

# Yellowstone Frost

## Dimension Stone Evaluation

Requested by:  
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Mineralogy, Inc. Number 23004

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## **CONDITIONS AND QUALIFICATIONS**

*Mineralogy, Inc. will endeavor to provide accurate and reliable laboratory measurements of the samples provided by the client. The results of any x-ray diffraction, petrographic or core analysis test are necessarily influenced by the condition and selection of the samples to be analyzed. It should be recognized that geological samples are commonly heterogeneous and lack uniform properties. Mineralogical, geochemical and/or petrographic data obtained for a specific sample provides compositional data pertinent to that specific sampling location. Such “site-specific data” may fail to provide adequate characterization of the range of compositional variability possible within a given project area, thus the “projection” of these laboratory findings and values to adjoining, “untested” areas of the formation or project area is inherently risky, and exceeds the scope of the laboratory work request. Hence, Mineralogy, Inc. shall not assume any liability risk or responsibility for any loss or potential failure associated with the application of “site or sample-specific laboratory data” to “untested” areas of the formation or project area. Unless otherwise directed, the samples selected for analysis will be chosen to reflect a visually representative portion of the bulk sample submitted for analysis. Where provided, the interpretation of x-ray diffraction, petrographic or core analysis results constitutes the best geological judgment of Mineralogy, Inc., and is subject to the sampling limitations described above, and the detection limits inherent to semi-quantitative and/or qualitative mineralogical and microscopic analysis. Mineralogy, Inc. assumes no responsibility nor offers any guarantee of the productivity, suitability or performance of any oil or gas well, hydrocarbon recovery process, dimension stone, and/or ore material based upon the data or conclusions presented in this report.*

*This report is to only be replicated in its entirety.*

*Sample Retention: Samples will be stored for a period of 30 days and thereafter discarded. If additional sample storage time and/or return shipping is required, appropriate charges will be billed to the client.*



## Introduction

A single sample of Yellowstone Frost Travertine dimension stone has been submitted for thin section petrographic analysis as per ASTM C1721 (Standard Guide for the Petrographic Examination of Dimension Stone).

Sample ID	Mineralogy, Inc. ID	Testing Protocol
Yellowstone Frost	23004-01	Thin Section Petrography



## Summary

The Yellowstone Frost Travertine is a calcite-rich, medium to coarsely crystalline, porous limestone. The petrographic sample was prepared from a 3 cm thick block (~ 10 cm x 18 cm) of white (N9) honed limestone that exhibits subtle overtones of yellowish gray (5 Y 7/2). The 'skeletal' framework of the travertine limestone fabric is comprised of sub-parallel bands & layers of relatively non-porous, finely crystalline calcite, separated by concentrations of macroporous, coarsely crystalline, subhedral to euhedral calcite spar cement. The bands of finely crystalline calcite are attributed to cycles of relatively rapid calcite calcite crystallization. Concentrations of macroporous, coarsely crystalline calcite cement locally alternate with the dense, finely crystalline calcite layers. The coarsely textured calcite likely precipitated relatively slowly, incorporating significant amounts of residual macroporosity within the limestone framework. The voids are irregular, ranging up to 25 mm long, and locally exhibit traces of pore-lining authigenic clay matrix. Macroporosity accounts for ~ 10-14% of the limestone bulk volume.



## Conclusions

The crystalline fabric of this travertine limestone sample is attributed to rapid and seasonally influenced cycles of calcite crystallization characterized by the movement of super-saturated calcium-rich solutions (e.g., within underground caves / Karst geologic settings).

The abundance, distribution, and inter-connectivity of macroporosity within the Yellowstone Frost travertine suggests that installations of this dimension stone will be potentially susceptible to the absorption +/- transmission of pore fluids and moisture vapor. The Yellowstone Frost travertine is generally not recommended for installations that are likely to experience significant exposure to surface wetting &/or elevated sub-grade moisture conditions.

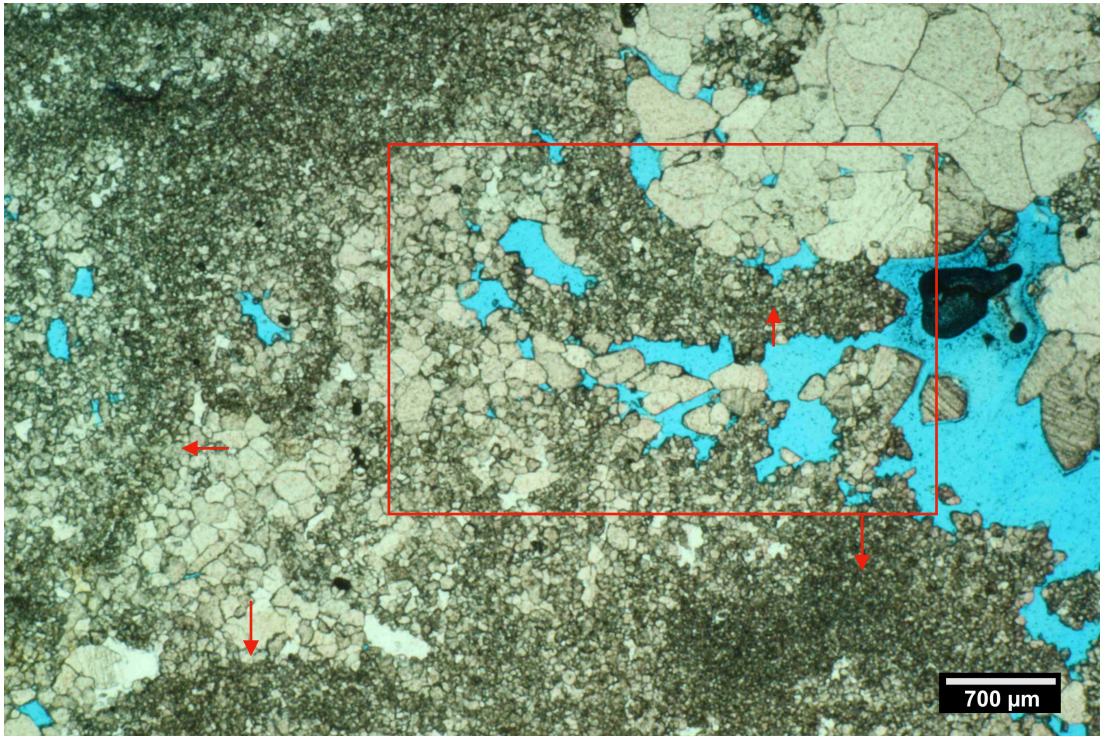


# Appendix I

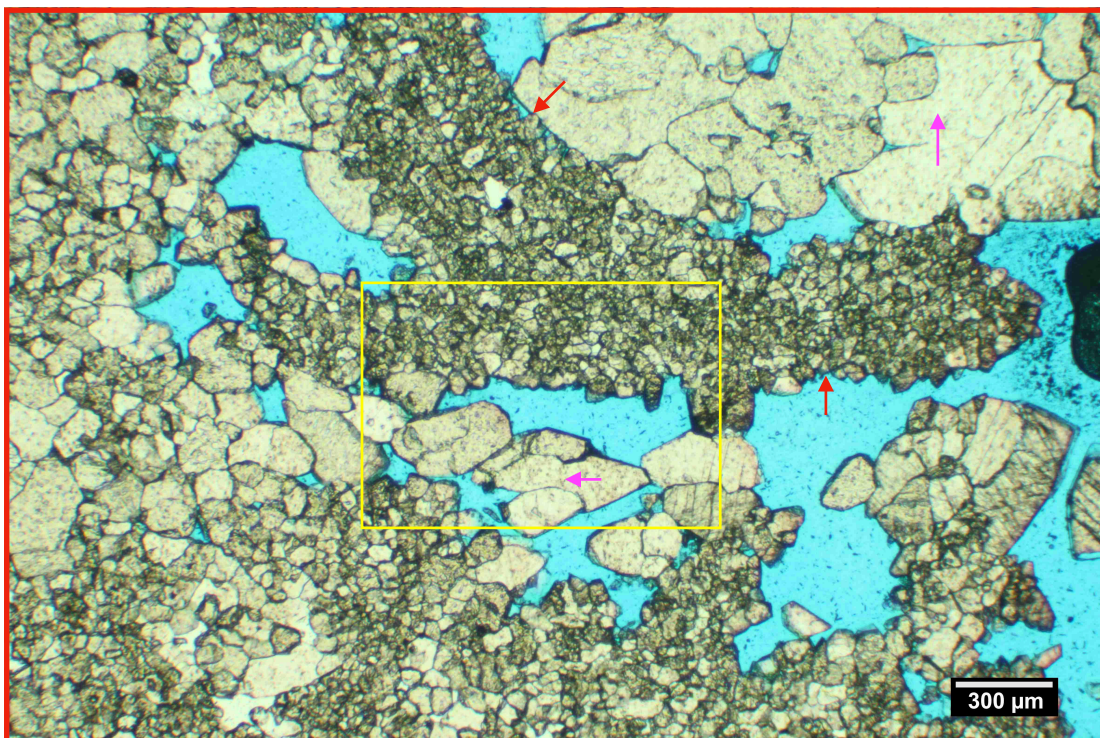
## Petrographic Findings



## Yellowstone Frost; MI#23004-01



1A. Medium to coarsely crystalline, macroporous, calcareous travertine limestone. Bands of finely crystalline calcite (red <) are attributed to episodes of relatively rapid calcite crystallization.

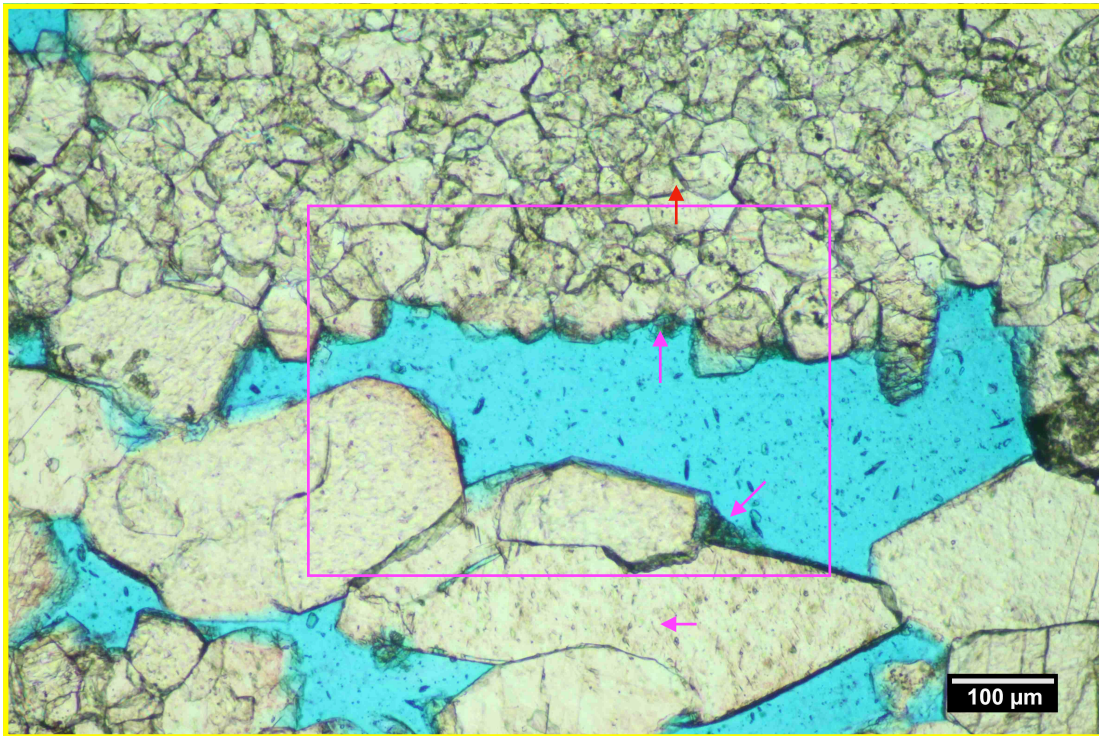


1B. Detailed view of the highlighted area from Figure 1A. Subhedral, coarsely crystalline, calcite spar cement (magenta <) partially fills the spaces that separate the bands of finely crystalline calcite (red <). Note the abundance of residual macroporosity (blue).

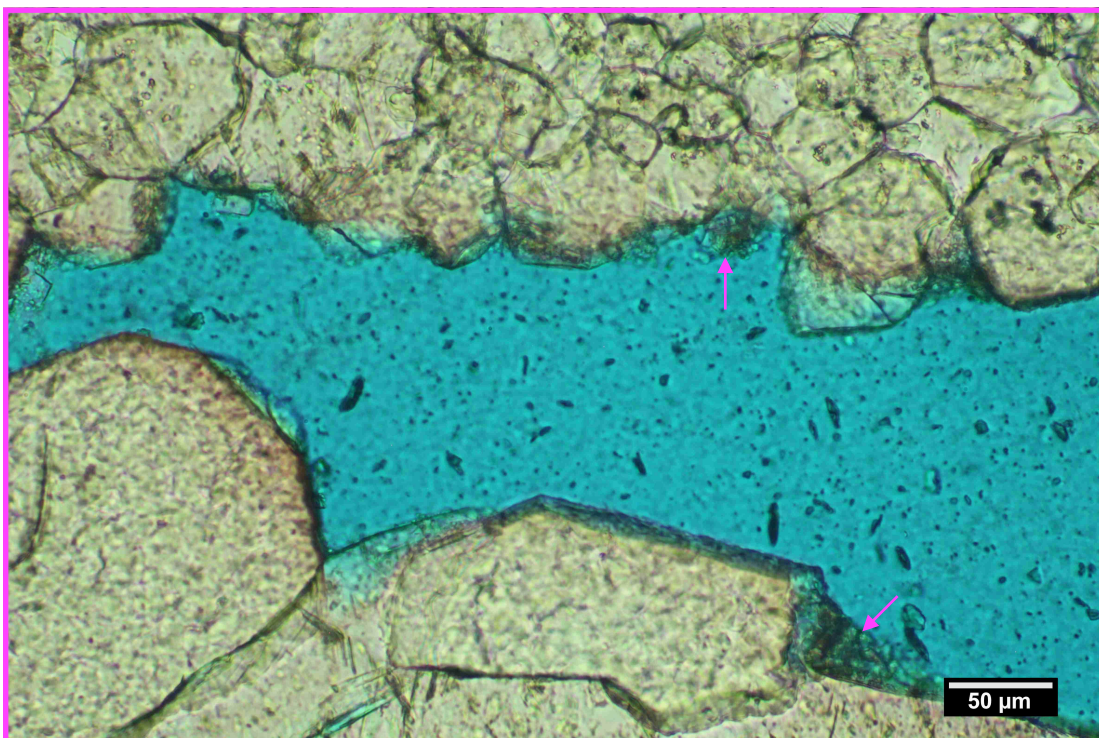




Yellowstone Frost; MI#23004-01



1C. Detailed view of the highlighted area from Figure 1B. The macropore (blue) is partially rimmed with traces of microcrystalline clay (blue-green; magenta <).



1D. Detailed view of the highlighted area from Figure 1C. The pore-lining authigenic clay (magenta <) comprises <0.1% of the mineral mass & is likely comprised of illite +/- chlorite.