PRELIMINARY GEOLOGIC DESCRIPTION

CLAYTON W. WILLIAMS, JR.
SAM HUGHES #1

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Prepared by

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INTRODUCTION

Two intervals of the Travis Peak Formation were cored in the Clayton Williams #1 Sam Hughes well, Panola County, Texas. Core was recovered from 6,834.0 to 6,851.7 ft and from 7,044.0 to 7,110.4 ft. The top of the Travis Peak in this well is at 6,830 ft, so the upper core begins a few feet below the contact with the Sligo Formation.

MACROSCOPIC CORE DESCRIPTION

The Travis Peak cores were described using a hand lens and binocular microscope, and graphic logs of the cores were made at a scale of 1 in = 5 ft (figs. 1, 2). The following features of the cores are noted on the descriptive logs: depth; rock type; accessories such as pyrite, organic matter, and burrows; sedimentary structures; texture (rounding and sorting); induration; grain size; relative amount of calcite cement; color; and special features such as fluorescence, dead oil, and calcareous clasts (figs. 1, 2). Porosity and permeability values reported by Petrophysical Services, Incorporated are noted on the graphic logs, as are the depths where thin sections were made.

The cores consist of intervals of very fine sandstone, siltstone, and mudstone. Mudstones at the base of the lower core are red and contain large calcareous clasts which are now calcite and iron-rich dolomite (ankerite) in composition. Poorly-sorted, upward-fining beds of calcareous clasts are found in both cores (figs. 1, 2).

Sandstone and siltstone intervals contain abundant festoon-shaped cross beds 1 to 2 cm high that were formed by small current ripples. Contorted beds, which are evidence of soft-sediment deformation, and plane beds are also present. The predominance of ripple cross bedding may be a result of the fine grain size. The average sand is about 0.1 mm, and at this grain size, ripples are the stable bedforms over a wide range of current velocity (Reineck and Singh, 1980). The sandstones and siltstones are texturally well sorted and well rounded, and they are also well indurated.

Dead oil was noted in several of the sandstone and siltstone intervals (figs. 1, 2). In some cases these intervals fluoresce, but other intervals that lack dead oil have bright fluorescence. This bright fluorescence may be caused by carbonate cement and not the dead oil. A dull fluorescence that diminished over time was observed in the upper core at depths of 6,842.5 to 6,844.5 ft (core depth). This is the zone that was completed, so it is likely that the weak fluorescence was caused by hydrocarbons that gradually volatilized out of the core.

DEPOSITIONAL HISTORY

Before a final interpretation of the depositional history of these rocks can be made, more regional mapping of sand body thickness and extent is necessary. However, preliminary interpretations can be made based on the features observed in the cores.

The lower core contains red mudstones with caliche nodules, which suggest deposition in a nonmarine environment. Pyrite and woody organic matter are abundant in burrowed gray mudstones, which may have been deposited in a flood plain environment. Thicker sandstones are interpreted as fluvial channel deposits, whereas thinner sandstone beds may represent crevasse splay deposits in the flood plain.

The upper core contains calcareous nodules, pyrite, and organics within mudstones below 6,845 ft. Ripple trough cross beds are dominant in the uppermost sandstones and siltstones. Long vertical burrows in mudstones at 6,838 ft suggest a marine setting, perhaps associated with a tidal flat or estuarine environment, for the upper core. The Sligo limestone occurs only a few feet above this core, and there must have been a transition to a marine environment by the time of Sligo deposition. This transition may be reflected in the uppermost Travis Peak.

PETROGRAPHIC DESCRIPTION

More detailed study of the core is being carried out with the scanning electron microscope (SEM) and petrographic microscope. This work has just begun, so interpretations must be considered preliminary.

Grain Size

An analysis of grain size has been started by doing grain-size point counts of thin sections. One hundred grains per slide are measured along their long dimension. In order to determine the original size of the detrital grains, cement overgrowths on grains are not measured.

Grain-size counts have been completed for three samples in the upper core and two in the lower core. The results are as follows:

Depth (ft)	Mean (mm)	St. Dev. (mm)	Sand (%)	Silt (%)	Clay (%)
6,835.7	.057	.024	28	58	14
6,842.5	.108	.034	90	10	0
6,843.7	.104	.030	95	5	0
7,066.1	.087	.048	58	32	10
7,090.3	.100	.036	72	11	17

Most sand grains are in the very fine range, which is from 0.62 to .125 mm. Most silt is coarse silt, between .031 and .062 mm. Clay particles are smaller than .004 mm. Eventually we hope to determine if original grain size influenced the subsequent diagenesis and, therefore, reservoir quality and permeability.

Mineral Composition

Four samples have been point counted so far to determine mineralogic composition of the Travis Peak. The sandstones are mineralogically mature and are classified as quartz arenites or subarkoses, with quartz constituting 91 to 96 percent of the essential constituents (quartz, feldspar, rock fragments). Feldspar varies from 2 to 6 percent, and rock fragments from 0 to 4 percent. Zircon and tourmaline are the most common heavy minerals, and they are another indication of the mineralogic maturity of the Travis Peak sandstones.

Authigenic cements constitute between 23 and 36 percent of the sandstone volume in these four samples. Quartz overgrowths, ankerite, and chlorite are the most abundant diagenetic minerals, and up to 28 percent of the total sandstone volume is quartz cement (fig. 3). No calcite cement was observed in the samples. Chlorite cement (2 to 7 percent by volume) occurs as rims of tangentially oriented crystals around detrital grains or as isolated patches of pore-lining cement (fig. 4). Ankerite cement (0 to 4 percent by volume) fills pore space (fig. 5) and also may replace framework grains or earlier cements.

Chlorite cement can cause completion problems in a well that is treated with acid and oxygenated fluids, because iron is liberated from the chlorite and reprecipitates as ferric hydroxide (Almon and Davies, 1978). The ferric hydroxide crystals are large enough to block pore throats. This problem can be prevented by using an oxygen scavenger and an iron chelating agent during acidization.

Porosity

The amount of porosity that remains in the Travis Peak sandstones is quite variable. The four thin sections that have been point counted have both primary and secondary porosity as follows:

Depth	Total Porosity (%)	Primary (%)	vs	Secondary (%)
6,842.5	4	50		50
6,843.7	22	85		15
7,093.5	1	67		33
7,095.3	5	45		55

Primary pores are most commonly bounded by quartz crystal faces. Where quartz cement is most abundant, primary pores are small (about .03 x .05 mm), but in samples with less authigenic quartz, primary pores are up to .06 x .2 mm. Secondary pores are approximately the same size as detrital grains, and they commonly contain remains of dissolved detrital grains or chlorite cement. Abundant microporosity occurs within chlorite cement.

The major control on the amount of porosity in a sample appears to be the amount of quartz cement. Where dead oil is present, it also has an important affect on reducing porosity.

REFERENCES

Almon, W. R., and Davies, D. K., 1978, Clay technology and well stimulation: Gulf Coast Assoc. Geol. Socs. Trans., v. 28, part I, p. 1-6.

Reineck, H. E., and Singh , I. B., 1980, Depositional Sedimentary Environments: New York, Springer-Verlag, 549 p.

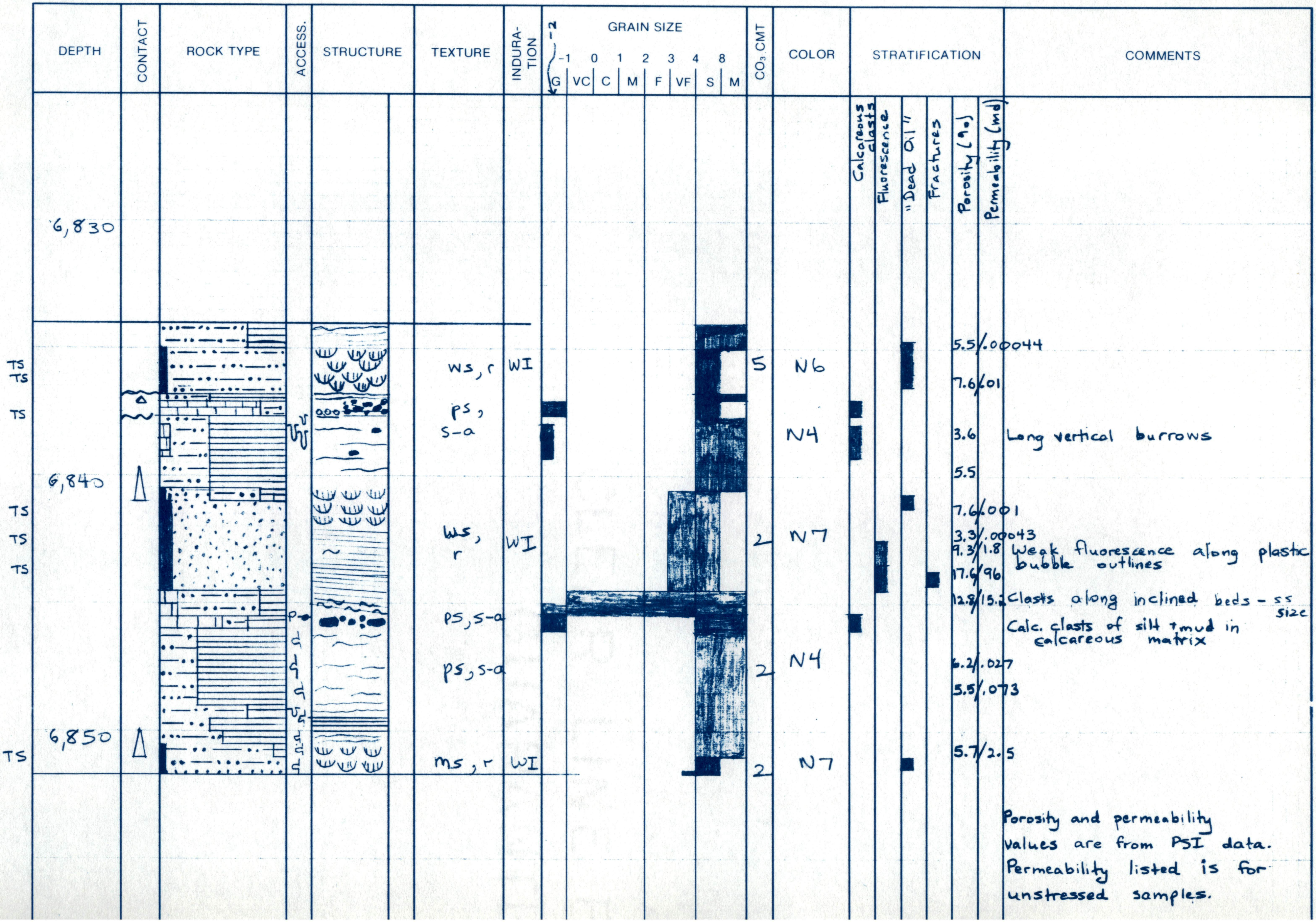
FIGURE CAPTIONS

Figure 1. Descriptive log of upper core of the Travis Peak from the Clayton W. Williams, Jr. Sam Hughes #1 well, Panola County, Texas. Core depth is from 6,834.0 to 6,851.7 ft; core minus 2.0 ft equals gamma ray log depth at 6,850 ft.

Figure 2. Descriptive log of lower core of the Travis Peak from the Clayton W. Williams, Jr. Sam Hughes #1 well, Panola County, Texas. Core depth is from 7,043.0 to 7110.4 ft; core depth minus 2.5 ft equals gamma ray log depth at 7,090 ft.

WELL C. Williams #1 Sam Hughes CORE DEPTH (+)(-) 2.0 ft = GR LOG DEPTH @ 6850 ft

FORMATION Travis Peak COUNTY Panola, TX LOGGED BY S. Dutton DATE 5/84

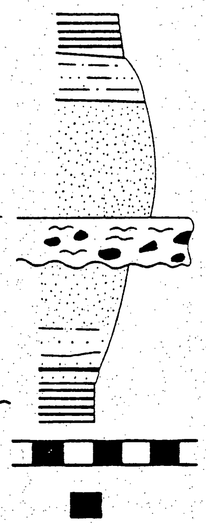


EXPLANATION OF SYMBOLS

CONTACT

- Gradational G
- Upward fining
- Planar
- Erosive E
- Upward coarsening
- Slightly irregular

ROCK TYPE (%)



- Mudstone
- Siltstone and sandy siltstone (—···—)
- Sandstone
- Mud clast and mud flake (~~) conglomerate
- Interbedded sandstone (····), siltstone (—···—), and
- Mudstone
- Coal
- Porosity

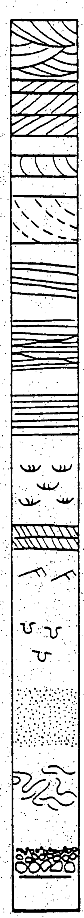
ACCESSORIES

- Vertical and horizontal burrows
- Organic fragments
- Rootlets
- Shells
- Mica flakes
- P Pyrite
- Callianassa burrows

TEXTURE

Sorting		Rounding	
vp-s	Very poor	a	Angular
p-s	Poor	s-a	Subangular
m-s	Moderately well	s-r	Subrounded
w-s	Well	r	Rounded

STRUCTURES



- Trough crossbedding
- Planar crossbedding
- Crossbeds with oversteepened foresets
- Indistinct cross-stratification
- Gently inclined lamination = GI
- Gently inclined lamination separated by low-angle discordances
- Horizontal lamination
- Ripple trough lamination
- Planar ripple lamination
- Climbing-ripple lamination
- Heavily bioturbated sandstone
- "Massive" sandstone = M
- Contorted bedding
- Graded bedding

INDURATION

WI	Well indurated
I	Indurated
IF	Indurated but friable
IS	Indurated but shaly

RELATIVE CALCITE CONTENT

1	Slight effervescence
3	Moderate effervescence
5	Strong effervescence
10	Very strong effervescence

COLOR

Abbreviations from Rock-Color Chart, Geological Society of America

Abbreviations from Rock-Color Chart

N4 - Medium dark gray

N5 - Medium gray

N6 - Medium light gray

N7 - Light gray

5Y 6/1 - Light olive gray

10R 4/2 - Grayish red

FIGURE 3.

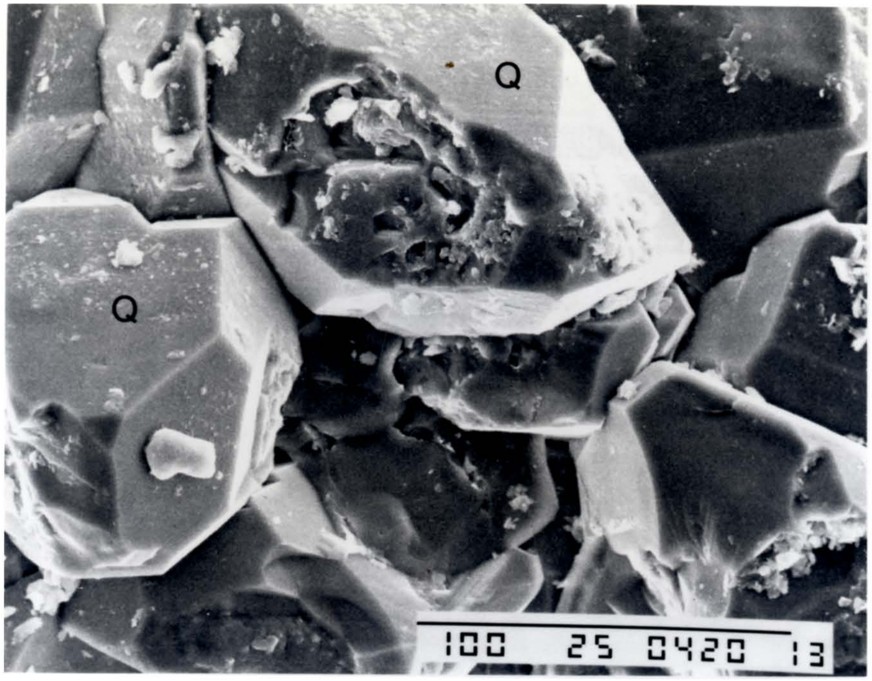
SEM photograph of quartz overgrowths (Q) covering detrital sand grains. Depth is 6,843.5 to 6,843.7. Bar length is 100 um; magnification is 500X.

FIGURE 4.

SEM photograph of quartz overgrowths (Q) bounding primary, intergranular porosity (arrows). Authigenic clays (C1) also reduce porosity. Depth is 6,843.5 to 6,843.7 ft. Bar length is 10 um; magnification is 750X.

FIGURE 5.

SEM photograph of carbonate cement (C) occluding primary porosity. The cement is probably an iron-rich dolomite. Depth is 6,843.5 to 6,843.7 ft. Bar length is 10 um; magnification is 2000X.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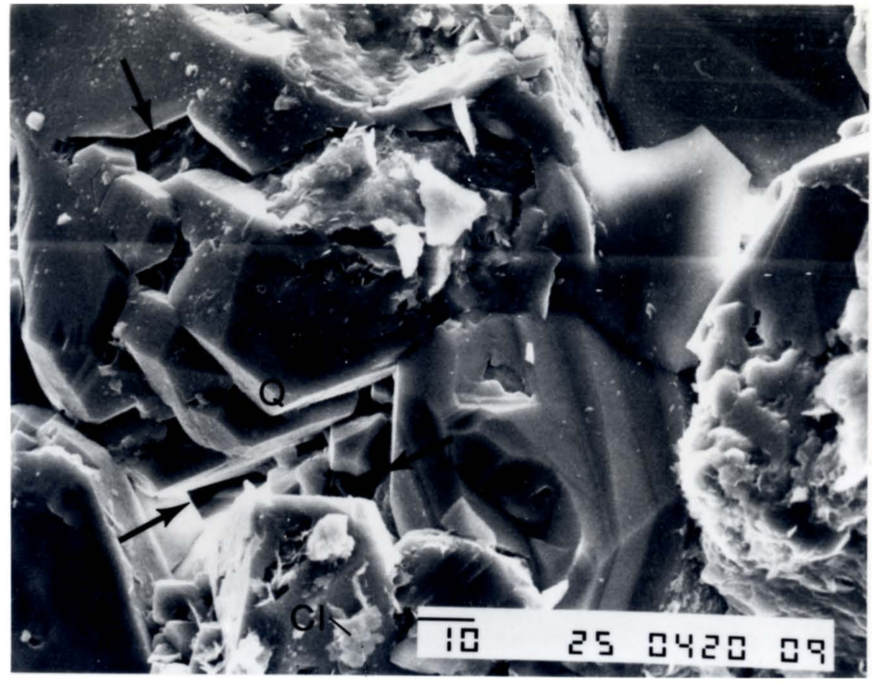
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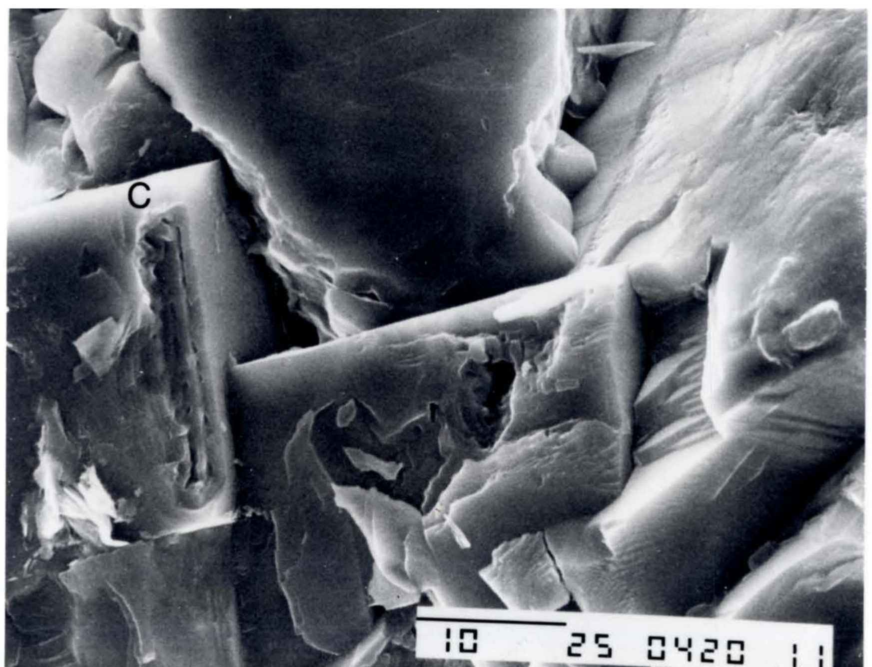
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