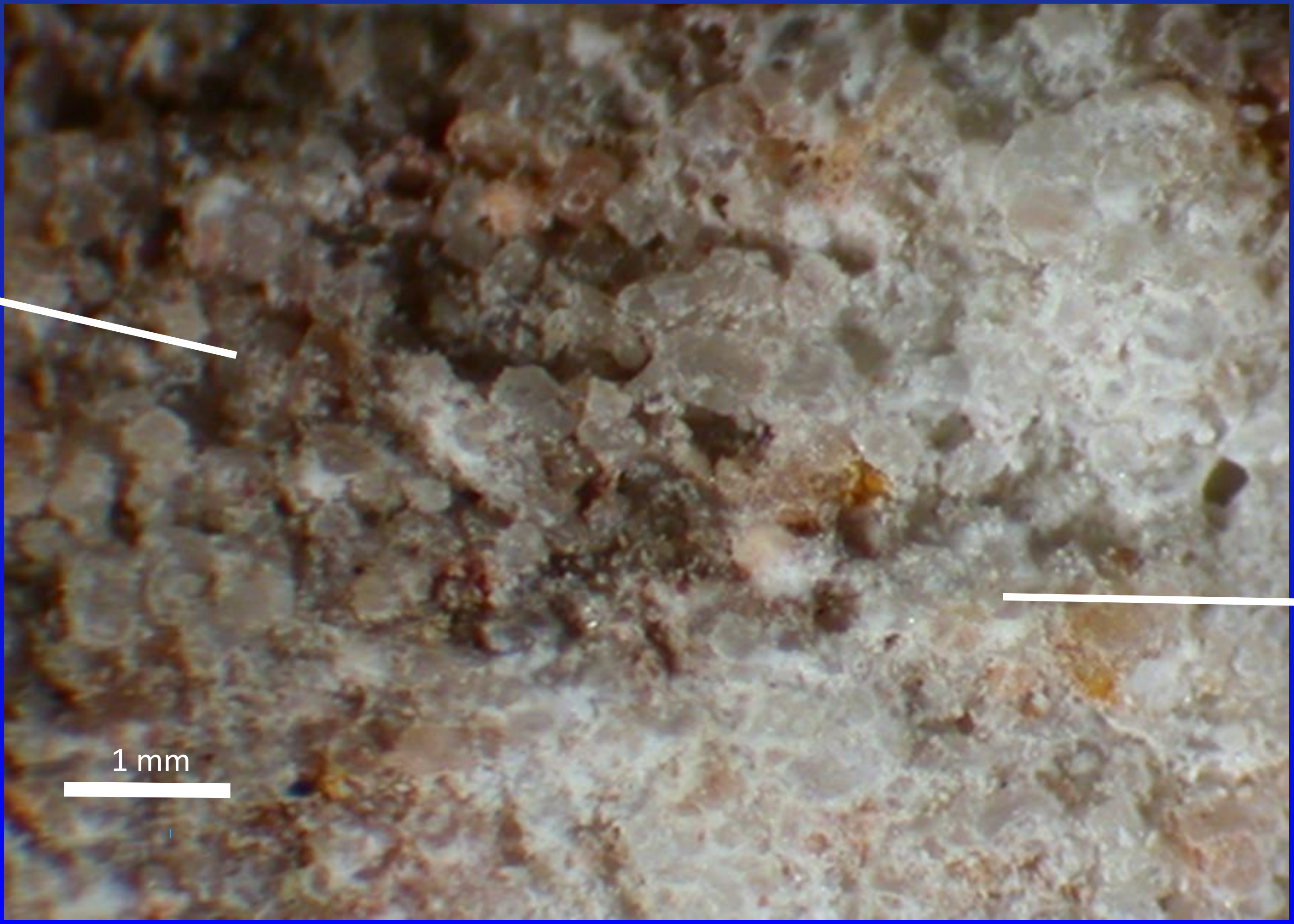
Microscopic views of host rock and concretions indicate a gradational contact between the two, also more cement in the concretions

THIN SECTION OF CONTACT BETWEEN HOST ROCK AND CONCRETION

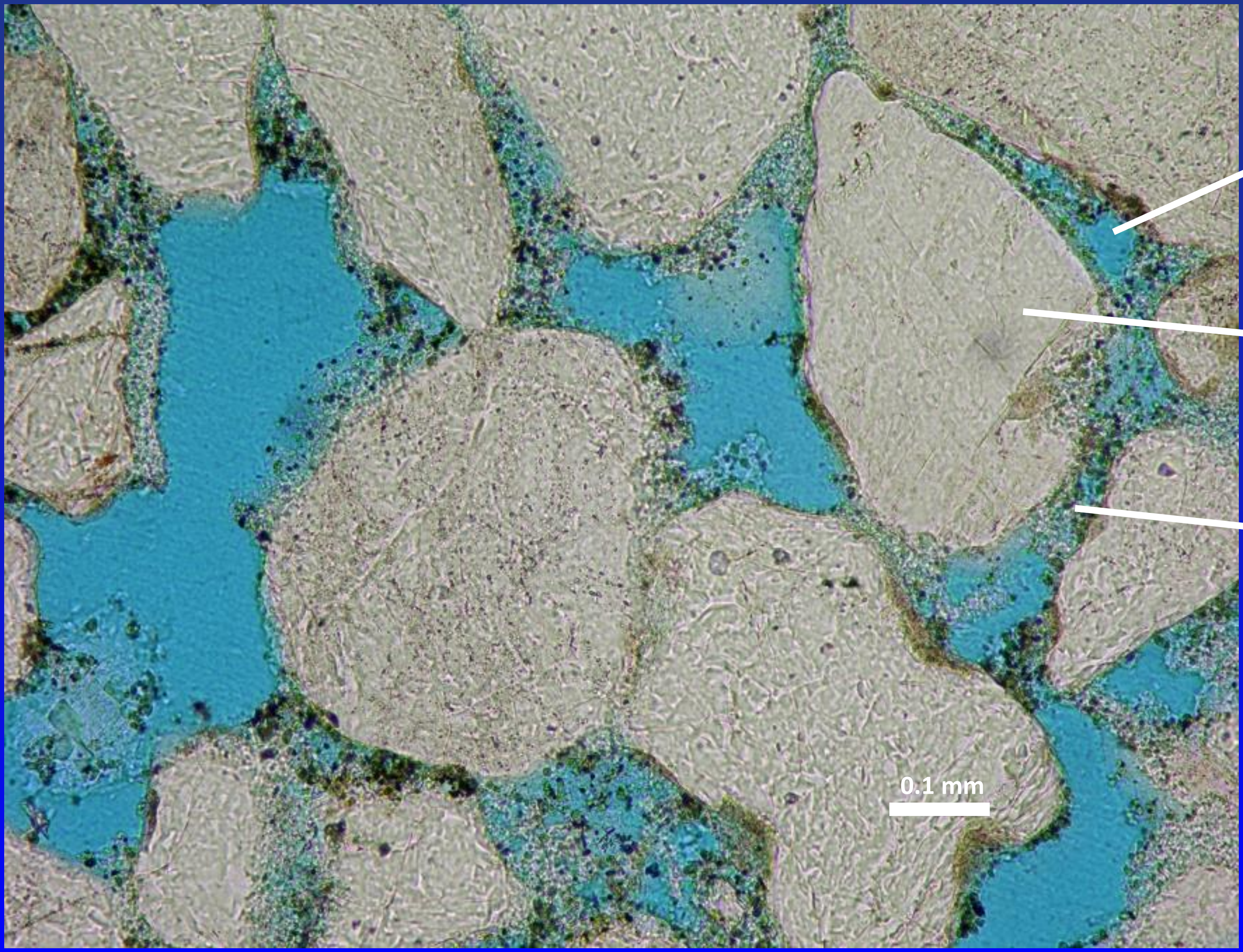


MICROSCOPIC VIEW BY REFLECTED LIGHT OF CONTACT OF HOST ROCK AND CONCRETION

Note gradational diffusion of white cement into host rock



THIN SECTION, HOST ROCK

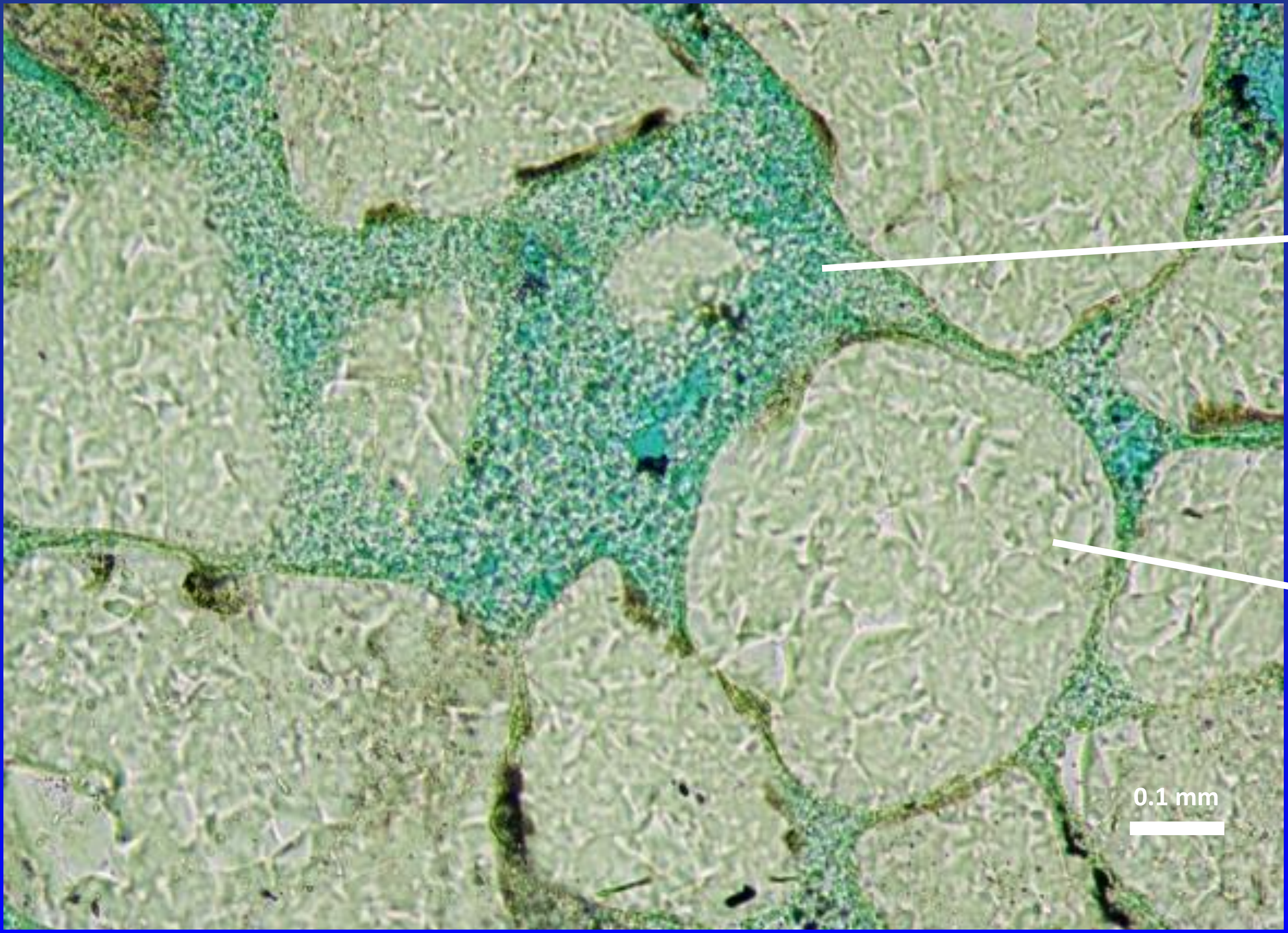


Primary pore

Silica grain

Cement

THIN SECTION CONCRETION



CEMENTATION

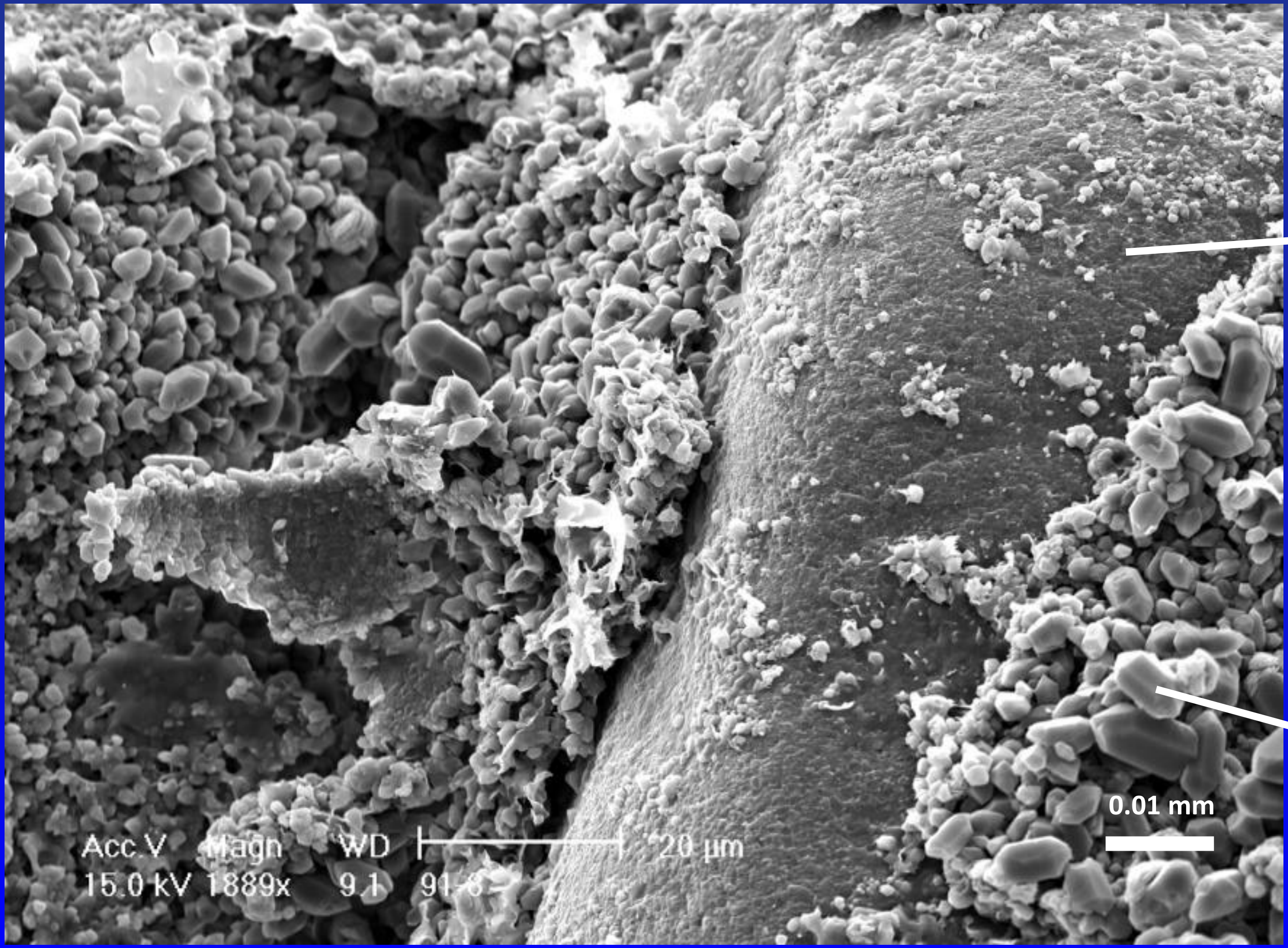
Cementation of the grains in the host rock consists of several common minute minerals including kaolinite, chlorite, smectite, and sparse microcrystalline quartz.

Cementation in the concretions consists mainly of dominant minute microcrystalline quartz crystals.

The next slides illustrate this.

SCANNING ELECTRON MICROSCOPE VIEW OF DETAILS IN A CONCRETION

Note high magnification, see scale bar

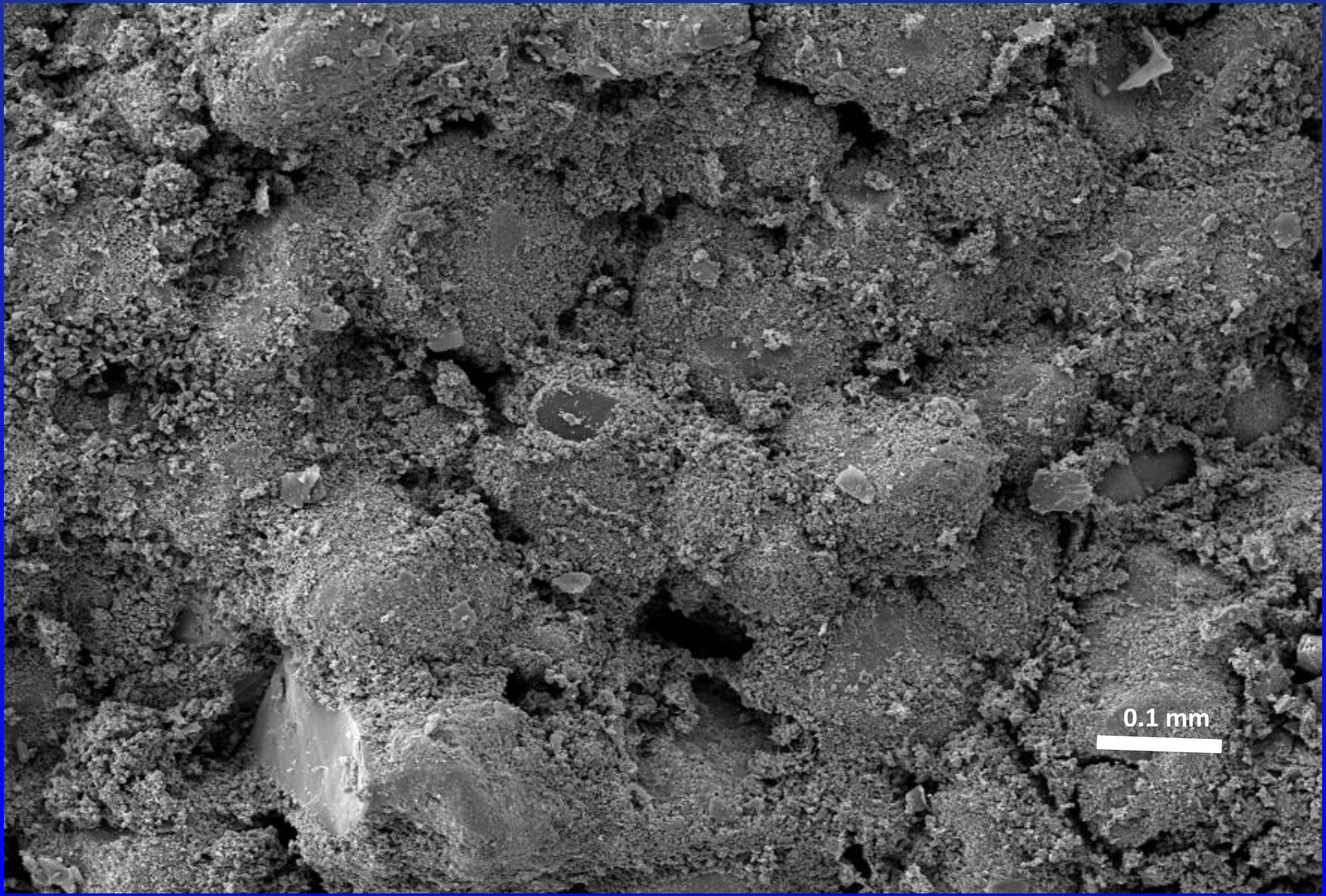


Surface of a silica (quartz) sand grain

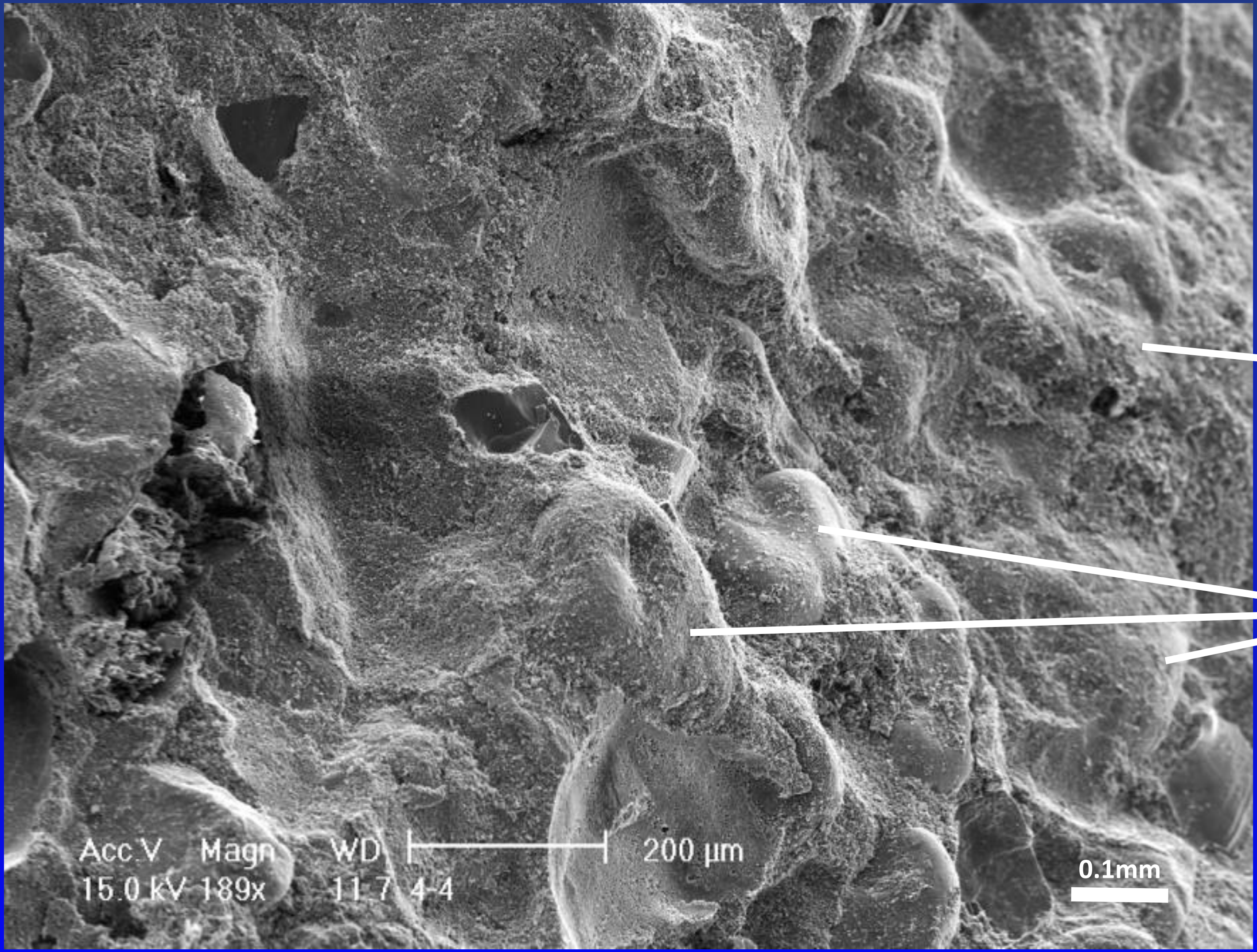
Microcrystal-line quartz (silica) that cements the grains

SCANNING ELECTRON MICROSCOPE VIEW OF HOST ROCK

Note the larger silica (sand) grains covered with a thin coat of cement. Also note several primary pores (black cavities) between some grains.



SCANNING ELECTRON MICROSCOPE VIEW OF A CONCRETION

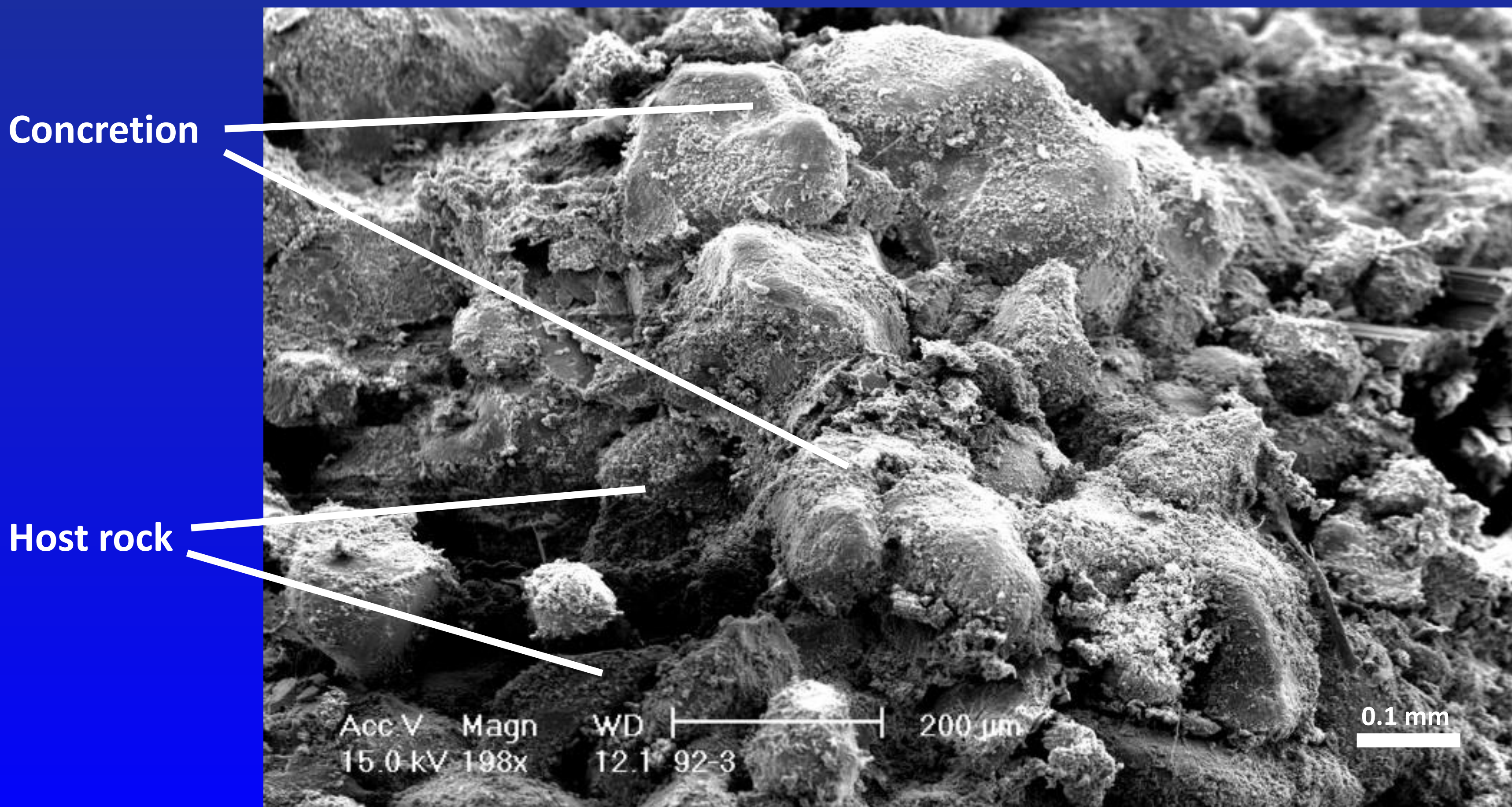


Cement is more abundant

Silica grains covered by a thin veneer of cement

SCANNING ELECTRON MICROSCOPE VIEW OF THE CONTACT BETWEEN A CONCRETION AND THE HOST ROCK

Note the irregular contact between the lighter shade concretion in the center and the darker host rock at the sides. The contact between the two is irregular and does not appear like the structured wall of a termite nest.



QUANTITATIVE STUDIES

The data provided above gives a general view of a usually significant difference between the concretions and the host rock. However, because of many observed variations, more definitive quantitative conclusions were wanted.

Specific quantitative comparisons were obtained by submitting multiple samples of host rocks and concretions to quantitative determination of major elements using X-ray Fluorescence; trace elements using Instrumental Neutron Activation Analysis; and component concentration using Point Count Analysis.

CONCENTRATION OF MAJOR ELEMENTS IN THE CONCRETIONS COMPARED TO THAT IN THE HOST ROCKS.

Results from X-ray fluorescence and instrumental neutron activation analysis.

Statistically significant ($p < 0.05$ or less) increase in the concretions of Si and increase in P were noted. Ca also increased, but not at a statistically significant value.

A decrease in concentration, typically by more than half, of the 23 other elements tested, many at a statistically significant level, suggesting a purer foreign sourcing, possibly by hydrothermal activity.

Tables 1 and 2 in the next slides gives the data details.

TABLE 1. X-RAY FLUORESCENCE MAJOR ELEMENT CONCENTRATION OF HOST ROCK AND CONCRETIONS

***n* = 8 concretions + 8 host rock. Lost on ignition of 0.25-1.5% treated as an element**

(Element values given as average weight in % of oxides)

ELEMENT	HOST ROCK	CONCRETION	*p* VALUE
Si	89.6	94.1	<0.001
P	0.0175	0.0638	0.039
Al	4.37	2.72	<0.001
Mg	0.398	0.174	0.001
Na	0.319	0.151	0.001
K	1.40	0.901	<0.001
Fe	2.21	0.614	0.001
Mn	0.0213	0.00125	0.003
Ti	0.220	0.0965	0.024
Ca	0.21125	0.30125	0.074
Cr	0.0575	0.0525	0.505

TABLE 3. TRACE ELEMENT CONCENTRATION OF SELECTED ELEMENTS IN HOST ROCK AND CONCRETIONS (INAA)

(*n* = 7 host rocks, 6 concretions. Results in average ppm or average %)

ELEMENT	HOST ROCK	CONCRETION	*p* VALUE
Na ppm	2535	1170	0.003
Rb ppm	36.00	7.833	0.008
Fe %	1.703	0.4650	0.003
Sb ppm	0.3857	0.2333	0.005
La ppm	9.429	5.00	0.006
Hf ppm	4.571	1.533	0.031
Th ppm	2.314	1.201	0.027
Cr ppm	373.4	347.0	0.945
Sr ppm	304.3	213.3	0.945
Ba ppm	256.6	206.2	0.534
Ce ppm	11.19	7.050	0.189
Sm ppm	1.286	1.000	0.051
Eu ppm	0.5429	0.4833	0.945
Yb ppm	0.6714	0.4417	0.295
Lu ppm	0.1093	0.0617	0.181
U ppm	1.886	0.7175	0.181

MAJOR AND TRACE ELEMENT COMPARISONS

Note that in Table 2, all 16 elements compared are at a lower concentration in the concretions than in the host rocks thus suggesting the addition of a rather purer component that diluted matrix and grains. Table 1 suggests that what was added was rich in silicon that provided for the silica of the microcrystalline quartz.

POINT COUNTS

To determine quantitative comparisons of components of host rock and concretions, over 3600 randomly placed points were identified on thin sections.

The results indicate the following:

- The concretions show: an 8% decrease in framework grains, a 20% increase in cements, a 12% decrease in primary pores, and an 8% increase in the intergranular volume.
- Details are provided in Table 3, below.
- Figure 11 © in Roth, et al. (2019), based on point counts illustrates two distinct populations for the concretions compared to the host rock.

TABLE 3. POINT COUNTS OF COMPONENTS OF HOST ROCK AND CONCRETIONS

Thin sections: n = 8 country rock + 8 concretions, 223-259 counts for each

(Count values given in %)

COMPONENT	HOST ROCK	CONCRETIONS	p*VALUE*
Framework grains	67.93	60.07	0.014
Cement	17.62	37.90	<0.001
Primary pores	14.45	2.026	<0.001
Intergranular volume	32.07	39.93	0.014

POINT COUNTS (continued)

In reviewing that data, the point counts indicate that you have: (1) An increase in the proportion of cement, (2) An increase in intergranular volume. This indicates that in the concretions the sand quartz grains are further apart from each other than in the host rock. This can be seen in some of the thin sections of concretions where the grains are matrix supported (floating) instead of grain supported.

POINT COUNTS (continued)

Furthermore it is of interest, as referred to above, that while the host rock has 14% primary pores (open spaces between grains), the concretions only have 2%. This 12% decrease cannot accommodate the 20% increase in cement of the concretions, thus indicating that the additional material (likely silica) was added when concretions formed. This was more than just filling in pores in the host rock; the sediments were soft.

DISCUSSION

OTHER INTERPRETATIONS

There have been four other interpretations for these concretions. All have serious problems.

- Saucier (1967), Condon and Peterson (1986), suggest burrows. This interpretation suffers from lack of consistency in protrusion diameters, and at the microscopic level a lack of evidence of burrow walls because the contacts are gradational. The chemical element differences between host rock and concretions are also difficult to reconcile with burrowing.

- Hasiotis (1997), mentions, but does not endorse, a fulgurite (lightning) origin. But there is no evidence of any fusion of minerals in the concretions.

OTHER INTERPRETATIONS (Continued)

- Hasiotis (1997), and Hasiotis et al. (1997), propose a termite interpretation, but that view suffers from the absence of fossil termites (a large termite nest can harbor 1,000,000 termites), a pronounced paucity of termite chambers on the macromorphological level, and on the microscopic level, a lack of wall delineation; the contacts are gradational. Furthermore, if these were termite nests, it is noteworthy that termites do not select specific minerals (e.g. microcrystalline quartz) when making nests.

OTHER INTERPRETATIONS (Continued)

- Alonso-Zara et al. (2008), and Genise (2017), propose a rhizolith origin, i.e. they come from roots. Problems include the lack of root crowns at top, absence of rootlet pores or casts in the protrusion, and absence of a central root in the homogenous cores of the concretions.

The sediments appear to have been soft at time of formation of the concretion

This is as expected for formation during or soon after the Genesis Flood, before sediments were consolidated.

Significant evidence includes:

1. **Increase in intergranular volume with even floating grain distribution**
2. **Collapse of a concretion (See Fig. 5b © in Roth, et al., 2019)**
3. **Lineation in concretions from sliding of sediments**

Details follow

1. Increase in intergranular volume.

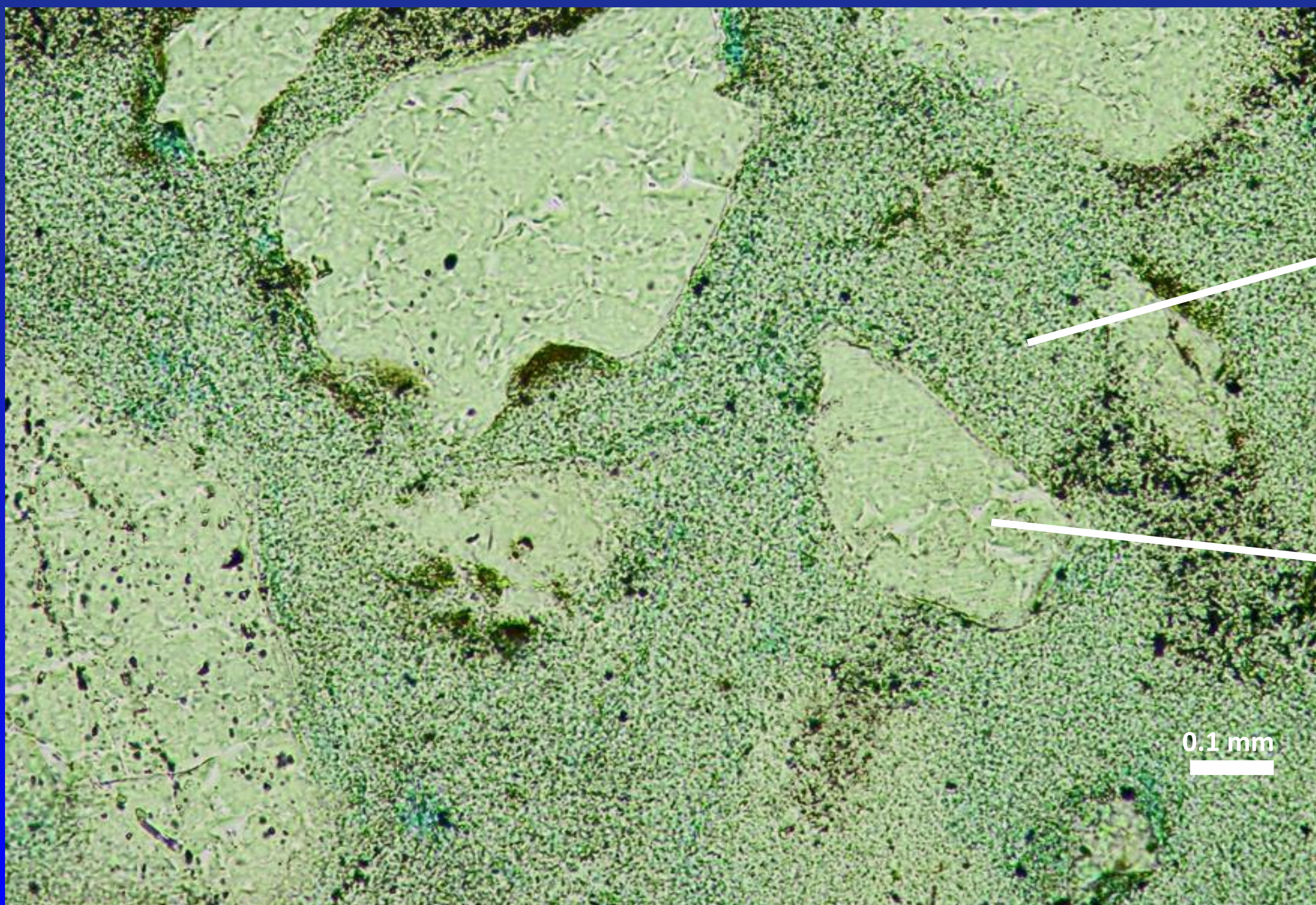
The point count study (Table 3) shows that on an average, the volume between the grains in the concretions increases by 8% when compared to the host rock, with a significance *p value* of 0.014.

If the grains of the host rock had been cemented together before insertion of the concretionary cement, they could not have expanded to accommodate the extra cement. As indicated earlier, the volume of cement in the concretions is 20% more than in the host rock that has only 14% primary pores, so this is not just filling of host rock primary pores. Concretions have only 2% primary pores.

Sometimes, in the concretions, the grains are floating, i.e. completely surrounded by cement (matrix) as illustrated in the next slide. This all seems to indicate that the host rock sediments were not cemented together at the time of formation of the concretions.

CONCRETION WITH ABUNDANT CEMENT (MATRIX)

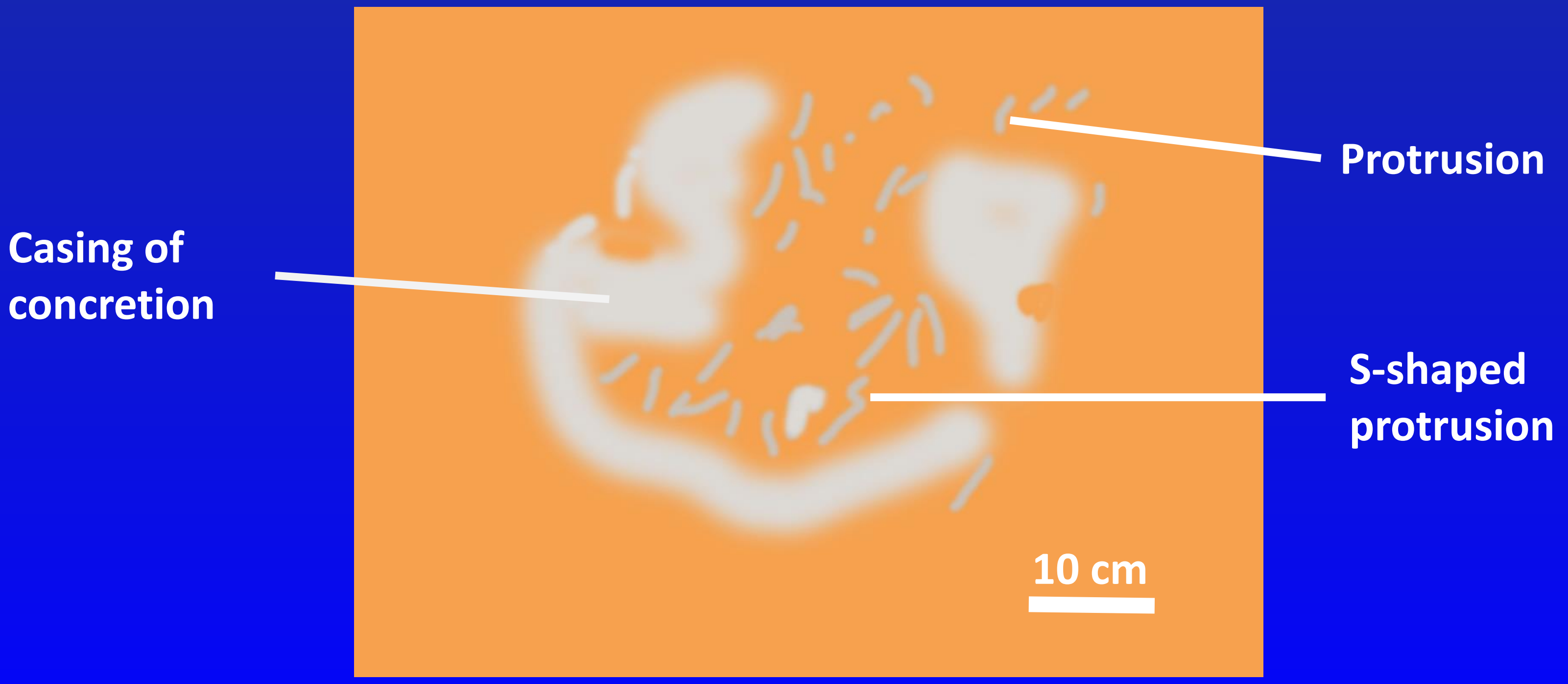
The sand grains appear to be "floating" in the cement, indicating that the host grains were not consolidated into firm rock before the addition of more cement.



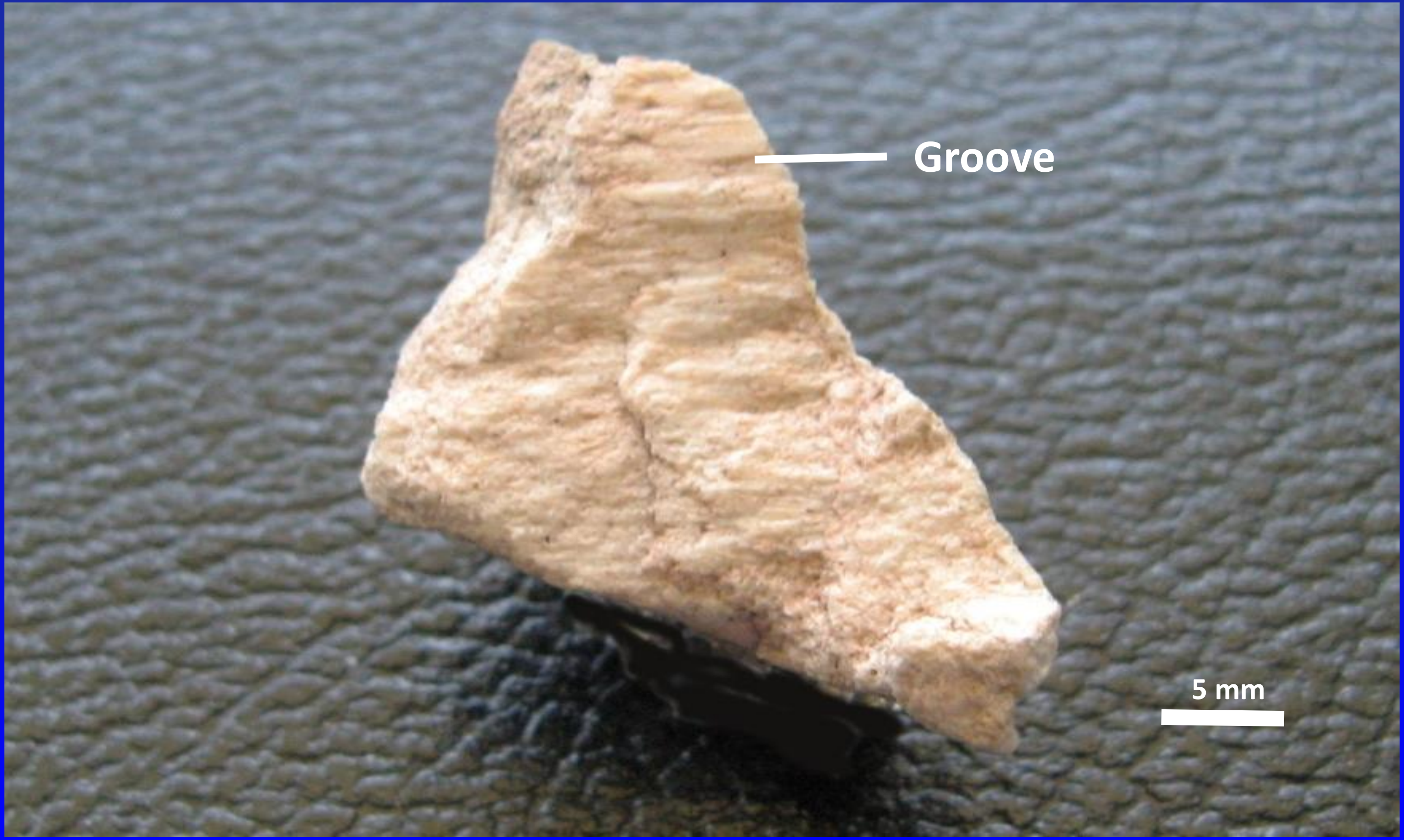
2. Collapse of a concretion

Figure 5B © in the research report on this study in the journal Sedimentary Geology [392 (2019) 105526], illustrates what appears to be a collapsed concretion. The figure below is a general representation of that figure.

This is a cross-section of a medium-sized concretion. Note the apparent drift of the insides towards the upper side as indicated by the orientation of the protrusions, and suggests soft sediment movement.



3. Lineation. In 14 of the concretions a lineation pattern was found. It is illustrated in the small sample below. Note the horizontal grooves through most of the sample caused by horizontal sliding. Similar grooves in hard rock result in the slickenside groves common to earthquake activity that grinds the rock components. However here the rock components are not traumatized, indicating that the sediments were still soft as shear pressure slid the components..



Abundant lineation in casing of a concretion, look especially on left

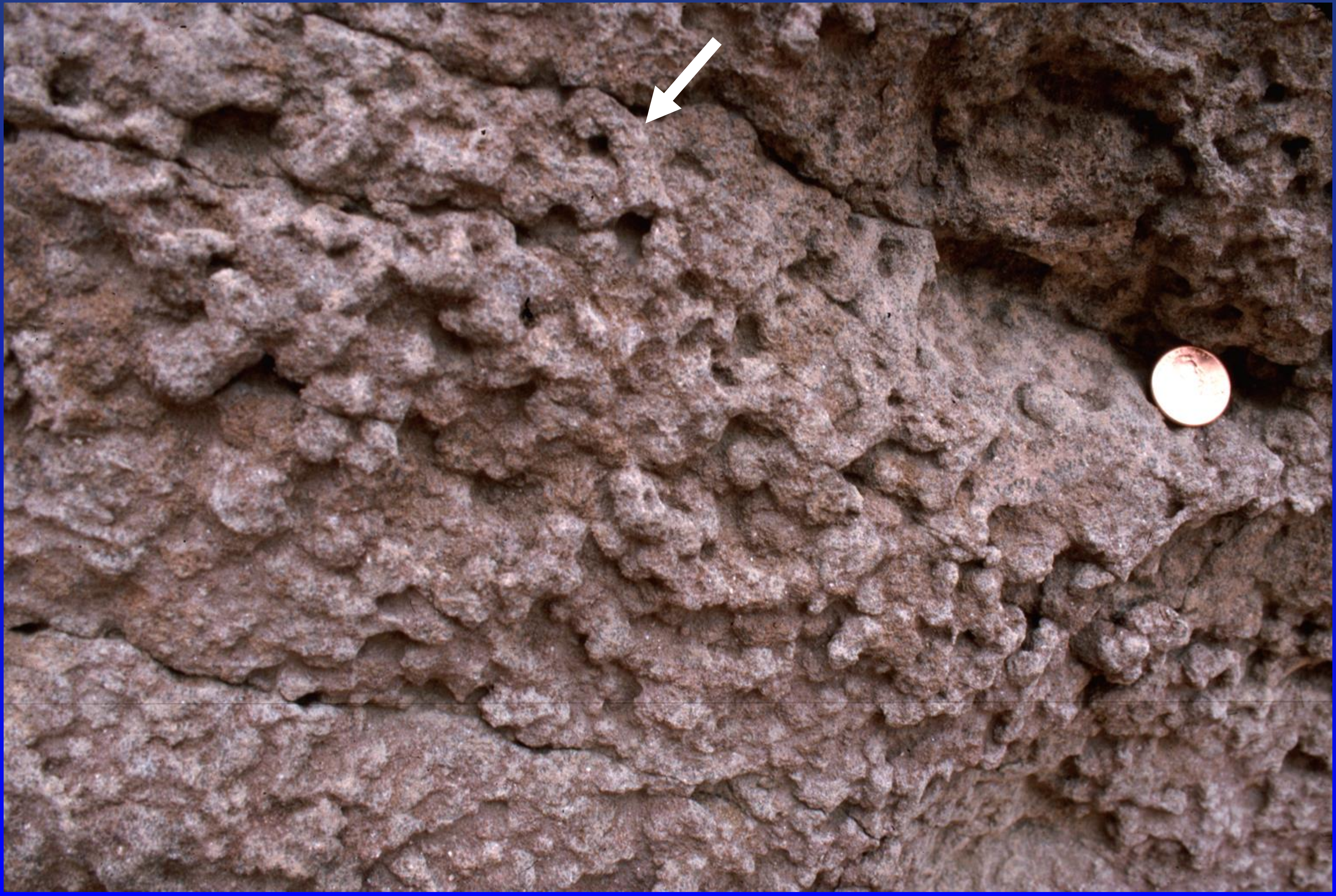
THE PROTRUSIONS

The protrusions are not common in most sediments, and are the basis for the biological interpretations for these concretions (termites, burrows, and roots). However, inorganic interpretations of these kinds of structures have also been observed. Examples follow:

- Protrusions of the same diameter as at Navajo Church have been described for deep sediments in the North Sea (Poulsom, 2006).
- There are many subtle cylindrical structures “protrusions” in the host rocks at Navajo Church with 5-10 mm diameters (Roth et al., 2019).
- Experiments using fine glass beads as sediments, where one sediment was injected into another, resulted in protrusions with diameters less than 10 mm, but some nearly 1 m long (Ross et al., 2011).
- The next slides illustrate some protrusions from the Navajo Church area in $CaCO_3$ concretions, an entirely different kind of rock than the SiO_2 quartz (silica) of the concretions purported to be termite nests. The protrusion on the carbonate concretions may be a proxy for the protrusions of the siliceous concretions.

Carbonate concretion at Navajo Church with protrusions on its side (arrow).

Protrusions (e.g. arrow) on side of protrusion in slide above.



Edge of a carbonate concretion showing protrusions (arrows).

THE VERTICAL CONCENTRIC CONCRETIONS

The concentric pattern of many of the concretions is similar to the concentricity of many clastic "pipes" described in geologic references.

The source for the pipes is usually considered to be from below, intruding in a fluidized state and ascending through likely unconsolidated sediments. Sometimes several concentric layers in the pipes are described, or an outside rind is described.

An unusual sample of "pipes" is found in Kodachrome Basin State Park in Utah. They show significant concentricity. Hornbacher (1984) found the source to be at least 120 m below and Ross et al. (2014) suggests sources from 200 m below; which represents injection through a great thickness of likely soft sediments and is more like expected for major catastrophic Flood activity instead of slow deposition over the putative 13 millions of years of geologic time for the Mesozoic strata involved in this transfer; and much less likely for a putative 150 million years, if top of Tertiary layers are involved, as may be the case (See Hornbacher, 1984).

Example of a clastic pipe in Kodachrome State Park, Utah

The sediments of the "pipe" came from sources assumed to be 13 million years older, but all had to be soft in order to facilitate transfer. Note vertical striations (lineation) on pipe. Diameter of pipe around 2 meters.

COMPARISON WITH EXTANT (MODERN) TERMITE NESTS

Extant termite nests have a few features that can be related to the concretions:

- Uprightness for many
- Greater intergranular volume than host rock
- General shape for some above ground nests; but Navajo Church Jurassic nests considered to be underground

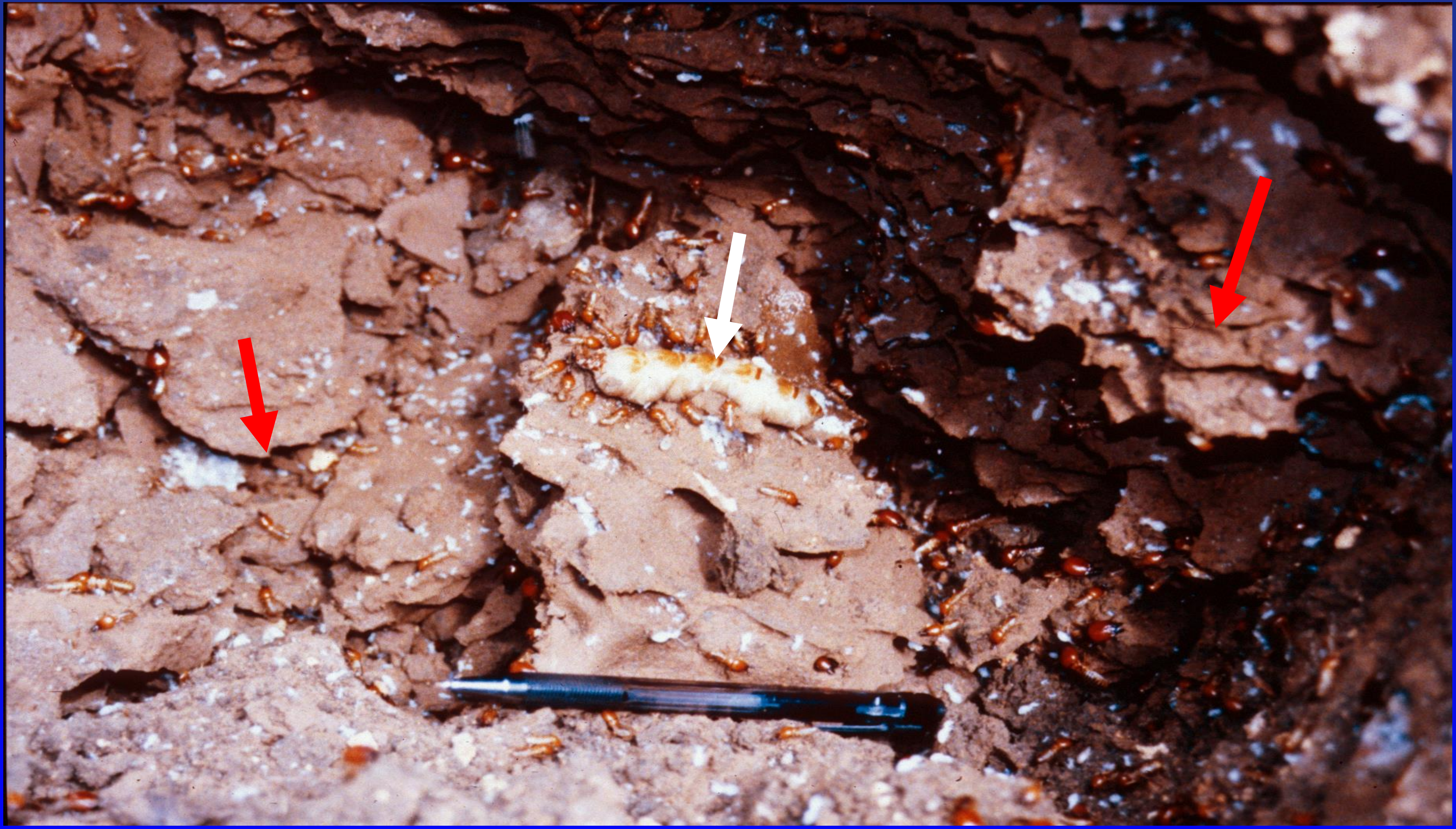
Extant termite nests have many features that are not found in concretions:

- Abundance of large chambers
- Walls for chambers and galleries, not gradational contacts
- Lining of some chambers and galleries
- Pelleted construction
- Small circulation tubes
- Vegetation chips, and even parts of termites in walls
- Mixed cement, not dominant microcrystalline quartz cement
- Termites! No termite fossils found at Navajo Church nor in any Jurassic or lower sediments over the world! Cretaceous fossils have been found.

Digging into an extant termite nest in Cote d'Ivoire, Africa

INSIDE AN EXTANT TERMITE NEST

The white body in the middle is the queen (white arrow) that produces the eggs for the nest. Pen is 14 cm. Note the walls of many collapsed chambers (red arrows)..



EXTANT TERMITE NESTS ACTIVITY

- The queen can lay some 30,000 eggs per day, or 10 million in 10 years
- Workers and soldiers are blind.
- Macrotermite nests (large African nests) grow at 5-55 cm/yr.

COMPARISON OF TOTAL ORGANIC CARBON

1. Concretions (n=7) = 0.0342 % carbon
2. Host rock (n=7) = 0.0957 % carbon
3. Live termite nest (n=3) = 0.427 % carbon

   1 versus 2: $p = 0.613$; not significant

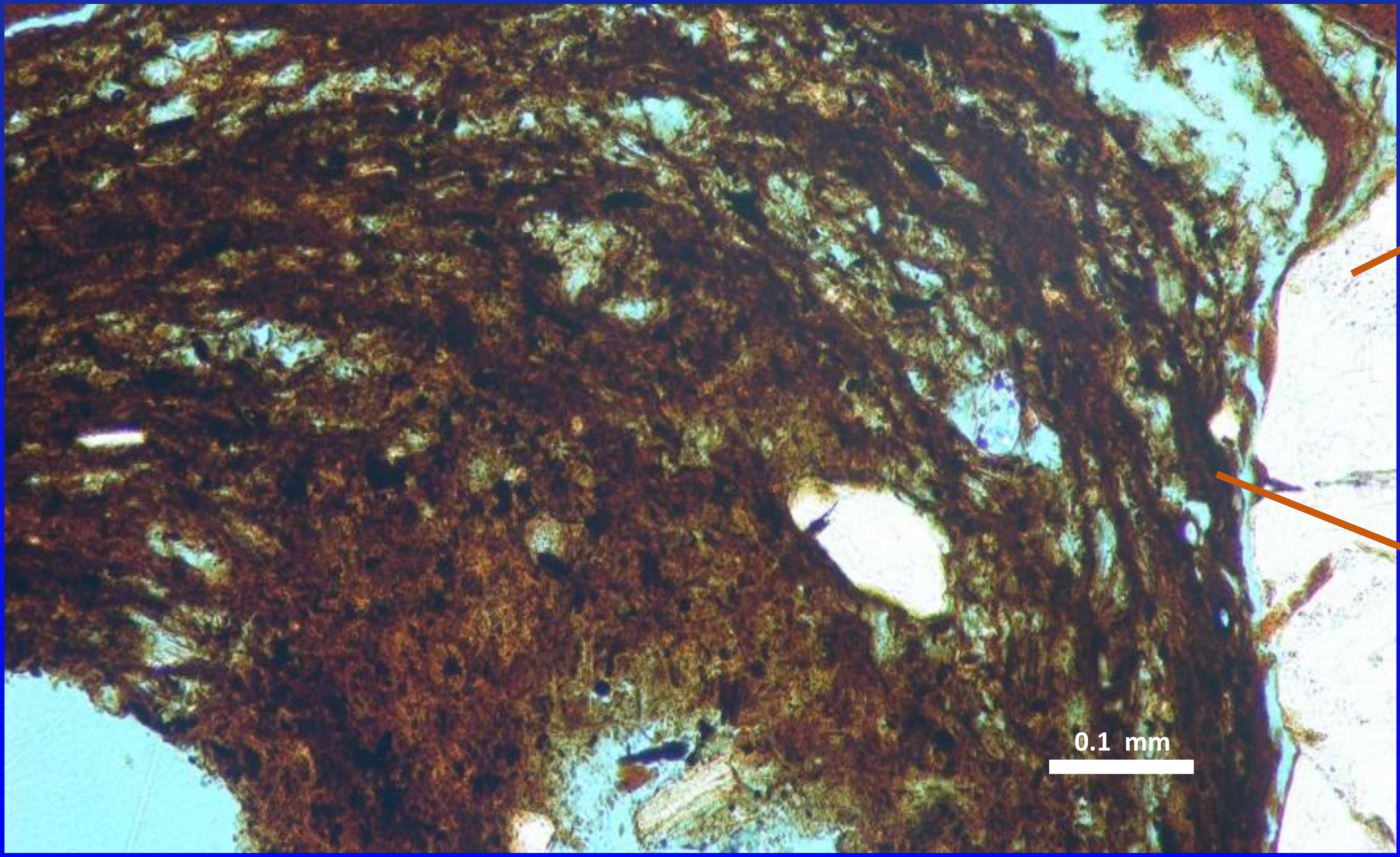
   1 versus 3: $p = 0.001$; highly significant

   2 versus 3: $p = 0.003$; highly significant

4. Fungus garden in a live termite nest (n=1) = 28.53 % carbon

LINING MATERIAL OF AN EXTANT TERMITE NEST CHAMBER

Nest from Nigeria, Africa. This massive brown lining illustrates the material expected next to walls inside termite nest structures . In extant nests, linings are usually much thinner, commonly in the 0.1 mm range in thickness. .Linings accentuate walled structures, in contrast to gradational contacts of concretions..



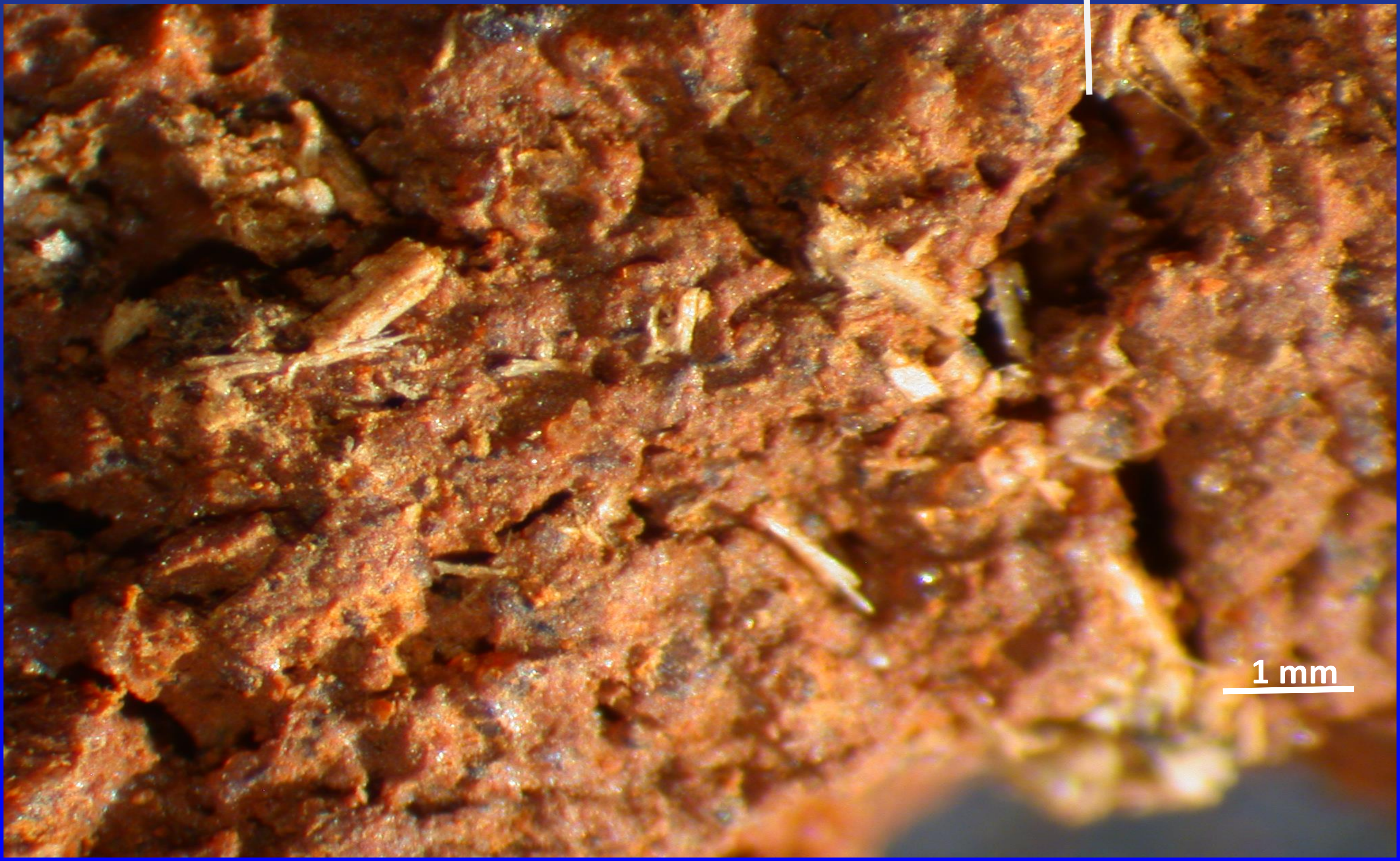
Wall of chamber

Lining of chamber

Microscopic view of components of a termite nest in Nigeria.

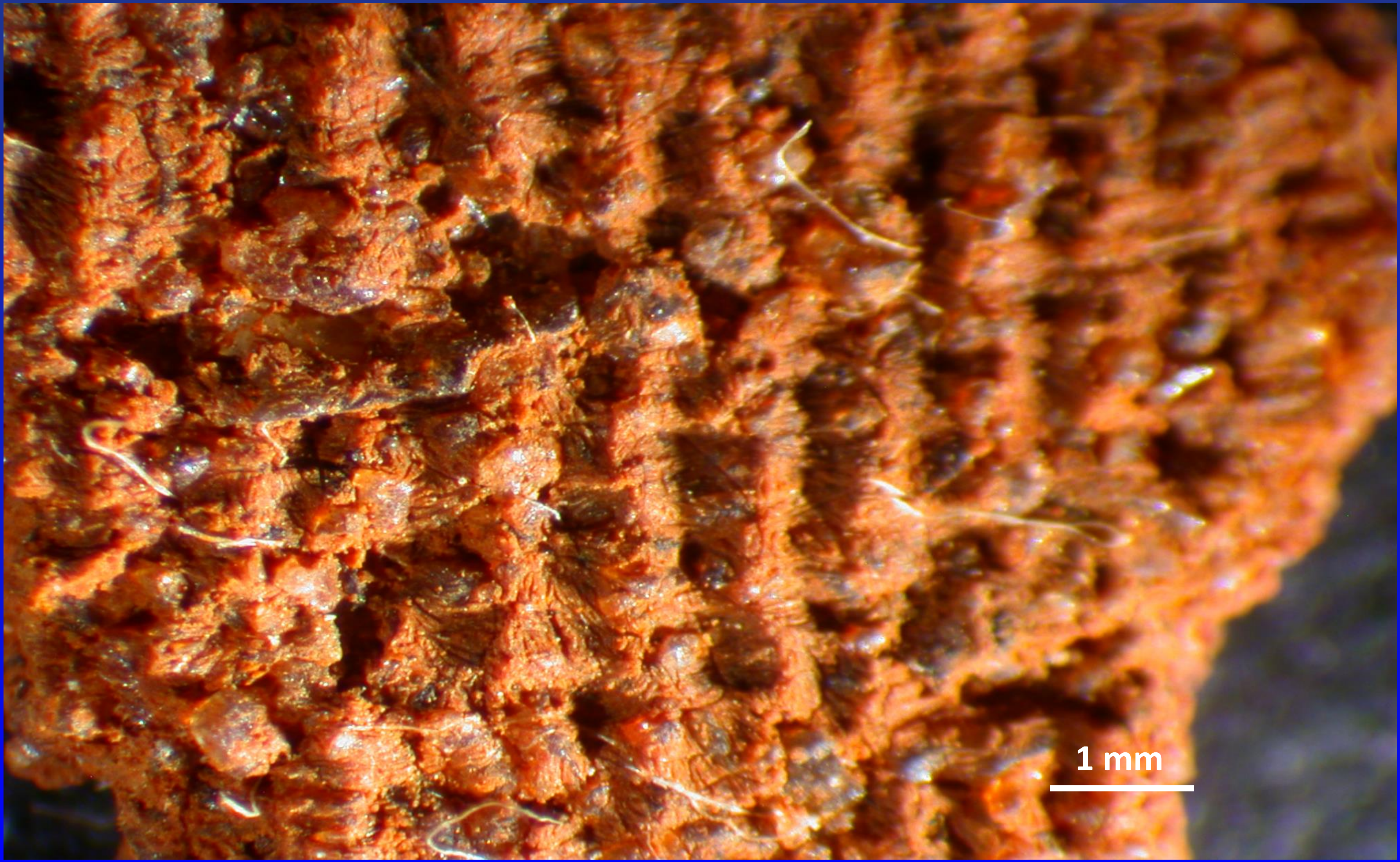
Wood chips about 1mm long.

Circulation tube.



Pellets arranged in rows by termites, as they build a nest.

Semi spherical pellets around ½ mm diameter. Not seen in concretions..



Sometimes termite body parts (arrows) are used in the construction of a nest.

Hasiotis' personal communication to Roth, July 1, 2007

- Agrees that mounds are not "fulgurites nor rhizoconcretions." Suggests are termite nests later replaced hydrothermally.
- Found organic balls. [SEM by Roth shows random fungus common]
- The area of the nests is in the path of "uranium roll fronts and other hydrological and hydrothermal activities."
- Suggests igneous activity following termite nests formation resulting in present structures at Navajo Church.
- Body fossils of termites and other social insects are rare to begin with. This is underplayed by the opposing view.
- "Please let's keep in touch and maybe collaborate on some of these structures to look at the cement histories in detail."

PR0BLEMS WITH SECONDARY EMPLACEMENT OF MICROCRYSTALINE QUARTZ INTO PROPOSED TERMITE NESTS

1. Where are some original termite nests, or parts thereof?
2. Where are the walls of the nest chambers and galleries? The contacts are gradational.
3. Why would microcrystalline quartz form in the outside walls (casing) of the nests, and inside the passages (protrusions) and galleries, but not in the cores? There is great confusion about the basic structure of these so-called nests?
4. How was the original cement of the nests removed to make room for the microcrystalline quartz?

Comment from other authors:

Alonso-Zarza AM, Genise JF, Cabrea MC, et al. 2008. Megarhizoliths in Pleistocene aeolian deposits from Gran Canaria (Spain). Paleogeography, Paleoclimatology, Paleoecology 265:39-51.

“From eolian settings in the Jurassic Morrison Formation (USA), Hasiotis (2004), (Fig. 23) recorded giant cylindrical structures that resemble megarhizoliths. Regrettably, the description of the trace fossils in that paper is too brief to allow any discussion regarding their origin (Bromley et al., 2007). However, when analyzing the origin of this type of structure, Roth et al. (2006) ruled out fulgurite and termite nests because of the lack of any micro- or macromorphological characters. A root origin was also considered problematic given the classical morphologies used in comparisons, which as shown herein do not cover the broad morphological range that root traces display.”

Comment by Roth: However, Morrison concretions are different. Theirs are $CaCO_3$ not SiO_2.

LATER DISCUSSIONS:

Genise (2017) in his book ICHNEOENTOMOLOGY refers to the Navajo Church concretions as roots.

A note to Roth, after the 2019 detailed publication by Roth et al., indicates that Genise still believes they are of root origin (rhizoconcretion).

STATEMENTS IN THE ARTICLE BY Roth et al. (2019) IMPORTANT TO A FLOOD INTERPRETATION.

FROM THE ABSTRACT

"Macromorphological data and open grain packing indicate concretions formed in unconsolidated sediments." As expected during a flood.

FROM THE MAIN TEXT

"The host rock preserves an average of 14% large intergranular primary pores compared to only 2% in concretions (Fig. 9B, D). This 12% decrease is much lest than the 20% increase in concretion cement." I.e., sediments had to be soft to accommodate the excess cement.

(Continued on next slide)

STATEMENTS IN THE MAIN ARTICLE BY Roth et al. (2019) IMPORTANT TO A FLOOD INTERPRETATION (Continued)

FROM THE MAIN TEXT

"Several lines of data indicate that the concretions were produced in unconsolidated sediments. These include the preservation of high pre-compaction levels of intergranular volumes and the dominance of floating grain textures in the concretions. In 14 of the concretions, a lineation pattern (slickensides) is present, but the grains appear intact. This may indicate a record of differential compaction around early cemented concretions. Although lineation is often attributed to shear forces in hard rock, it is also observed in soft sediments such as soils … or mudstones … . Any structural movement in the concretions would seem more likely if the host sediments were not cemented. … A unique example … also suggests unconsolidated host sediments and is probably best explained as a collapsed concretion with fluid escape focused in one direction and soft sediment deformation producing S-shaped protrusions."

STATEMENTS IN THE MAIN ARTICLE BY Roth et al. (2019) IMPORTANT TO A FLOOD INTERPRETATION (Continued)

FROM THE "CONCLUSIONS"

"Petrographic observations show the silica is in the form of microcrystalline quartz cement that was emplaced relatively early, before compaction of the host rock. … Concentric structures in some concretions may be explained by diagenetic modification from basinal fluids or fluidized sediment movement."

PEER REVIEW PROCESS OF 2019 ARTICLE BY ROTH ET AL.

I.e. for: **Complex siliceous concretions in the Jurassic Morison Formation, Church Rock, New Mexico, USA: Implications of inorganic factors in ichnological interpretations. Sedimentary Geology 392, 2019 105526.**

Only one minor scientific suggestion was made by one of the three reviewers about the possibly that more than one kind of organism may have been involved. However, another reviewer made several hundred minor format and major organization suggestions! Suggestions were generally followed and the article was published.

CONCLUSIONS

A WORD OF CAUTION

This study challenges the iconic Navajo Church termite nests at Navajo Church, but a number of other fossil termite nest findings, with or without the evidence of fossil termite body parts, have been reported in the scientific literature. That some of these might represent more recent termite activity in older rocks is not considered. Paleontologists, almost always, date fossils as that of the putative geological ages of the host rock; but more recent activity, such as the possibility of recent termite activity in older rocks, is not considered. For instance if an ant nest built and abandoned 50 years ago in Morrison sediments is discovered later, the tendency would be to consider it as Jurassic in age. Also, too often, odd structures in the fossil record are assigned to termites without confirming evidence.

CONCLUSIONS

This study indicates that the siliceous concretions at Navajo Church involve a source extraneous to the hosting rock. Gradational contacts suggest infiltration activity.

The data also suggests that the concretions formed in unconsolidated sediments as expected in flood activity such as the Genesis Flood.

This study also indicates that the siliceous concretions in the Jurassic Morrison Formation do not seem to be termite nests, burrows, fulgurites, or rhizoconcretions.

A confirming mechanism for structural details awaits further investigation.

This investigation raises the broader question of what we can believe. It underlines the need to dig deeper than usual to find what is true.

There are a lot of untested scientific statements that need reevaluation. While few have time to repeat published research, we should at least be cautious in accepting what respected scientific journals present as fact.

ACKNOWLEDGEMENTS

Special gratitude is due to:

Kevin Nick for astute assistance in data and SEM analysis

Floyd Peterson for statistical evaluation

Tom Zoutwelle, and Dwight Hornbacher for persistent field work and manuscript assistance

Ben Clausen for help in collecting extant African termite nests

Nellie Begay for permission to collect small samples

Geoscience Research Institute for five research grants

USE PERMIT

Free unrevised use for personal and non-commercial distribution of this material in its original publication medium is granted and encouraged. Proper attribution should be given. Permission for multiple printing for classroom use or not-for-profit public meetings is also freely allowed.

In using this material in this format, accurate attribution should be maintained for any illustrations where credit is designated. Many illustrations are by the author and free use is granted for all media. However, when credit to another source is given, permission might be necessary from the source for certain different kinds of communication media than the present use.