ESL-91003-PR

Petrographic Summaries for Cores from 15 Geothermal Wells in The Geysers Steam Field, California

for

Unocal Geothermal Division
Unocal Corporation
3576 Unocal Place
Santa Rosa, CA 95406

Jeffrey B. Hulen

Earth Science Laboratory

University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, Utah 84108
(801) 524-3422

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ABBREVIATIONS

AB -- albite
ABUN. -- abundant
ABUND. -- abundant
ACT. -- actinolite
ADJ. -- adjacent
AGG. -- aggregate
AGGR. -- aggregate
ALT. -- altered
ALTN. -- alteration
ANH. -- anhedral
APP. -- apparent(ly)
ASSOC. -- associated

BIREF. -- birefringence
BIREFR. -- birefringence
BRN. -- brown
BTE. -- biotite
BTM. -- bottom
BX(S). -- breccia(s)

CAL. -- calcite
CAV('S). -- cavities
CHL. -- chlorite
CHLOR. -- chlorite
CHLTN. -- chloritization
CHLTZN. -- chloritization
CHT. -- chert
COMM. -- commonly
CPXN. -- clinopyroxene
CPY. -- chalcopyrite
CRS. -- coarse

DIA. -- diameter
DISS. -- disseminated
DISSOL. -- dissolution
DIST. -- distributed
DOM. -- dominantly
DK. -- dark

EMPL. -- emplaced
ENCAPS. -- encapsulated
EP. -- epidote
ESP. -- especially
EST. -- estimated
EUH. -- euhedral

F. -- fine

FeAx -- ferroaxinite
FLUOR. -- fluorite
FRAC. -- fracture, fracturing
FRAGS. -- fragments
FRAMEWK. -- framework
FRANC. -- Franciscan
FRX. -- fractures
FSP. -- feldspar

GN -- galena
GR. -- grained
GRAN. -- granular
GRW -- graywacke

HBL. -- hornblende
HC -- hydrocarbon
HORIZ. -- horizontal
HYDROTH. -- hydrothermal(ly)

IL -- illite
ILM -- ilmenite
INCL. -- including
INCL'S -- inclusions
INT -- intensely
INTERCRYST. -- intercrystalline
INTERXLN. -- intercrystalline
IRREG. -- irregular(ly)

KF -- potassium feldspar
KFSP -- potassium feldspar
K-SPAR -- potassium feldspar

L -- liquid
LEUC. -- leucoxene
LEUCOX(N). -- leucoxene
LIQ. -- liquid
LT. -- light

MAG. -- magnetite
MED. -- medium
MET. -- metamorphic, metamorphosed
MGW. -- metagraywacke
MICROFRACS. -- microfractures
MICROFRX. -- microfractures
MICROXLN. -- microcrystalline
MIN. -- minimum

ABBREVIATIONS, continued

MINRL. -- mineral
MM. -- millimeter
MOD. -- moderate
MONZ. -- monzonite

NEG. -- negative

ORG. -- organic

PHENOS. -- phenocrysts
PLAG. -- plagioclase
PO -- pyrrhotite
POSS. -- possibly
PREF. -- preferentially
PROB. -- probably
PTLY. -- partly

QTZ. -- quartz

RECONN. -- reconnaissance
REFRX. -- refractured
REPL. -- replaced
REXLZN. -- recrystallization

SEC. -- section
SER. -- sericite, sericitization
SIL. -- silicate(s)
SL. -- slightly
SMPL. -- sample
SP -- sphalerite
SS -- sandstone
ST. -- stage
STKWK. -- stockwork
STOCKWK. -- stockwork
SUBH. -- subhedral
SULF. -- sulfide(s)

TEMP. -- temperature
T_h -- homogenization temperature
TL. -- total
TOUR(M). -- tourmaline
TR. -- trace
TRANSM. -- transmitted
TRANSP. -- transparent

UNK. -- unknown

V -- very
V.-RICH -- vapor-rich
VAP. -- vapor
VAR. -- variety, varieties
VN(S). -- vein(s)
VNLT(S). -- veinlet(s)
VOLC. -- volcanic
VRF -- volcanic rock fragment

W/ -- with
WAIR. -- wairakite

X -- cross
X-CUT -- cross-cut
XL(S). -- crystal(s)
XLN. -- crystalline
XN -- crossed nicols

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL LF-48; SMPL I	JEFF HULEN JAN. 14, 1991

Rock Type BIOTITE-CLINOPYROXENE QUARTZ MICROMONZONITE PORPHYRY; PHENOS. OF QTZ, PLAG, MICROPERTHITE, CPX, BTE; GLOMEROCRYSTS COMMON; QTZ. PHENOS. ROUNDED, UP TO 10 MM. DIA. (COMPOSITES) (QUARTZ-EYE PORPHYRY)

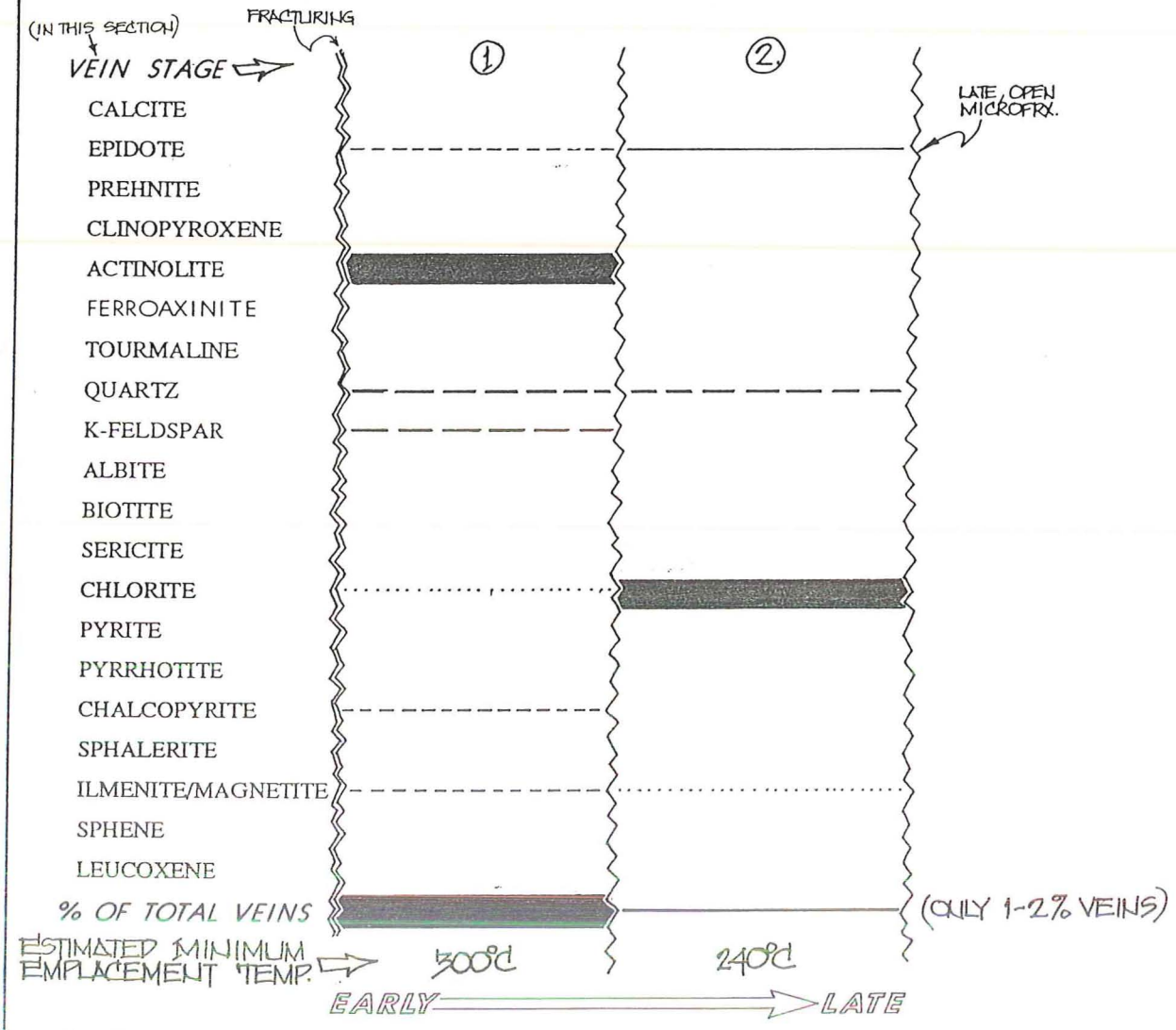
Fracturing/Brecciation/Veining and Vug-Filling VERY SPARSELY VEINED (1-1.5%); VNLTS ARE DISCONTINUOUS, < 0.5 MM. WIDE, POSSIBLY DEUTERIC, BUT TWO GENERATIONS

Porosity Summary < 0.5%, MOSTLY LATE, OPEN, MICROFRACTURES; SOME INTERGRANULAR $\not\emptyset$

Alteration/Metamorphism PROBABLY MOSTLY DEUTERIC ALTN.; CPX'N PARTIALLY REPLACED W/ BIOTITE, ACTINOLITE, ILMENITE/MAGNETITE, CHLORITE, EPIDOTE; PLAG. ESSENTIALLY FRESH, BUT SPARSELY, LOCALLY ALT. TO PHENGITE, EPIDOTE, ACTINOLITE; POSS. MINOR, LOCAL, K-SPAR "FLOODING".

Fluid Inclusions NONE OBSERVED IN VEIN MINERALS BUT ABUNDANT SECONDARIES IN QTZ. PHENOS. — THESE ARE UP TO 60 DIA. MOSTLY ROUNDED, MOSTLY VAP.-RICH; SOME LIQ-RICH INCLUSIONS HAVE OBVIOUS DAUGHTER MINERALS, BOTH HALITE(?) & UNKNOWN BIREFRINGENT PHASES.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	> 15-50%	
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%	

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL LF-48, SMPL. J	JEFF HULEN JAN. 22, 1991

Rock Type BIOTITE-PYROXENE QTZ MICROMONZONITE PORPHYRY, HYDROTHERMALLY ALTERED & VEINED

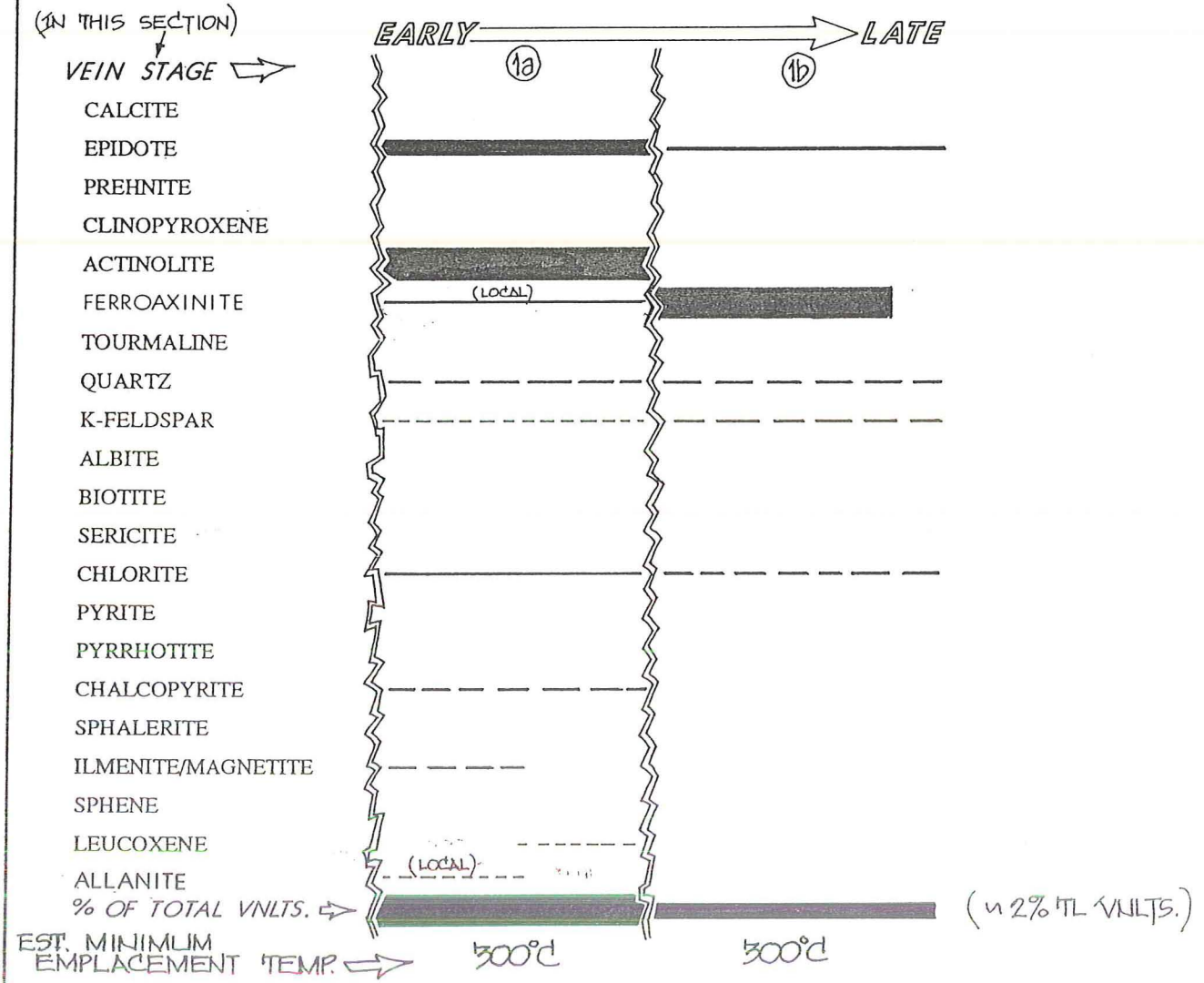
Fracturing/Brecciation/Veining and Vug-Filling ~2% STOCKWK. VNLTS., 2 OBVIOUS GENERATIONS; EARLIEST ACT-CHL-EP-FeAX, <0.1-0.35 MM. WIDE; LATER FeAX-EP-Q-CHL-KFSP, < 0.1 MM. WIDE.

Porosity Summary EST. 2.5% INTERXLN. VOIDS IN ST. 2 VNLTS; IRREG VOIDS IN ST 1 VNLTS; SPONGY DISSOLUTION Q IN PLAG., FORMER CPXN.

Alteration/Metamorphism
BROAD SELVAGES/PATCHES ADJACENT TO STAGE 1 & 2 VNLTS IN WHICH PLAG. IS MASSIVELY ALTERED TO KFSP.; CPXN. EXTENSIVELY DISSOLVED, REPLACED WITH VARIOUS COMBINATIONS OF ACTINOLITE, CHLORITE, LEUCOXENE, EPIDOTE; BTE. NEARLY FRESH TO TOTALLY ALTERED TO CHL & LEUCOXENE ± EPIDOTE; STAGE 1 VEIN ALLANITE PARTIALLY RIMMED/REPLACED W/EPIDOTE.

Fluid Inclusions
ABUNDANT SECONDARIES IN QTZ, VAPOR & LIQ-RICH, UP TO 15μ DIA (AVG. <4μ); LIQ-RICH VARIETIES HAVE L/V RATIO ~2.5-3/1, & SOME HAVE CUBIC/ISOTROPIC &/OR BIREFRINGENT DAUGHTER PRODUCTS.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	> 15-50%	
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%	

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL LF-48, SMPL. K (8089.3')	J. HULEN, NOV. 30, 1990

Rock Type BIOTITE-PYROXENE QUARTZ MICROMONZONITE PORPHYRY ("QUARTZ-EYE PORPHYRY")

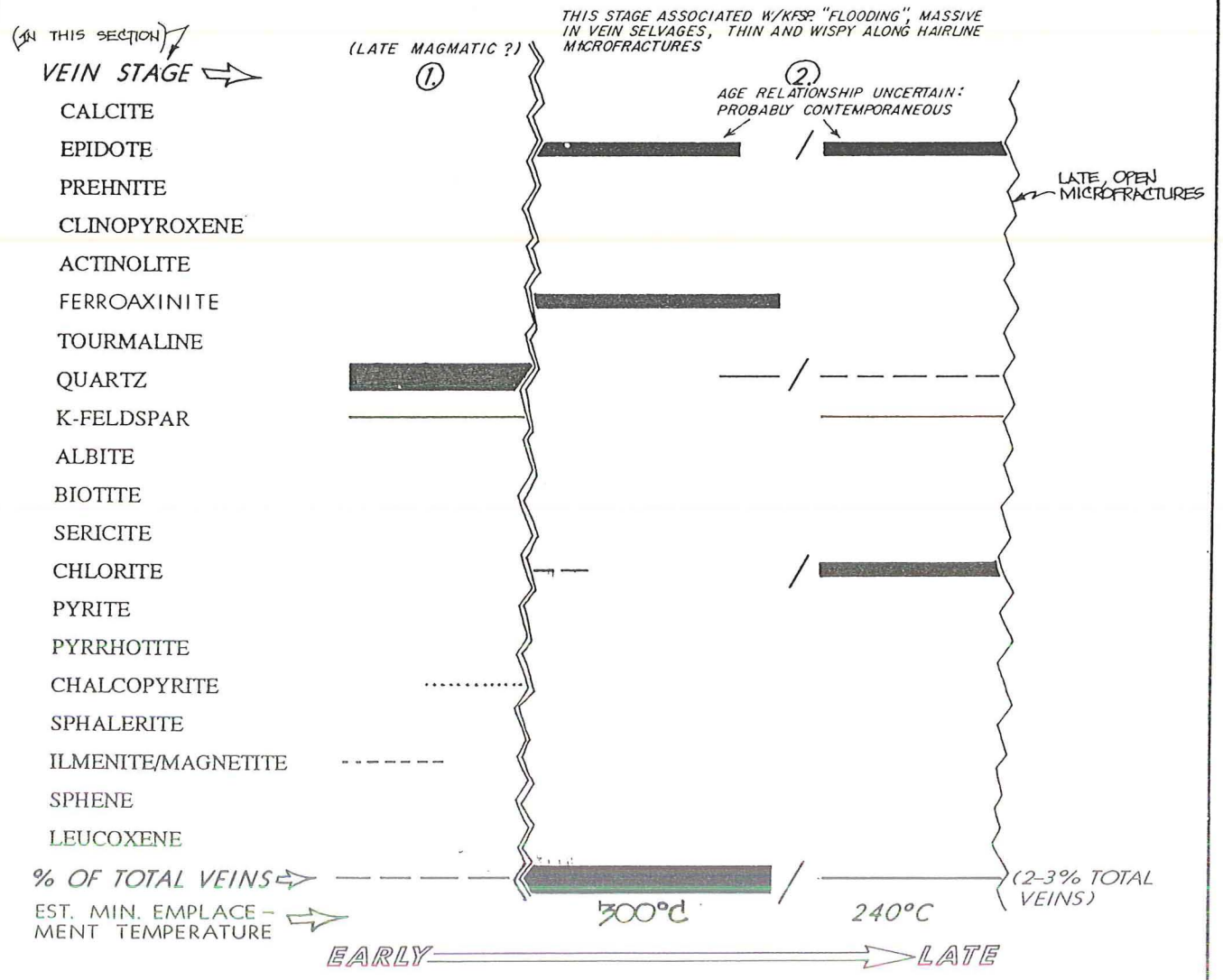
Fracturing/Brecciation/Veining and Vug-Filling ACTUAL OPEN-SPACE FILLING MINERALS ACCOUNT FOR ONLY 2-3% OF ROCK, BUT K-SPAR FLOODING ADJACENT TO VEINS & "SOAKING" OUTWARD FROM HAIRLINE MICROFRACTURES ACCOUNTS FOR 35-40% OF THE ROCK; 2 OBVIOUS VEIN STAGES (BELOW)

Porosity Summary ≈ 2.5% DOM. DISSOLUTION Φ IN K-SPAR FLOODED ZONES, ALT. PLAG. & MAFIC PHENOS; LATE-STAGE, OPEN Φ FRX.

Alteration/Metamorphism EXTENSIVE K-SPAR "FLOODING" ASSOCIATED W/EMPLACEMENT OF STAGE ② VEINLETS; PARTIAL ALTN. OF PLAG. PHENOCRYSTS WITHIN THESE ZONES TO K-SPAR, EPIDOTE, LOCAL CHLORITE; PARTIAL TO COMPLETE ALTN. OF CPXN. TO EPIDOTE, CHL., LEUCOXENE ... BIOTITE TO CHL. & LEUCOXENE ± EPIDOTE; ALSO: PLAG. PHENOS. LOCALLY REPL. W/UP TO 1.5X0.8MM EUHEDRAL FERROAXINITE "AXE-HEAD" CRYSTALS

Fluid Inclusions (RECONN.) NO USABLE INCLUSIONS FOUND IN VEIN-FILLING PHASES, BUT VAPOR AND LIQUID-RICH INCLUSIONS, PRESUMABLY 2ND, ARE V. ABUNDANT IN PRIMARY QTZ. THESE ARE <1-10μ IN DIA., TYPICALLY ROUNDED-APPEARING; LIQ-RICH VARIETIES HAVE LIQ/VAP. ≈ 9/1; PROBABLE BOILING

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-21, 5864.5'(A)	JEFF HULEN, NOVEMBER 29, 1990

Rock Type SERIATE TO PORPHYRITIC BIOTITE-HORNBLENDE-TOURMALINE QUARTZ MONZONITE; TRACES RELICT CLINOPYROXENE PHENOCRYSTS

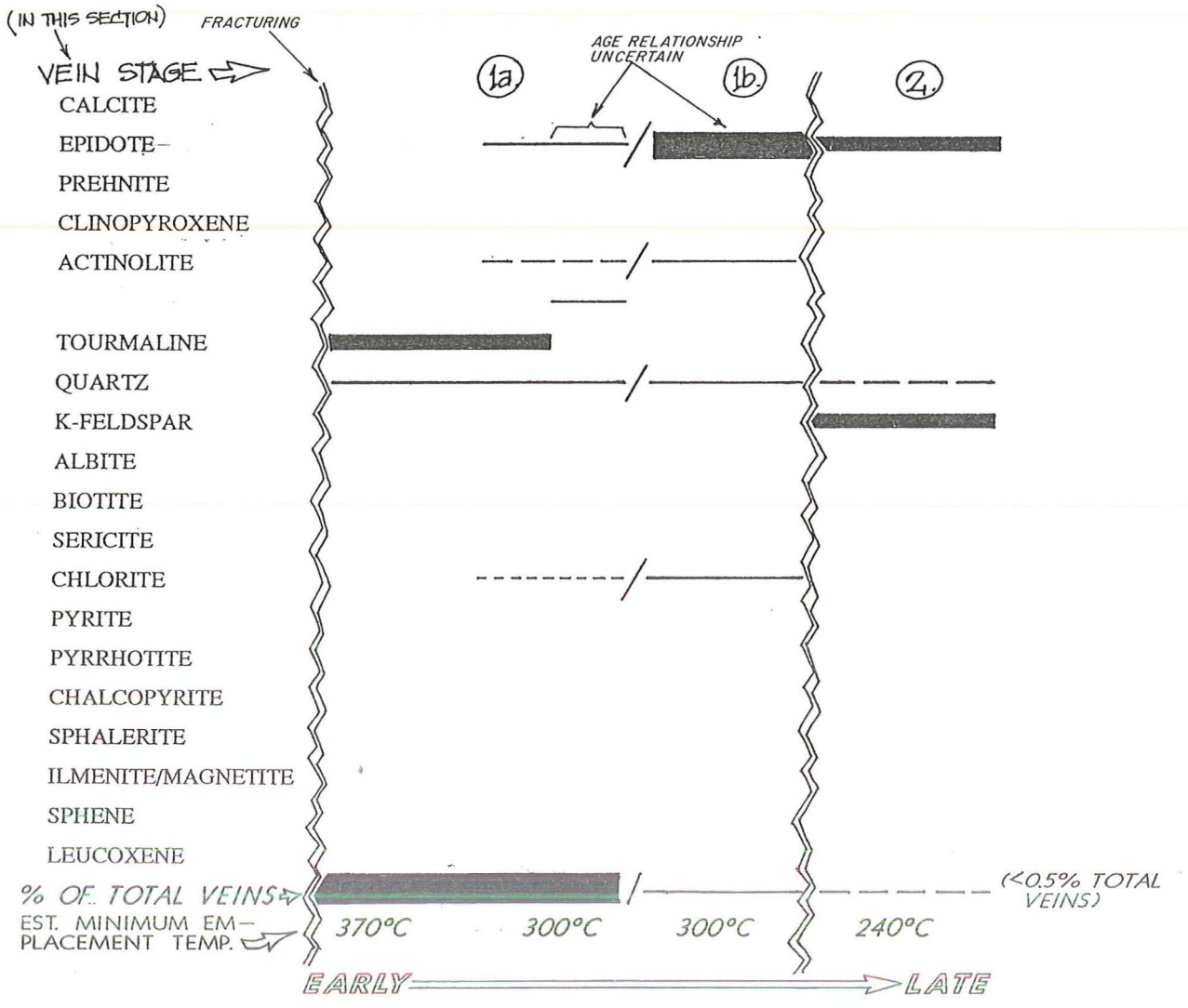
Fracturing/Brecciation/Veining and Vug-Filling VERY SPARSELY FRACTURED & VEINED; EST. < 0.5% TOTAL VEIN MINERALS; EARLY VEIN TOURMALINE REPLACED & LOCALLY X-CUT BY FERROAXINITE

Porosity Summary < 0.5%; NO IN MAFIC CLOTS, ALONG RARE VEINLETS

Alteration/Metamorphism PARTIAL TO COMPLETE REPLACEMENT OF ORIGINAL HORNBLENDE BY BROWN TOURMALINE, IN TURN REPLACED BY INDIGO TOURMALINE; HBL. ALSO LOCALLY ALT. TO PALE GREEN, FIBROUS ACTINOLITE; SPARSE, DISS. EPIDOTE IN PLAG.; BTE. & AMPHIBOLE RARELY & LOCALLY CHLORITIZED.

Fluid Inclusions NO USABLE INCLUSIONS FOUND IN VEIN-FILLING PHASES.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-21, 5864.5' (B)	JEFF HULEN 01/22/91

• NOTE: ABUND. RUTILE NEEDLES, ESP. IN QTZ.

Rock Type SERIATE TO PORPHYRITIC, BIOTITE-HORNBLENDE-CLINOPYROXENE-TOURMALINE QTZ. MONZ.; BULK OF ROCK HAS SUBOPHITIC TO OPHITIC TEXTURE W/ AVG. 0.1 X 0.3 MM. PLAG. LATHS (SUBH.-EUH.) IN ANH.-GRAN. QTZ-KF AGGR. (XLS. AVG. 0.5-0.7 MM)

Fracturing/Brecciation/Veining and Vug-Filling
VERY SPARSELY VEINED (AVG. < 0.05 MM WIDE, DISCONTINUOUS) → ∿ 0.3%; IN STAGE 1 VNLTS, INDIGO TOURMALINE WHERE BROWN TOUR. XLS. ARE TRAVERSED

Porosity Summary
UNKNOWN (NOT INJECTED W/ COLORED EPOXY) BUT V. V. LOW

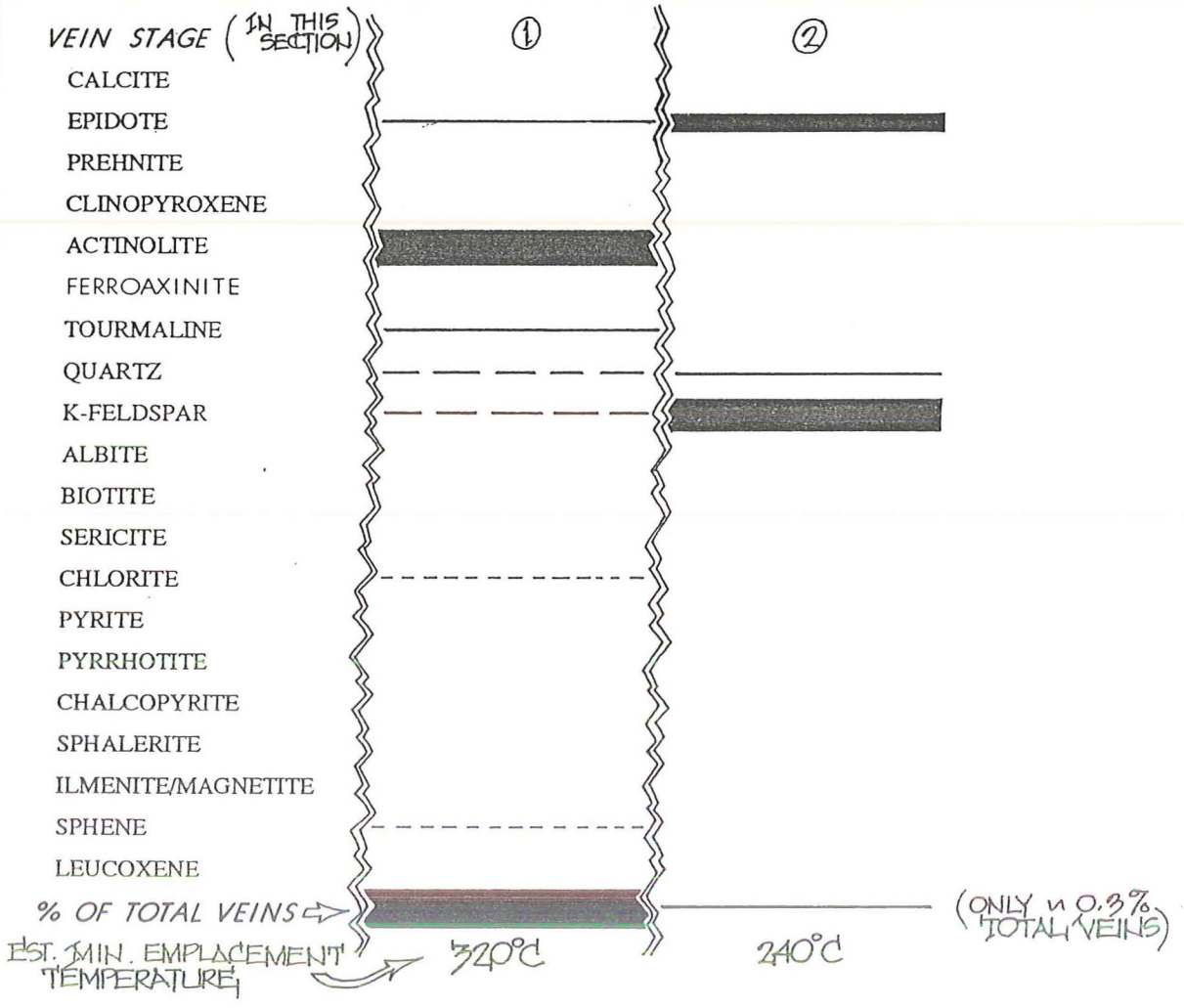
Alteration/Metamorphism
(LATE MAGMATIC): CPXN. PARTLY ALT. TO HBL., HBL. LOCALLY & PARTLY ALTERED TO BTE

(LATE MAGMATIC OR PEUTERIC): HBL. LOCALLY, PARTIALLY TO COMPLETELY ALTERED TO BROWN TOURMALINE, IN TURN PARTLY ALTERED TO INDIGO TOURMALINE.

SPARSE EP. REPL. PLAGIOCLASE

Fluid Inclusions
NONE OBSERVED IN VEIN MINERALS, BUT PRIMARY QTZ. CONTAINS ABUND., ROUNDED, VAPOR-RICH INCLUSIONS < 3 μ DIA. SCATTERED LIQ-RICH INCLUSIONS W/ L:V 2.5-3.5/1 & A FEW OF THESE WITH CUBIC, ISOTROPIC, DAUGHTER MINRL.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	> 15-50%	
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%	

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-21, SMPL. E	JEFF HULEN JAN. 15, 1991

Rock Type SERIATE TO PORPHYRITIC, BIOTITE-HORNBLENDE-TOURMALINE QUARTZ MONZONITE; GROUNDMASS TEXTURE DOM. SUBOPHITIC (PLAG. IN KFSP & QTZ); ABUNDANT GROUNDMASS RUTILE NEEDLES

Fracturing/Brecciation/Veining and Vug-Filling
VERY SPARSELY VEINED (<0.5%) — THESE ARE DISCONTINUOUS, <0.08 MM. WIDE, POSS. DELITERIC.

Porosity Summary
LOCAL TR.; DISSOLUTION POROSITY IN PLAG.; INTERGRANULAR ϕ

Alteration/Metamorphism THE ROCK APPEARS QUITE FRESH; HORNBLENDE LOCALLY ALT. TO DK. GREEN ACTINOLITE; ALSO MANY ARE PARTIALLY TO COMPLETELY ALTERED TO BROWN TOURMALINE, IN TURN PARTIALLY ALTERED TO INDIGO TOURMALINE (BOTH VARIETIES VERY PLEOCHROIC); IT'S POSSIBLE THAT SOME OF THE BROWN TOURMALINE IS A PRIMARY PHENOCRYST MINERAL; SUSPECT THAT MUCH OF THE TOURMALINE IS OF DELITERIC ORIGIN; MINOR DISS. EPIDOTE, MOSTLY IN PLAG; POSS. TR. FERROAXINITE (?) REPLACING HORNBLENDE (BIREFR. PROB. TOO LOW)

Fluid Inclusions NONE IN VEIN MINERALS BUT ROCK-FORMING QTZ HOSTS MYRIAD SECONDARY INCLUSIONS — MOST OF THESE ARE ROUNDED-APPEARING, <3U DIA. VAPOR-RICH; LIQ-RICH INCLUSIONS HAVE LIQ/VAP. RATIOS OF 2.5-4/1, & MANY HAVE DAUGHTER MINERALS (UP TO 4 INCL. HALITE)

Interpreted Paragenesis of Vein- and Vug-Filling Minerals

Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

.....	trace	— — — —	> 1-5%
- - - - - - - -	< 1% (vol.)	———	> 5-15%
			> 15-50%
			> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-21, SMPL. F	JEFF HULEN; JAN. 21, 1991

Rock Type SERIATE TO PORPHYRITIC, BIOTITE-HORNBLENDE-CPXN-TOURMALINE QUARTZ MONZONITE; ABUNDANT EARLY RUTILE NEEDLES

Fracturing/Brecciation/Veining and Vug-Filling VERY SPARSELY VEINED; ≤0.7%, & THESE ARE < 0.1 MM. WIDE, DISCONTINUOUS

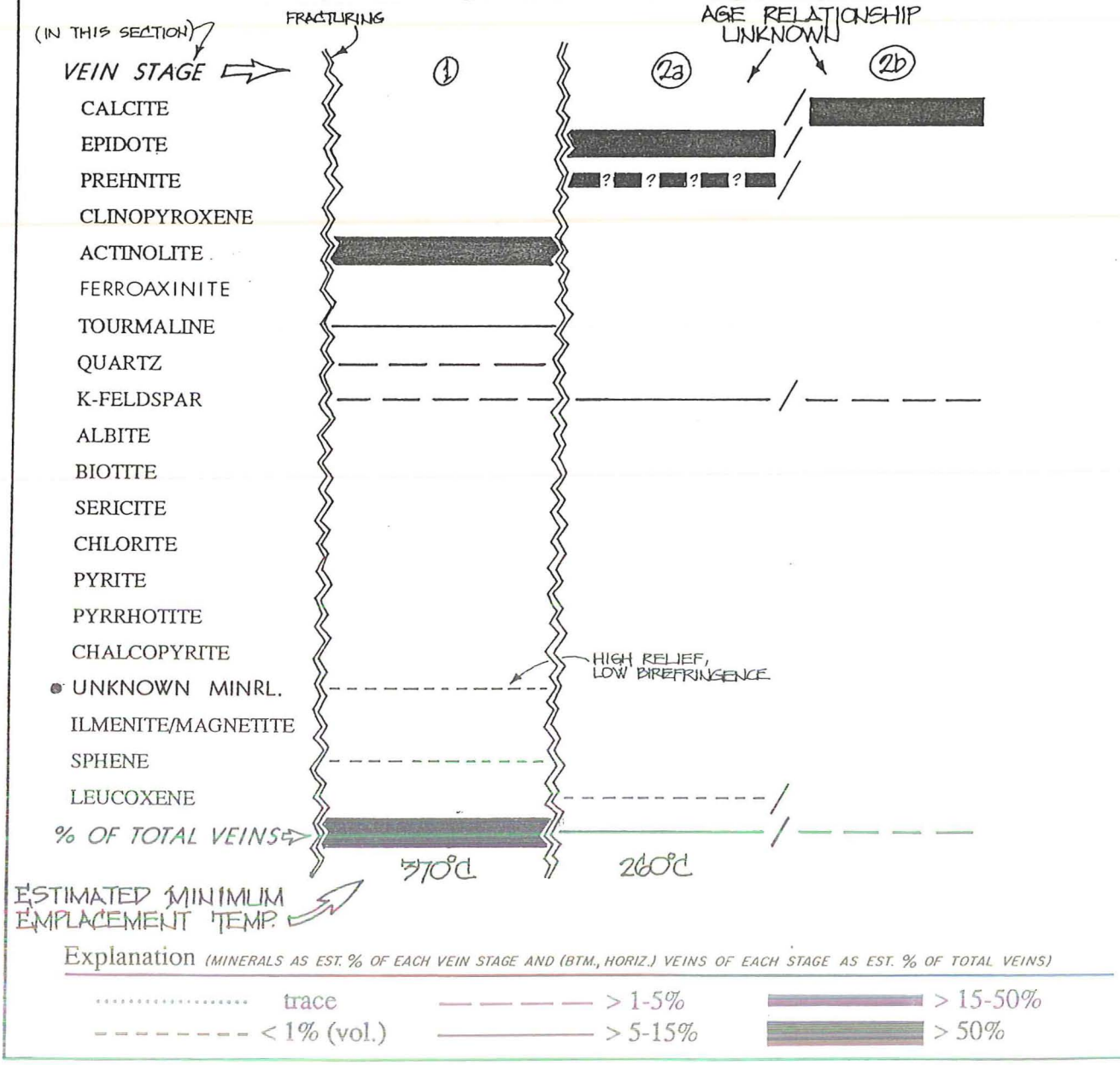
SPARSE EPIDOTE REPL. PLAGIOCLASE

Porosity Summary APPARENTLY NONE (OR IMPERFECT EPOXY INJECTION)

Alteration/Metamorphism ABUNDANT DEUTERIC OR LATE MAGMATIC BROWN TOURMALINE DISCRETE XL. AGGREGATES & REPLACING HORNBLENDE PHENOCRYSTS → THIS VARIETY IN TURN REPL. PARTIALLY WITH INDIGO TOURMALINE; CPXN. PTLY REPL. BY HBL.; HBL. PTLY. & LOCALLY REPLACED W/ GREEN (VIVID) ACTINOLITE; HBL. ALSO LOCALLY REPL. W/ TR. LATE MAGMATIC BTE.; TOUR. APPARENTLY LOCALLY REPLACED W/ UNKNOWN LOW-BIREFR., HIGH RELIEF 2ND PHASE (PROBE)

Fluid Inclusions NONE OBSERVED IN VEIN MINERALS; PRIMARY QTZ. CONTAINS MYRIAD 2ND INCLUSIONS, BOTH VAPOR & LIQUID-RICH; THE LATTER HAVE L/V ≅ 2.5-3.5/1, & COMMONLY CONTAIN AN ISOTROPIC, CUBIC DAUGHTER MINERAL

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL DV-2 SMPL. G (≈3711.7')	JEFF HULEN, NOV. 26, 1990

Rock Type QUARTZ MICROMONZONITE PORPHYRY ("QUARTZ-EYE" PORPHYRY) W/ ROUNDED QUARTZ PHENOCRYSTS, LOCAL GRANOPHYRIC GROUNDMASS; ROCK IS HYDROTHERMALLY BRECCIATED, HEAVILY VEINED (ALSO OLIGOCLASE & K-SPAR PHENOCRYSTS)

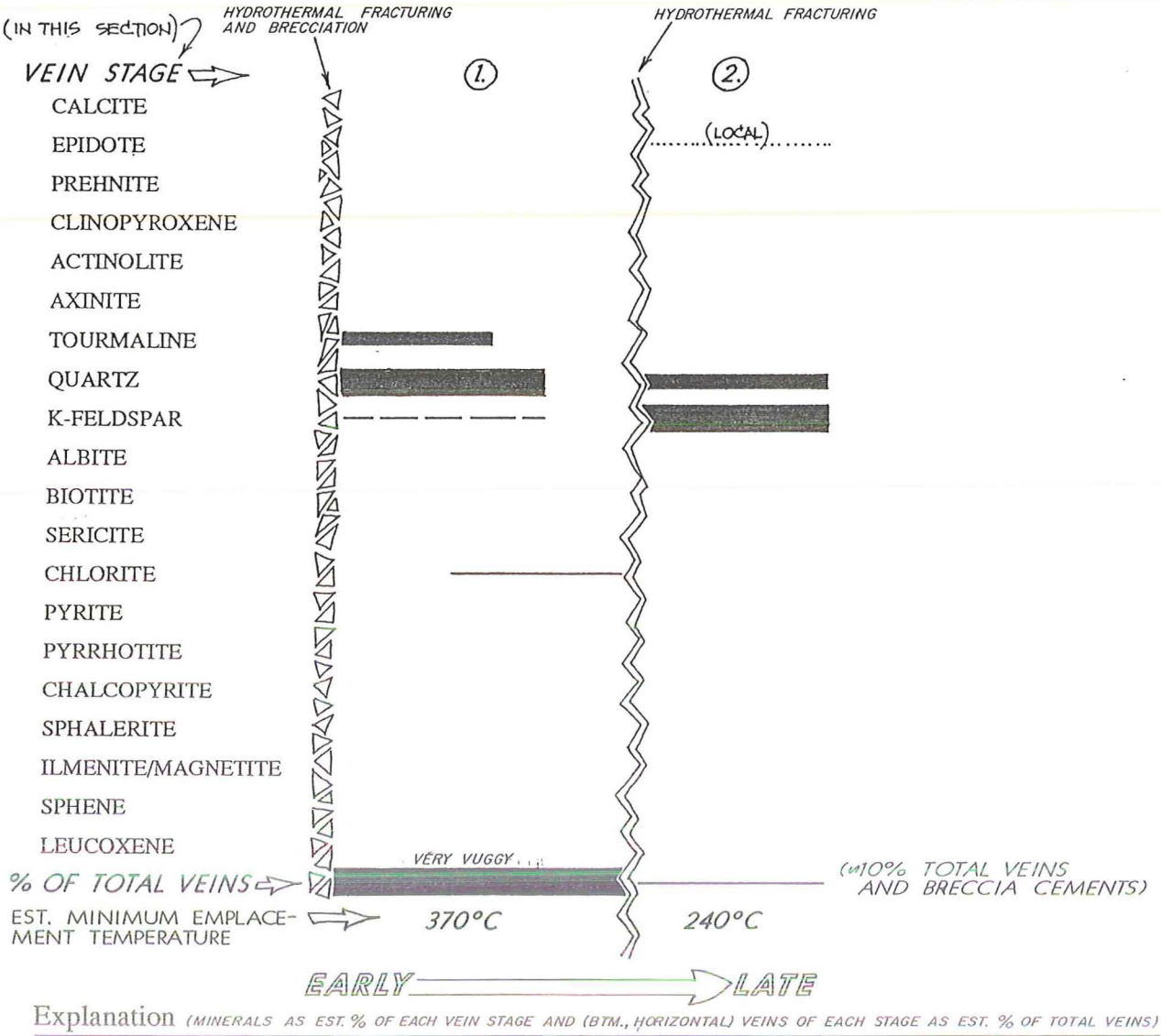
Fracturing/Brecciation/Veining and Vug-Filling INTENSE HYDROTHERMAL FRACTURING & BRECCIATION, 2 MAIN (OBVIOUS) EPISODES, FRACTURES & BRECCIAS OF EACH CEMENTED PARTIALLY W/ 2ND MINERALS (VERY VUGGY VEINS & BRECCIA CEMENTS)

Porosity Summary ≈ 2.5% MOSTLY AS ANGULAR TO IRREG., PRIMARY INTERCRYSTALLINE CAVITIES IN STAGE ① & ② VEINS

Alteration/Metamorphism THE ROCK IS WIDELY SILICIFIED (± DISS. TOURMALINE) ADJACENT TO & BETWEEN STAGE ① QTZ-TOURMALINE VEINLETS & BRECCIA CEMENTS; MUCH OF THE GROUNDMASS PLAGIOCLASE IS SERICITIZED (PROBABLY DURING THE WANING STAGE OF STAGE ① VEINING; POSS. A FEW MICROPEGMATITIC QTZ-K-SPAR ± TOURMALINE AMYGDULES (< 1 MM.); COMMON RUTILE NEEDLES, CONCENTRATED IN PRIMARY QUARTZ.

Fluid Inclusions (RECONN.) STAGE ① VEINLETS & BX CEMENTS CONTAIN (IN QTZ.) ABUND. PRIM. & 2ND INCL'S., MOSTLY VAPOR-RICH, SOME LIQ-RICH W/ L:V ≈ 2.5/1 (EST. T_h > 300°C) — THESE ALSO MAY HAVE HALITE DAUGHTERS. STAGE ② QTZ — RARE INCL., BUT THESE COMMONLY LIQ-RICH — L:V ≈ 3-3.5/1

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZONTAL) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	> 15-50%	
- - - - - - - - < 1% (vol.)	> 5-15%	> 50%	

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL DV-2, „ SMPL. H	JEFF HULEN JAN. 22, 1991

Rock Type "QUARTZ-EYE PORPHYRY: BIOTITE QTZ. MICROMONZONITE PORPHYRY; PROMINENT GRANOPHYRIC GROUNDMASS: 7-10% MOSTLY GLOMEROPORPHYRITIC, ROUNDED QTZ. PHENOCRYSTS, INDIVIDUALS < 2.5 MM. DIA., CLUSTERS < 10 MM. DIA. ** #

Fracturing/Brecciation/Veining and Vug-Filling HYDROTHERMALLY FRACTURED, RESULTING OPEN SPACES/FRX INCOMPLETELY FILLED W/QTZ, TOURM., KFSP; RESULTING ∉, INTERXLN. VOIDS UP TO 10MM. IN DIAMETER; ∿10% VEIN MINERALS.

Porosity Summary ∿5% — MOSTLY ∉ INTERXLN. VOIDS IN ST. 1 VNLTS; MINOR DISSOLUTION Φ IN K-SPAR & PLAG (PRIMARY)

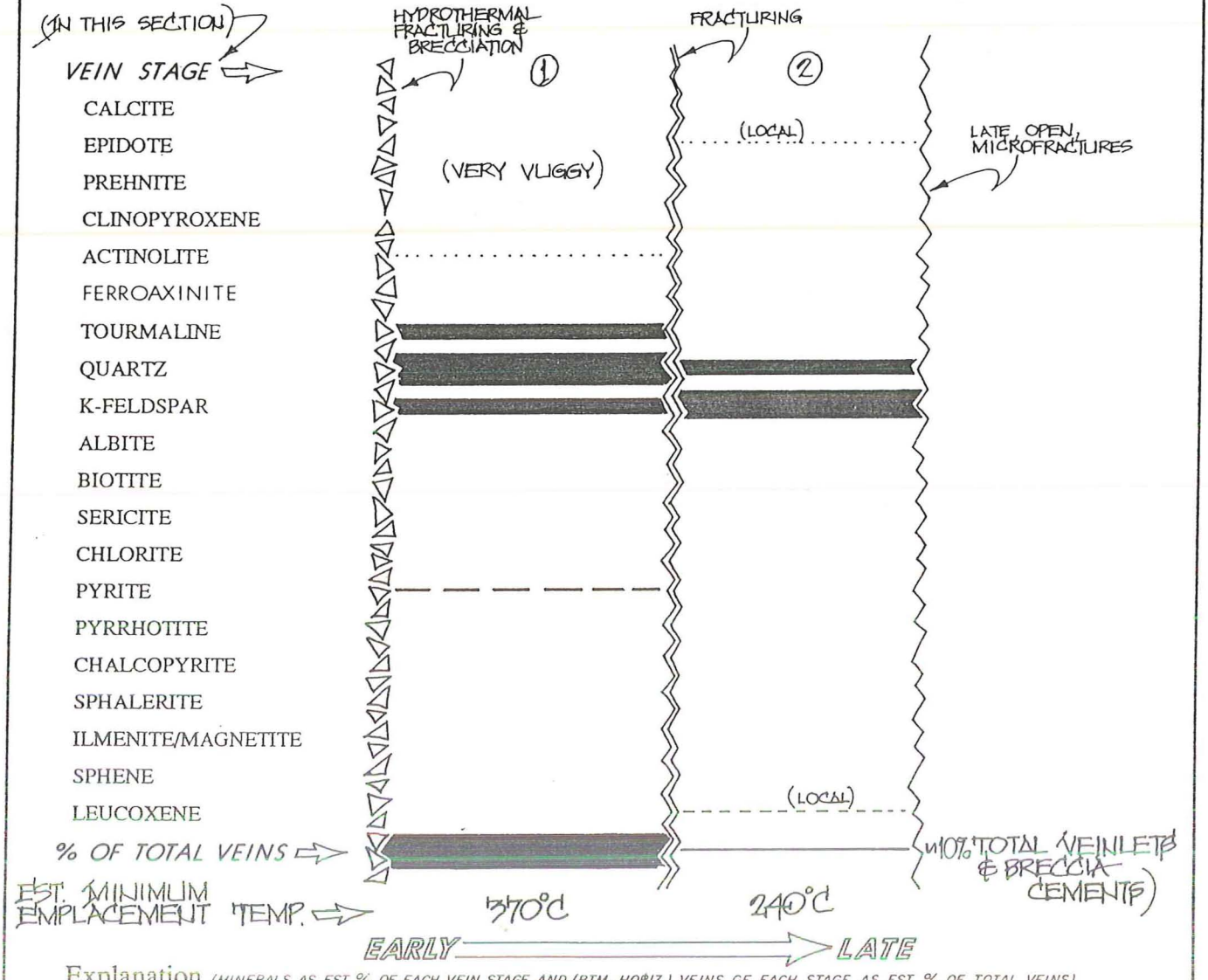
Alteration/Metamorphism
SERICITIZATION OF PLAG. PARTIAL TO COMPLETE, IN SELVAGES EXTENDING INTO WALLROCK UP TO 1FX VEIN WIDTH; → THIS LOCALLY ACCOMPANIED BY SILICIFICATION; ORIGINAL BTE. ALT. TO CHL. & MINOR LEUCOXENE; TR. DISS. LEUCOXN. & EPIDOTE

** NOTE ALSO: SCATTERED, IRREGULAR, MICROPEGMATITIC CLOTS OF QTZ-KFSP-TOURMALINE

ALSO: COMMON RUTILE NEEDLES ENCAPS. IN PRIMARY MINRLS.

Fluid Inclusions
ABUND. IN ST. 2 QTZ; DOM. VAPOR-RICH; <1-12μ DIA; NEG. XL. SHAPES COMMON; MANY ROUNDED; RARE* LIQ-RICH VAR. W/L:V 2.5-4/1 — SOME MAY HAVE DAUGHTER PRODUCTS
*LOCALLY MORE ABUNDANT.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL DV-2, 3708c-B	JEFF HULEN JAN. 22, 1991

Rock Type "QUARTZ-EYE" PORPHYRY: HBL-BTE QTZ MICROMONZONITE PORPHYRY W/ PROMINENT GRANOPHYRIC TO MICROGRAPHIC GROUNDMASS; EMBAYED, ROUNDED QTZ PHENOS, COMMONLY AS GLOMEROCRYSTS; ALSO SUBH-EUH PLAG. & PERTHITE PHENOS.

Fracturing/Brecciation/Veining and Vug-Filling
NO VEINS, BUT 3-4% PARTIALLY TO COMPLETELY FILLED APPARENT MICROPEGMATITIC VESICLES → THESE LINED/FILLED WITH QTZ, KFSP ± TOUR, CHL (ALL SUBH.-EUH.)

Porosity Summary
NOT INJECTED W/COLORED EPOXY, BUT ESTIMATE ~2%

Alteration/Metamorphism
BIOTITE WEAKLY TO TOTALLY ALTERED TO CHL. & MINOR LEUCOXENE; HBL. ALT. TO VARIOUS COMBINATIONS OF CHL, LEUCOXN., EP., ACT.; PLAG COMMONLY FRESH, BUT LOCALLY WEAKLY TO INTENSELY ALTERED TO SERICITE; TR. DISS. EPIDOTE & LEUCOXN.

Fluid Inclusions
ABUNDANT VAPOR & LIQ-RICH INCL., ESP. IN & NEAR QTZ-KFSP MICROPEGMATITIC CLOTS; IRREG. TO ROUNDED, UP TO 25μ DIA. (AVG. < 5μ) → LIQ-RICH VAR. HAVE LIQ/VAP. RATIOS OF 2.5-3/1, & MANY OF THESE HAVE DAUGHTER MINERALS (BIREFR. & CUBIC-ISOTROPIC).

Interpreted Paragenesis of Vein- and Vug-Filling Minerals

VEIN STAGE

CALCITE
EPIDOTE
PREHNITE
CLINOPYROXENE
ACTINOLITE
FERROAXINITE
TOURMALINE
QUARTZ
K-FELDSPAR
ALBITE
BIOTITE
SERICITE
CHLORITE
PYRITE
PYRRHOTITE
CHALCOPYRITE
SPHALERITE
ILMENITE/MAGNETITE
SPHENE
LEUCOXENE

(NO VEINS, BUT MICROPEGMATITIC CLOTS W/ QTZ, KFSP, TOUR.)

% OF TOTAL VEINS

Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

..... trace
- - - - - - - - - < 1% (vol.)
— — — — > 1-5%
——— > 5-15%
▬▬ > 15-50%
▬▬ > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL OF-27A-2, 10,373'	JEFF HULEN, SEPT. 23, 1990

Rock Type SHEARED, INTERLAMINATED, SANDY HORNFELSIC ARGILLITE & ARGILLACEOUS LITHIC METAGRAYWACKE (HORNFELSIC)

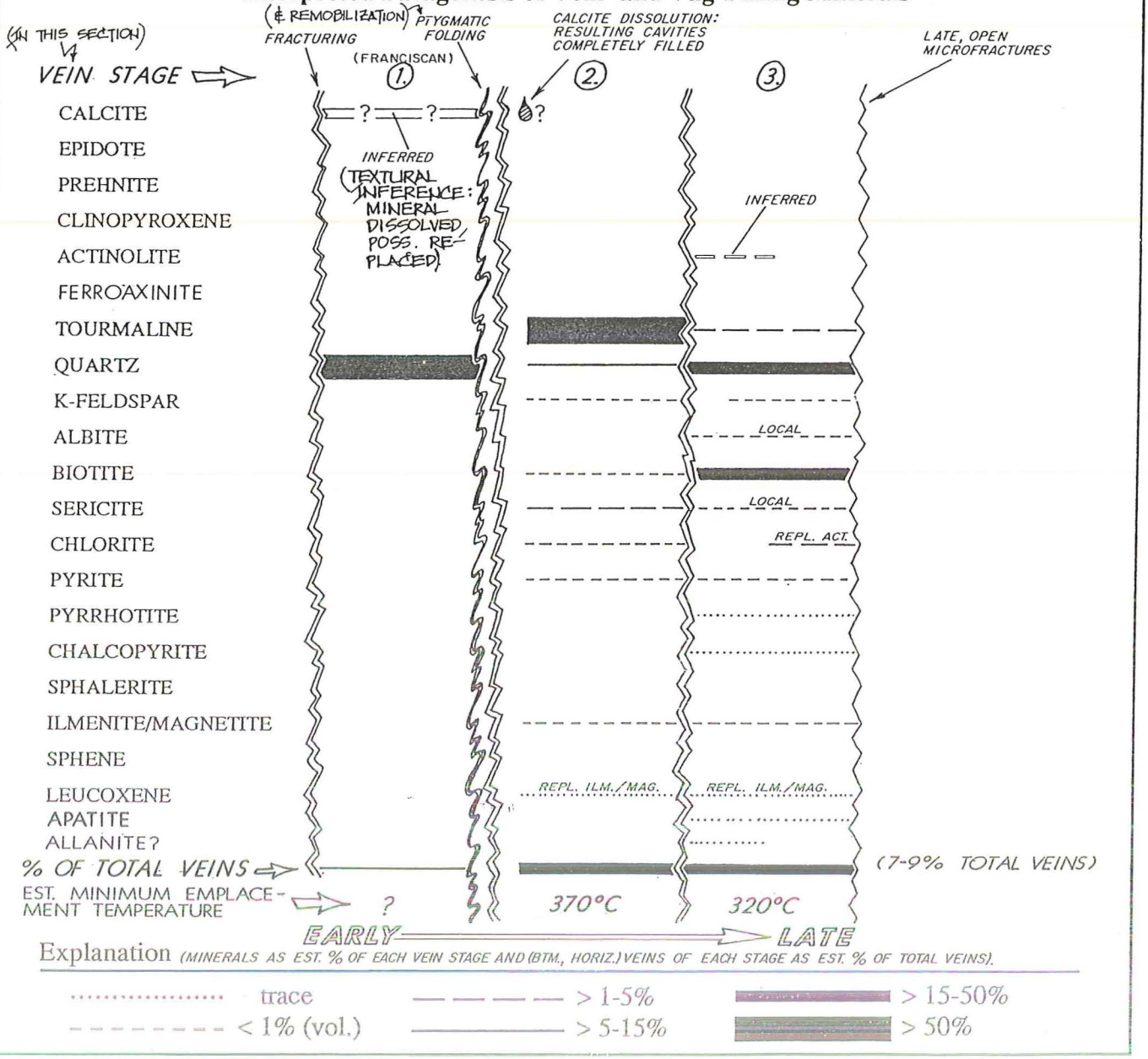
Fracturing/Brecciation/Veining and Vug-Filling
MOD.–INT. VEINED (7-9% OF TOTAL THIN-SECTION AREA) 3 STAGES OF VEINING—EARLIEST PROB. FRANCISCAN-AGE; STAGE 3 POTASSIC VEINS REMINISCENT OF THOSE IN PORPHYRY COPPER DEPOSITS

Porosity Summary
EST. 0.7-1%, MOSTLY LATE, OPEN FRACTURES SOME μPOROSITY IN LAYER SILICATES, VEIN QTZ.

Alteration/Metamorphism
CONTACT METAMORPHISM OF ORIGINAL ILLITE/CHL-RICH MATRIX TO BIOTITE & BROWNISH PHENGITE; ALBITE TO OLIGOCLASE/ANDESINE; PTYGMATIC FOLDING OF FRANCISCAN QTZ (-CALCITE) VEINLETS; SERICITE SELVAGES ADJACENT TO STAGE ② VEINLETS; HYDROTHERMAL BIOTITE AFTER MET. BTE. ADJACENT TO & NEAR STAGE ③ VEINLETS.

Fluid Inclusions (RECONN.)
ABUNDANT IN STAGE ② & ③ VEINLETS; ONLY 2ry INCLUSIONS FOUND; <1-10μ DIA., MOSTLY VAPOR-RICH (BOILING STRONGLY INDICATED); RARE LIQUID-RICH INCLUSIONS SHOW LIQ/VAP RATIOS OF 2.5-3/1; (EST. T_h 280-300°C); LARGER LIQ.-DOM. INCL. CONTAIN HALITE.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS).

trace — < 1% (vol.) — > 1-5% — > 5-15% — > 15-50% — > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL OF27A-2, 10,378'	JEFF HULEN 02/02/91

Rock Type HORNFELSIC, BIOTITE-RICH, V. POORLY SORTED, V. FINE- TO CRS.-GRAINED LITHIC METAGRAYWACKE

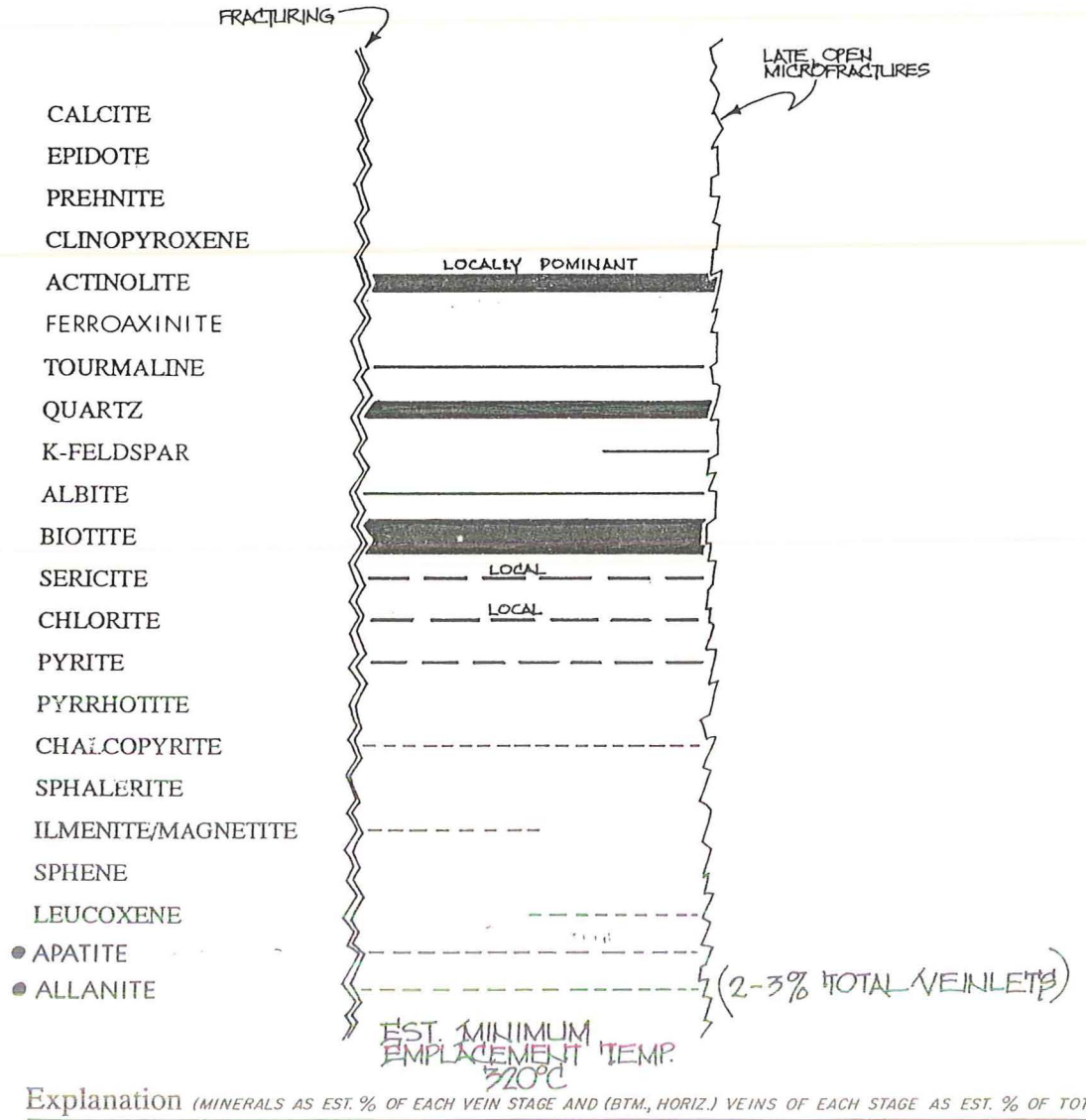
Fracturing/Brecciation/Veining and Vug-Filling 2-3% TOTAL VNLTS. ALL APPARENTLY ONE GENERATION, BUT THIS MAY INCLUDE RELICTS OF FRANCISCAN(?) QUARTZ VNLTS.; TECTONIC ORIGIN FOR LARGEST VN-CONTROLLING FRAC.

Porosity Summary < 0.3% MOSTLY LATE, OPEN MICROFRX. (CORING-INDUCED?)

Alteration/Metamorphism HORNFELSIC RECRYSTLZN. OF ORIGINAL FL/CH-RICH MATRIX TO BTE & GREENISH- TO BROWNISH PHENGITE; PLAG. (OLIG.?) SPARSELY ALT. TO PHENGITE, BTE, TOURM., LOCAL ACTINOLITE; INTERMEDIATE- TO BASIC- COMPOSITION VRFS COMMONLY ALT. TO ACTINOLITE ± BTE, TOUR.; TOURM. (BROWN TO INDIGO) ≈ 3% OF ROCK (EXCLUDING VEINLETS)

Fluid Inclusions ABUND. IN EIN QTZ., DOM. ROUNDED, <1-10μ (AVG. 2μ) DIA., DOM. VAPOR-RICH; RARE LIQ-RICH INCL.'S. W/ LIQ:VAP = 2.5-3/1 → THESE CONTAIN A CUBIC-ISOTROPIC & A BIREFRINGENT DAUGHTER MINRL.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

..... trace — — — — > 1-5% > 15-50%

– – – – – – – – < 1% (vol.) ——— > 5-15% > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL OF-27A-2, 10,379'	JEFF HULEN 01/25/91

Rock Type POORLY-SORTED, V. FINE- TO CRS.-GRAINED, HORNFELSIC, BIOTITE-RICH LITHIC METAGRAYWACKE

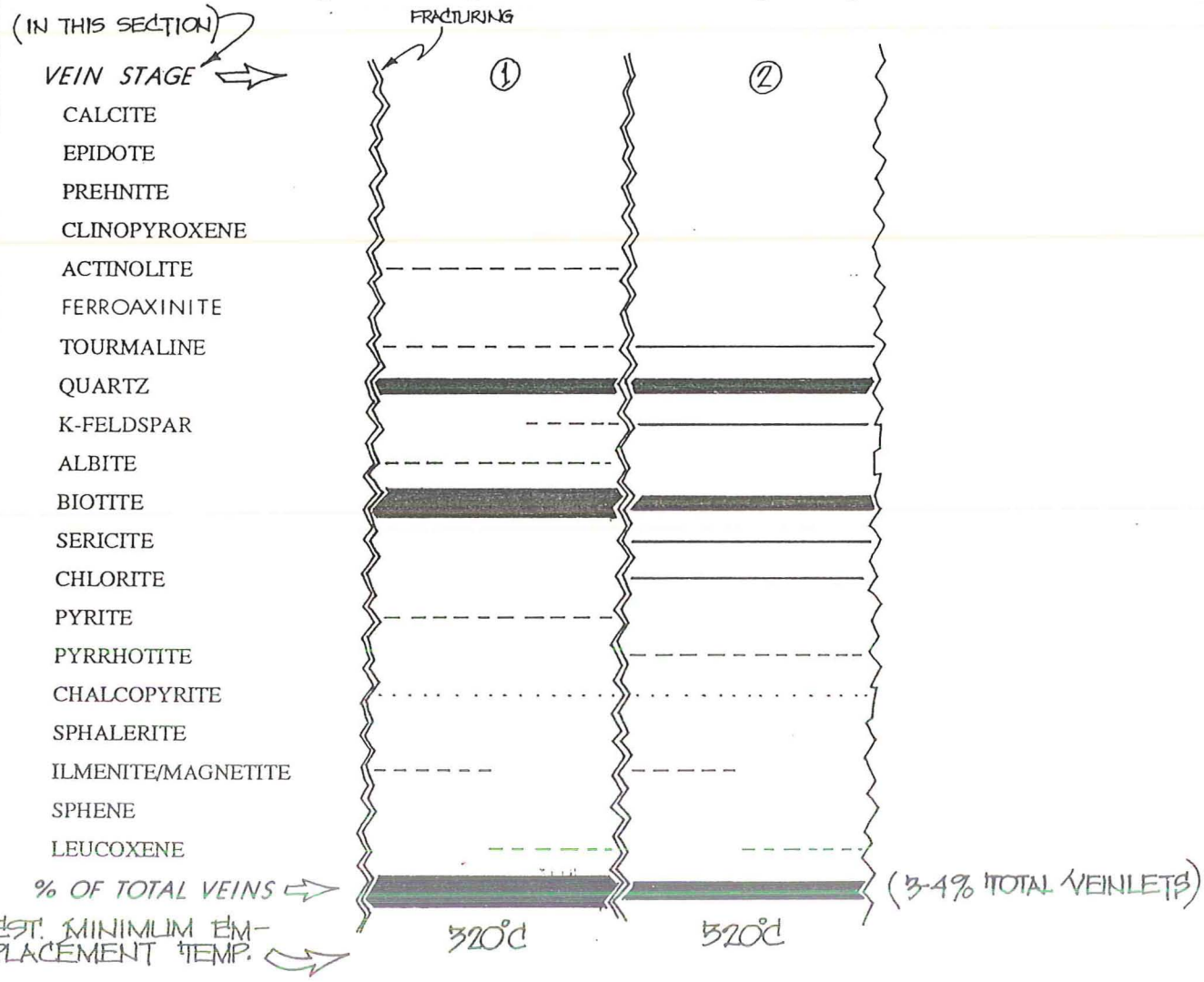
Fracturing/Brecciation/Veining and Vug-Filling
SPARSELY VEINED, ONLY ~ 3-4% OF SECTION, & APPARENTLY ONLY 2 GENERATIONS IN THIS SECTION (THE LATEST 2 IN THE CORE AS A WHOLE)

Porosity Summary
0.3% ALMOST ALL AS LATE, OPEN μFRX.

Alteration/Metamorphism
METAMORPHIC RECRYSTN. OF ORIGINAL FL/CH MATRIX TO BIOTITE & BROWNISH PHENGITE; PATCHY ALTN. OF THIS MATRIX TO GREENISH BIOTITE & SERICITE NEAR ST. 2 VNLTS; MINOR SILICIFICATION ADJ. TO STAGE 1 VNLTS

Fluid Inclusions
ABUND, ROUNDED, VAPOR-RICH INCLUSIONS < 5μ DIAMETER IN ST. 2 QTZ.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL OF 27A-2, 10,381'	JEFF HULEN JAN. 25, 1991

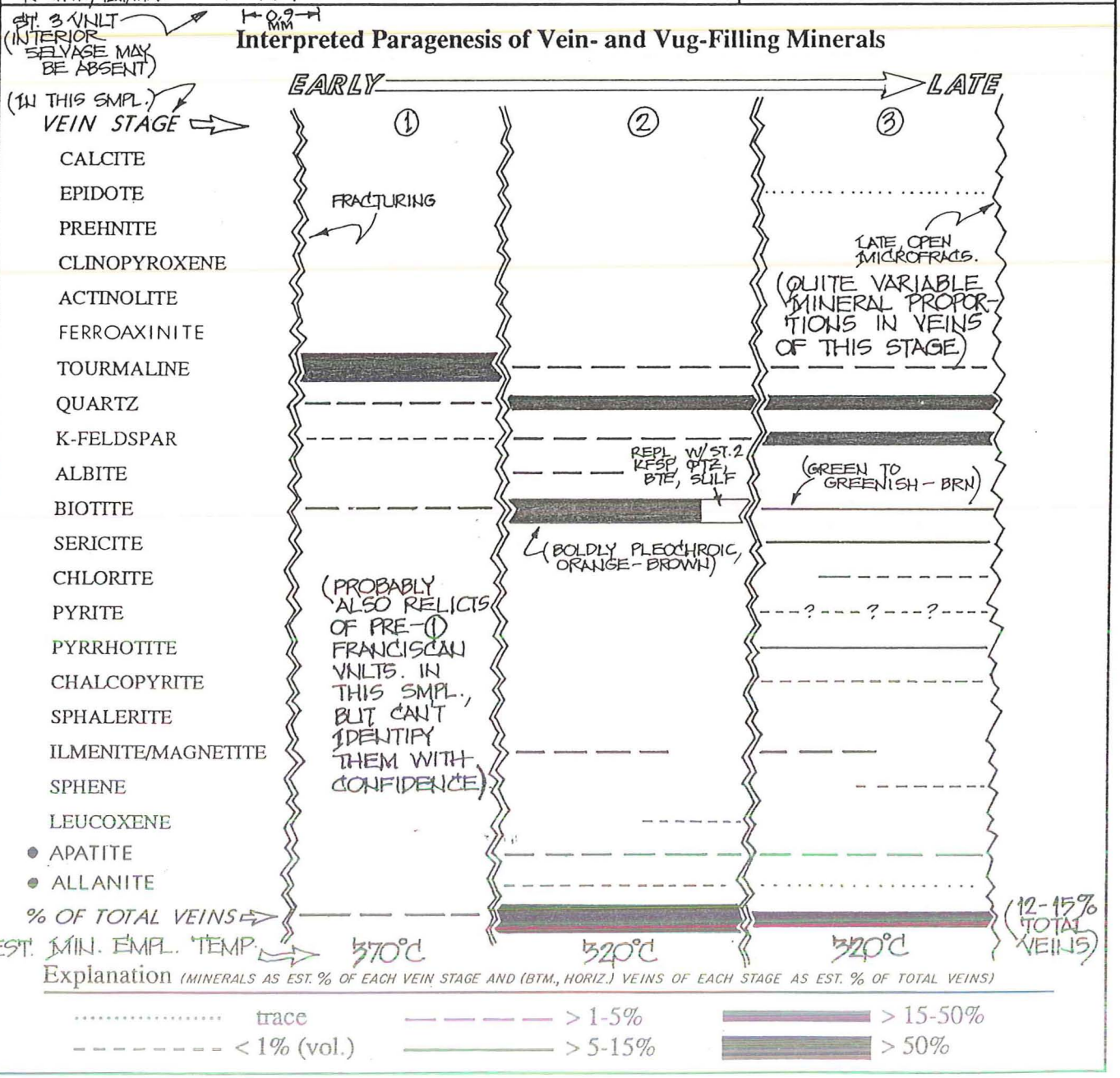
Rock Type HORNFELSIC, BIOTITE-RICH, V.F.-CRS. GRAINED LITHIC METAGRAYWACKE, ARGILLACEOUS, INTRICATELY STKWK-VEINED

Fracturing/Brecciation/Veining and Vug-Filling COMPLEXLY STKWK-VEINED; AT LEAST 3 GENERATIONS EXCLUDING POSSIBLE FRANCISCAN VEIN QTZ. RELICTS; VEINLETS ACCOUNT FOR 12-15% OF THE ROCK (W/ SELVAGES u 35%); STAGE 3 VNLTS. LARGELY SUB-PARALLEL, ACCOUNT FOR LOCAL GREENISH CAST.

Porosity Summary ROCK NOT INJECTED W/ COLORED EPOXY BUT PROB. < 1%.

Alteration/Metamorphism METAMORPHIC REXLZN. OF ORIGINAL IL/CH MATRIX TO BTE, PHENGITE; SILICIFICATION SELVAGES ADJ. TO ST. 2 VNLTS.; V. COMPLEX, LOCALLY BANDED SELVAGES ADJ. TO ST. 3 VNLTS.; THESE LATTER CONSIST OF QTZ, KFSP, BTE, TOUR, SER & PO/CPY IN VARIOUS COMBINATIONS

Fluid Inclusions ABUND. IN ST. 2 & 3 QTZ, DOM. VAPOR-RICH, BUT RARE LIQ-RICH W/ L:V u 2.5-3/1 & W/ COMMON CUBIC-ISOTROPIC & BIREFRINGENT DAUGHTER-MINRL. PAIRS; COMMON VAP-RICH INCL. IN ST. 1 TOURMALINE & ST. 3 APATITE (?)
• BOILING STRONGLY INDICATED



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL OF27A-2, 10,382'	JEFF HULEN JAN. 30, 1991

Rock Type HIGHLY SHEARED, TECTONICALLY INTERMIXED, HORNFELSIC ARGILLITE & V.F.-CRS. GRAINED LITHIC METAGRAYWACKE

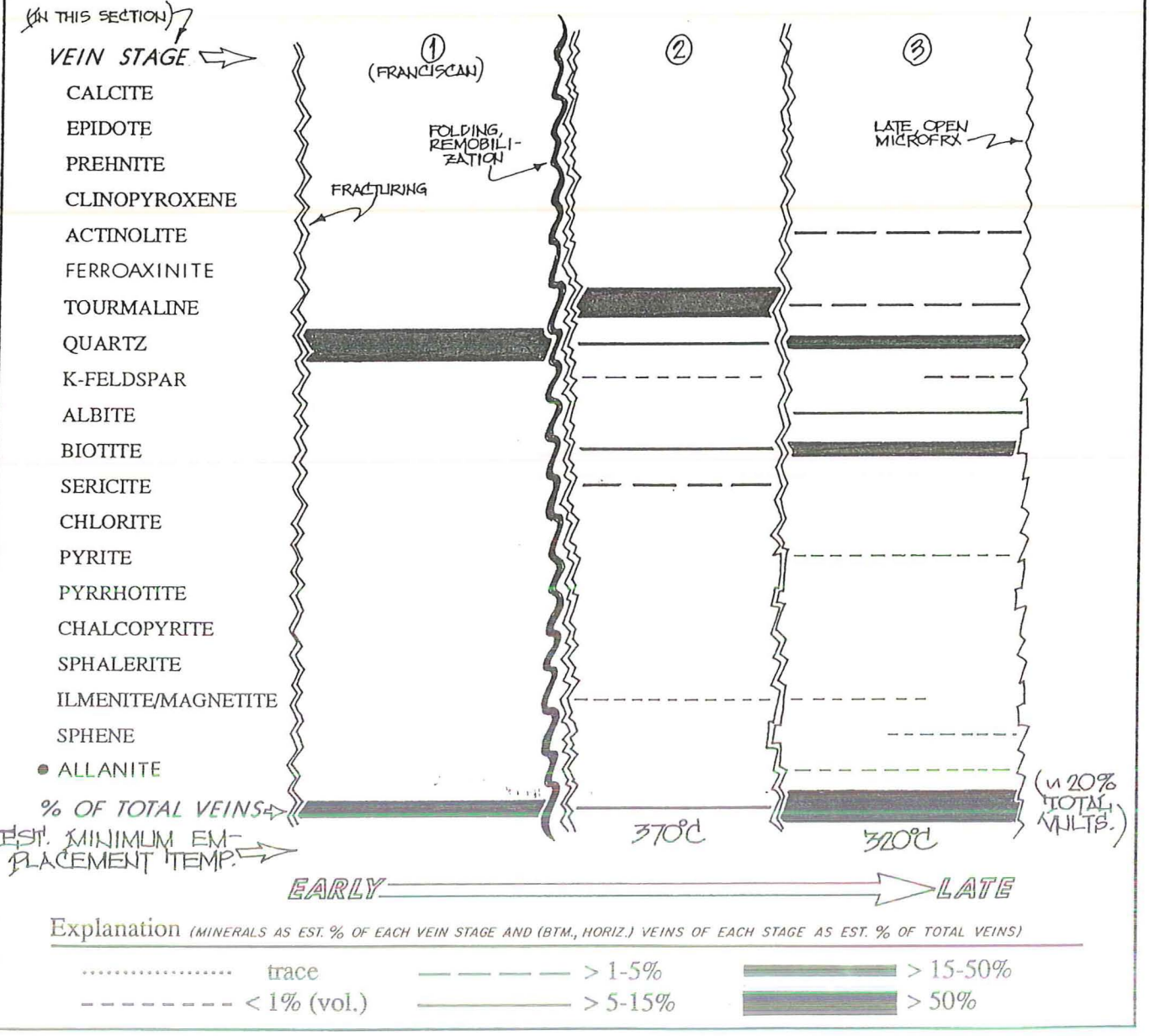
Fracturing/Brecciation/Veining and Vug-Filling AT LEAST 20% VNS; INCLUDING RELICT, CONTORTED QTZ. VNLTS. OF PROBABLE FRANCISCAN VINTAGE; EARLY TOURM-RICH VNLTS. ARE IRREG., DISCONTINUOUS, LOCALLY COALESCE TO FORM "MATS"

Porosity Summary <0.5%, MOSTLY LATE, OPEN, MICROFRACTURES

Alteration/Metamorphism
EXTENSIVE SILICIFICATION ADJACENT TO ST. 3 VNLTS; THESE SELVAGES LOCALLY COALESCE TO FORM IRREG. PATCHES UP TO 30X 20 MM. IN SIZE; WK. SERICITE SELVAGES ON SOME ST. 2 TOURMALINE VNLTS.; PRE-HYDROTHERMAL METAMORPHIC REXLZN. OF IL-CH MATRIX TO BIOTITE & PHENGITE.

Fluid Inclusions
ABUND. 2ND INCLUSIONS IN ST. 1 & 3 QTZ., ROUNDED-APPEARING, AVG. 20 DIA., >99% VAPOR-RICH; A FEW LARGER (UP TO 150) LIQ.-RICH INCLUSIONS W L:V ≈ 3/1 & W/ A CUBIC, ISOTROPIC DAUGHTER.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL OF-27A-2, 10,383.1'	JEFF HULEN, NOV. 24, 1990

Rock Type HORNFELSIC ARGILLITE, LOCALLY SILTY, CHAOTICALLY JUMBLED/SHEARED, RECRYSTALLIZED; INTENSELY STOCKWORK VEINED, AND MINERALIZED; RESEMBLES "PORPHYRY COPPER" ROCK

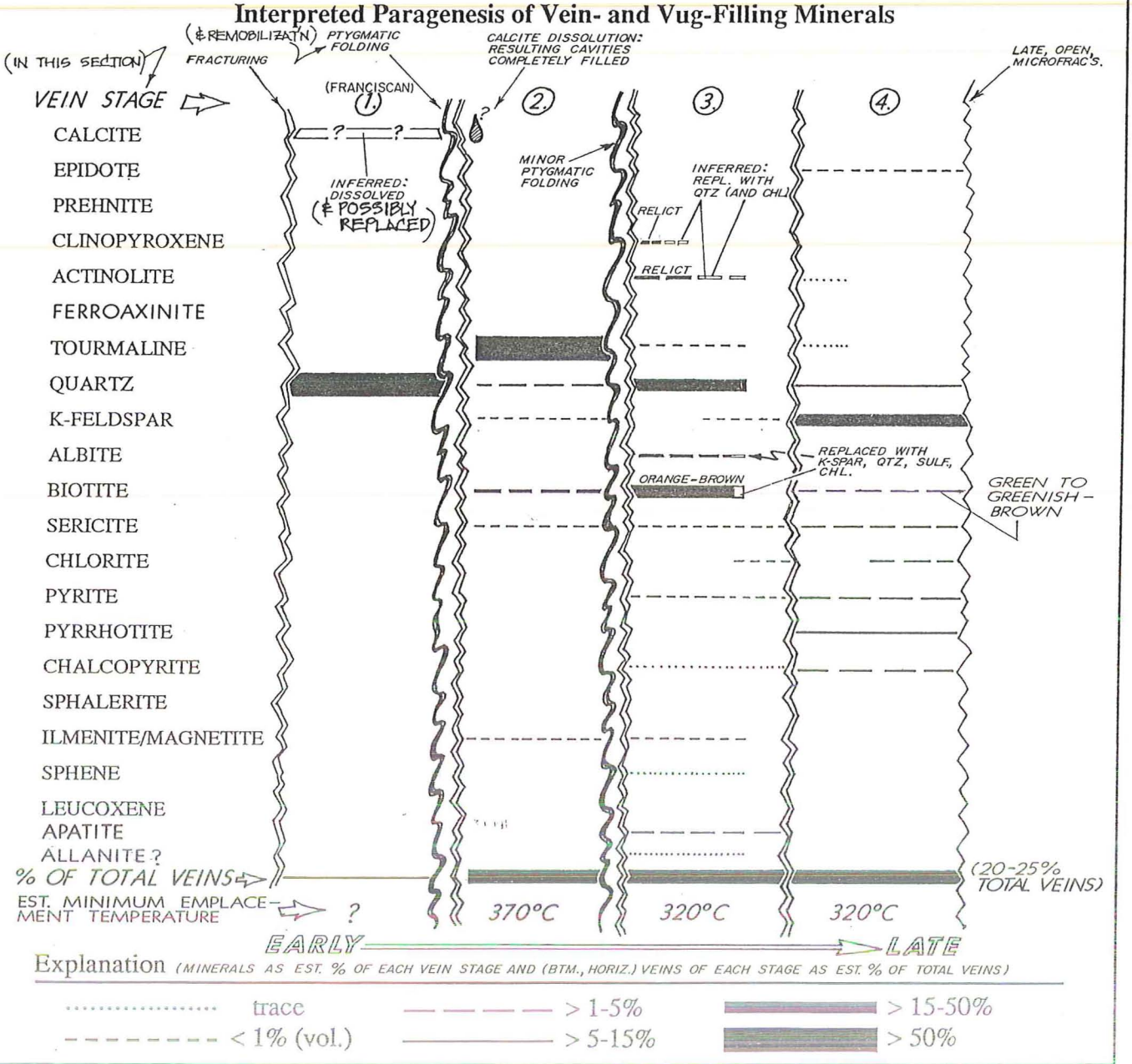
Fracturing/Brecciation/Veining and Vug-Filling INTENSELY VEINED (STOCKWORK); 4 STAGES VEINING, ACCOUNTING FOR 20-25% OF ROCK; YOUNGER VEINS COMMONLY INCORPORATE/FOLLOW EARLIER ONES.

Porosity Summary ≈1%, MOSTLY LATE OPEN MICROFRACTURES; SOME MICRO-Φ IN VEIN QTZ & LAYER SILICATE AGGR.

Alteration/Metamorphism MOST NOTICEABLE IS WIDESPREAD "FLOODING" (REPLACEMENT) ADJ. TO & BETWEEN STAGE ④ VEINLETS; THIS IS MICROCRYSTALLINE QUARTZ, K-FELDSPAR, CHL., SULFIDES, MINOR GREEN BIOTITE; THIS FLOODING AFFECTS 15% OF THE ROCK, INCLUDING EARLIER HYDROTHERMAL BIOTITE; APPEARANCE OF THIS "FLOODING" IN HAND SPECIMEN IS BLEACHED, LT. GREENISH.

Fluid Inclusions (RECONN.) ABUND. IN STAGE ③ & ④ QTZ.; DOM. VAP-RICH; LIQ-RICH INCLUSIONS HAVE LIQ./VAP ≈ 2.5/1 THESE < 2μ DIA.; MANY INCLUSIONS ROUNDED-APPEARING; INCL. IN K-SPAR MOSTLY < 1μ DIA.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL L'ESP-2, SMPL. A	JEFF HULEN JAN. 11, 1991

Rock Type STOCKWORK VEINED, HORNFELSIC, ARGILLACEOUS LITHIC METAGRAYWACKE MED., SL. ORANGE-BROWN BUT BLEACHED LT. GRAY ADJ. TO STAGE 2 VNLTS.

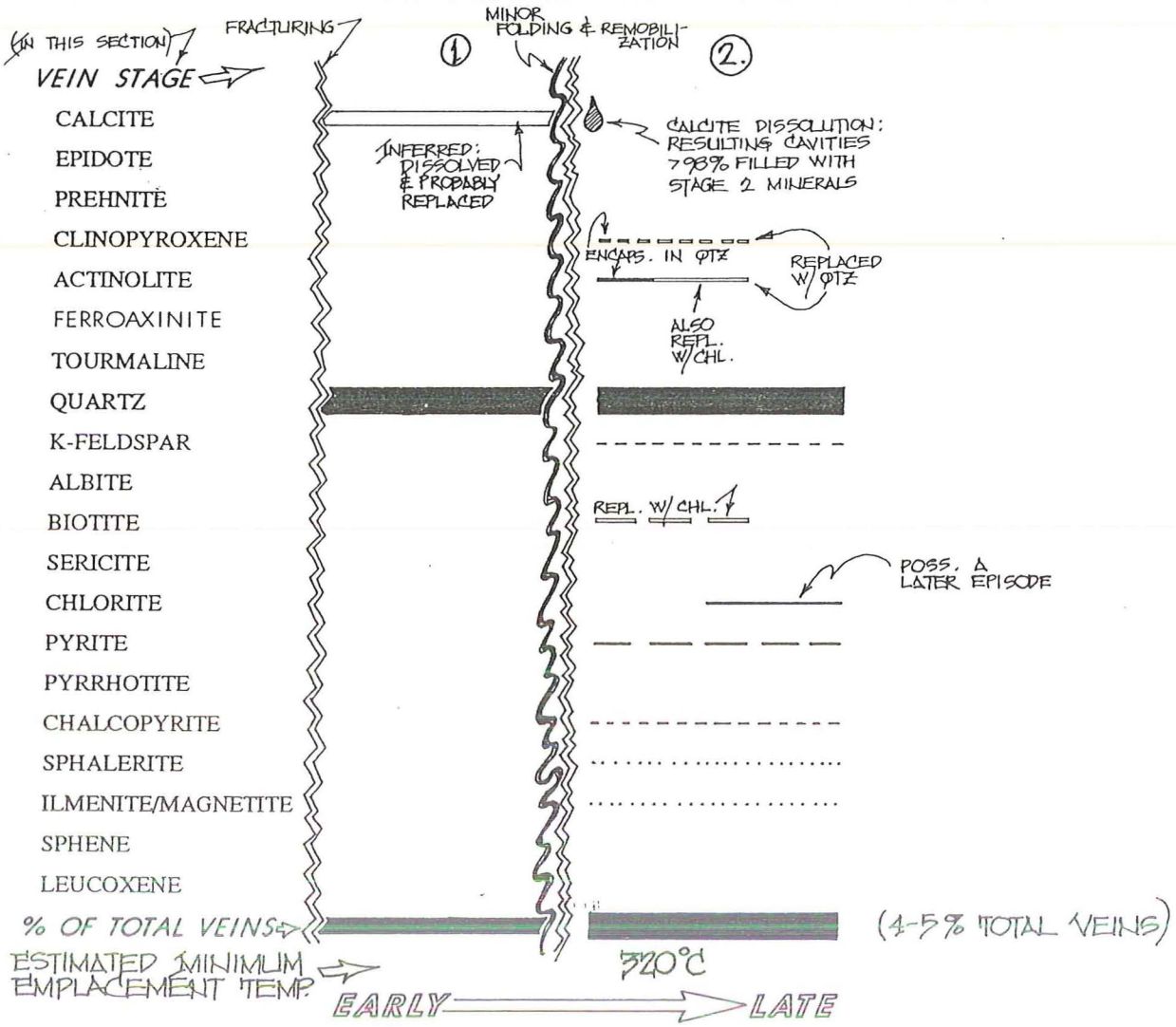
Fracturing/Brecciation/Veining and Vug-Filling 4-5% STKWK. & OLDER FRANCISCAN (& COMPOSITE) VEINLETS; APP. DISSOLUTION OF FRANC. CALCITE, INFILLING OF RESULTING VUGS W/ STAGE 2 MINERALS

Porosity Summary < 0.7%, MOSTLY ± INTERXLN. VUGS IN STAGE 2 VNLTS; NO LATE, OPEN μFRX.

Alteration/Metamorphism METAMORPHIC REXLZN OF ILLITE/CHL. MATRIX TO BTE. & BROWNISH PHENGITE; ~1.5% DISS., μXLN. ILM/MAG & 0.5% DISS. LEUCOX. ~1.0% DISS. PYRITE W/ TR. CPY; MASSIVE SILICIFIC. & CHLTZN. OF MATRIX IN BROAD, BLEACHED-APPEARING SELVAGES ADJACENT TO STAGE 2 VEINLETS; IN VEINLETS CHL & QTZ REPLACE ACT; CHL/BTE; QTZ/CPXN, WHICH OCCURS AS ROUNDED GRAINS/

Fluid Inclusions ABUNDANT LIQ & VAP-RICH INCL. IN STAGE 2 QTZ.; AVG. < 2μ DIA., COMMONLY WELL-ROUNDED; LIQ-RICH INCL. L/V ≈ 3/1 (THOSE THAT HAVEN'T LEAKED)

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

..... trace	— — — — > 1-5%		> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%		> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL L'ESP-2, SMPL. C (@11,052')	JEFF HULEN, SEPT. 28 & OCT. 24, '90

Rock Type MASSIVE, HORNFELSIC, LITHIC METAGRAYWACKE BIOTITE-RICH

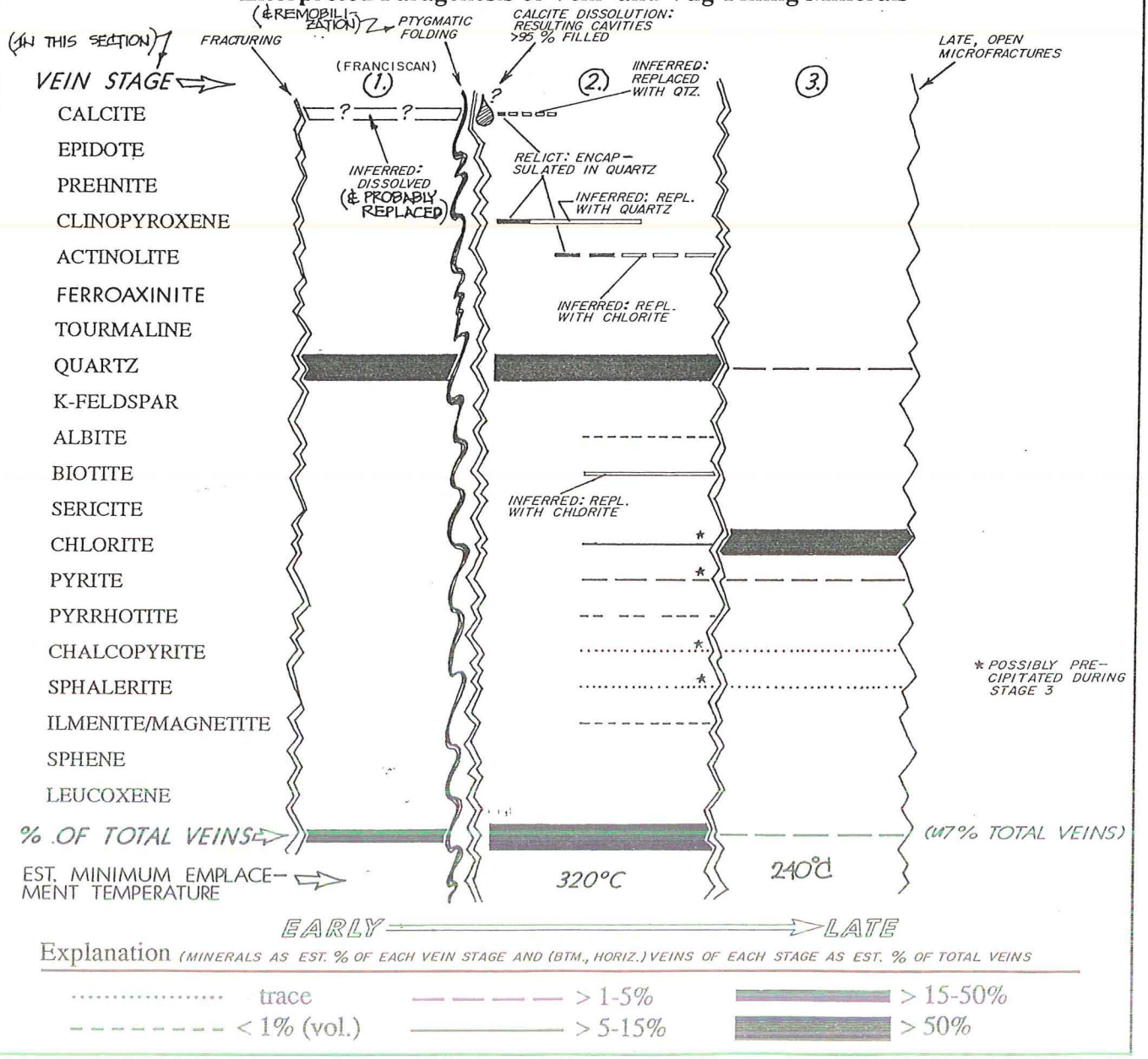
Fracturing/Brecciation/Veining and Vug-Filling MOD. VEINED (@7%) 3 VEIN STAGES — EARLIEST IS FRANCISCAN; STAGE 2 VEINS DOM. QTZ. & CHL., BUT APPEARS THAT CALCITE, CPX'N & ACT. ONCE MORE ABUNDANT (NOW REPL. W/ QTZ.)

Porosity Summary @1%, MOSTLY AS INTERCRYSTALLINE VOIDS IN STAGE ② VEINLETS

Alteration/Metamorphism ORIGINAL ILLITE-CHLORITE-RICH MATRIX METAMORPHOSED TO ORANGE-BROWN BIOTITE (W/ LOCAL TRACE GARNET); SUBSEQUENT CHLORITIZATION OF BTE. (STAGE ③?); SILICIFICATION & DEVELOPMENT OF 2ND PLAGIOCLASE (OLIG./ANDESINE?) ADJACENT TO STAGE ② VEINLETS.

Fluid Inclusions (RECONN.) ABUNDANT PRIMARY & 2ND INCLUSIONS IN STAGE ② VEINLETS; BOTH LIQ. & VAP.-RICH (BOILING INDICATED); LIQ-RICH AVG. @20 DIA., W/ LIQ.:VAP. RATIO @2.5/1; SOME CONTAIN HALITE OR SYLVITE DAUGHTERS.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS

..... trace	— — — — > 1-5%		> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%		> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL L'ESP-2, SMPL. E	JEFF HULEN JAN. 11, 1991

Rock Type PROMINENTLY VEINED & ALTERED, HORNFELSIC, ARGILLACEOUS, VERY FINE- TO COARSE-GRAINED LITHIC METAGRAYWACKE

Fracturing/Brecciation/Veining and Vug-Filling ~7% TOTAL VNS., MANY COMPOSITE VEINLETS DEVELOPED BY FRAC. & DISSOLUTION OF CALCITE FROM STAGE 1 VEINLETS, THEN INFILLING OF RESULTING VUGS W/ STAGE 2 MINRLS

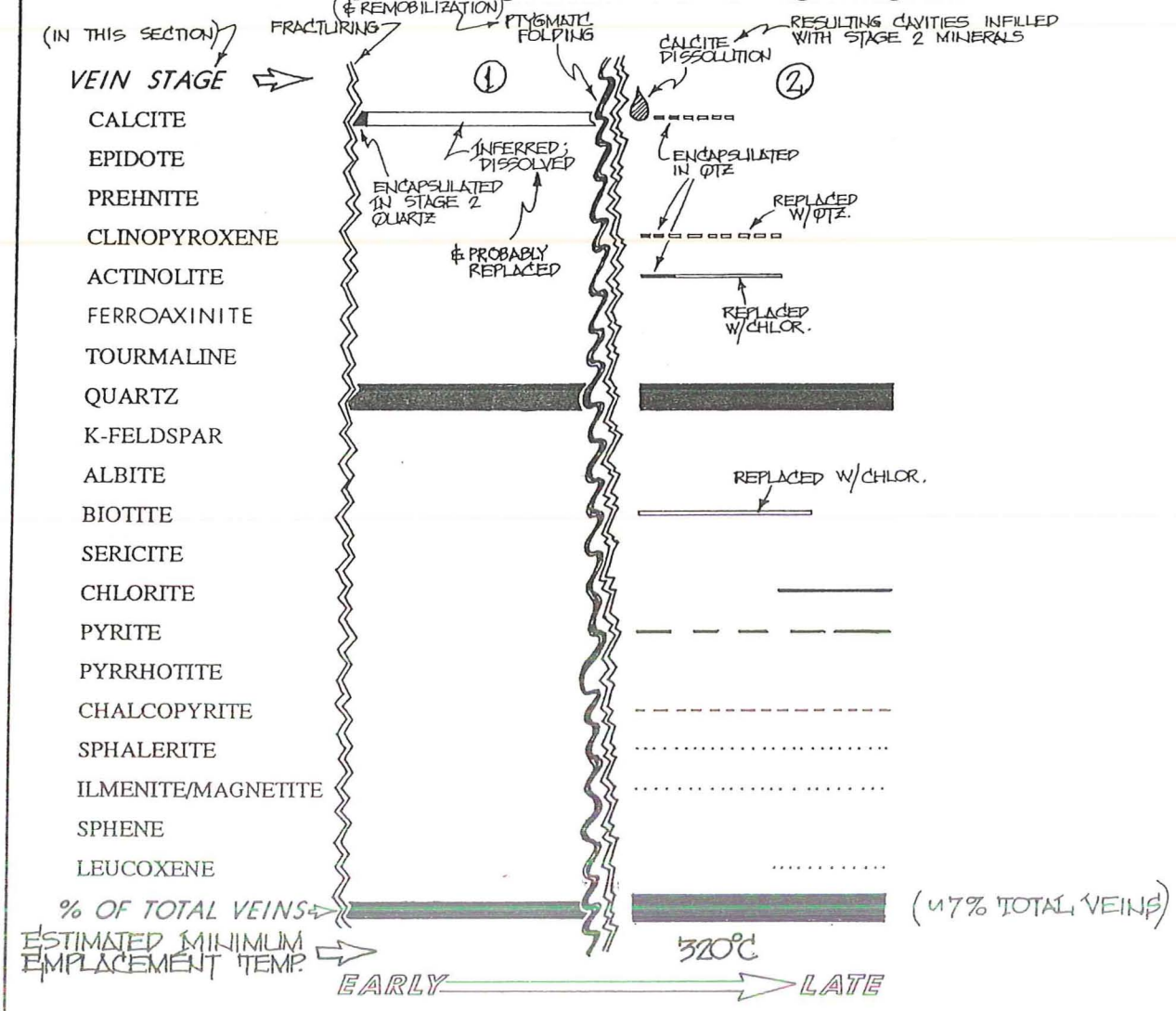
Porosity Summary ~0.5% MOSTLY SPARSE, 2° INTERXLN. VUGS IN ST. 2 VEINLETS & MASSES.

Alteration/Metamorphism
IN STAGE 2 VEINLETS: EARLY-FORMED CLINOPYROXENE MOSTLY REPLACED W/ COARSELY-XLN. QTZ, LEAVING CPXN AS DISS., ROUNDED GRAINS DEFINING "SKELETAL" XLS.

IN MATRIX: MET. REXLZN. OF IL/CH TO BTE. & PHENGITE; 1% DISS. ILM/MAG. & LEUCOXN.; SILICIF. & CHLTZN. IN SELVAGES OF STAGE 2 VNLTS.

Fluid Inclusions MYRIAD <1μ-DIA. VAPOR-RICH INCLUSIONS IN STAGE 1 QTZ. (NOT USABLE); ABUND LIQ & (ESP.) VAPOR-RICH INCLUSION, <2μ DIA., IN STAGE 2 QTZ. — THESE COMMONLY WELL-ROUNDED — LIQ-RICH INCLUSIONS HAVE L/V RATIOS OF ~3/1; NO UNAMBIGUOUS PRIMARY INCLUSIONS OBSERVED

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

..... trace	— — — — > 1-5%	▬▬ > 15-50%	
- - - - - - - - < 1% (vol.)	——— > 5-15%	▬▬ > 50%	

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL L'ESP-2, SMPL. F	JEFF HULEN JAN. 15, 1991

Rock Type VERY FINE- TO COARSE-GRAINED BIOTITE-RICH, ARGILLACEOUS, HORNFELSIC METAGRAYWACKE

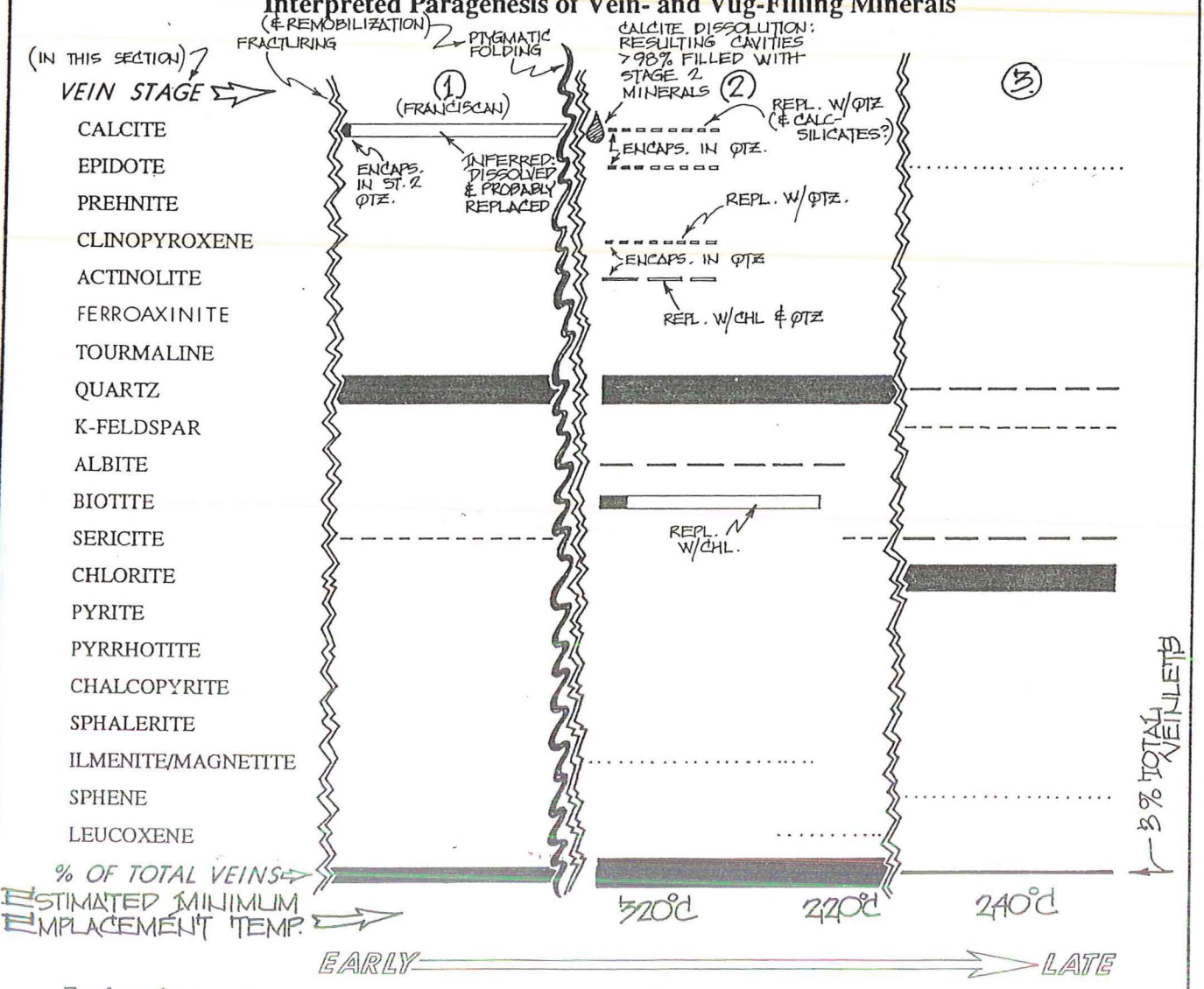
Fracturing/Brecciation/Veining and Vug-Filling SPARSELY VEINED; BUT ALTERATION SELVAGES ADJACENT TO THE VEINLETS ACCOUNT FOR 25% OF THE ROCK; MANY VEINLETS ARE COMPOSITE, FORMED BY DISSOLUTION OF STAGE 1 CALCITE, INFILLING OF RESULTING CAVITIES W/ STAGE 2 MINERALS

Porosity Summary <0.5%; MOSTLY ± INTERCRYSTALLINE VUGS IN STAGE 2 VEINLETS & MASSES.

Alteration/Metamorphism METAMORPHIC REXLZN. OF ORIGINAL IL/CH MATRIX TO ORANGE-BROWN BTE. & PALE BROWN PHENGITE; PROMINENT SILICIFICATION OF MATRIX IN SELVAGES ADJACENT TO STAGE 2 VEINLETS; EQUALLY PROMINENT SELVAGES FLANKING ST. 3 VEINLETS ARE DOM. PXLN. CHLOR. IN STAGE 2 VNLTS. & MASSES, ACTINOLITE & CPXN. ARE EXTENSIVELY REPLACED W/ QTZ (COMMON "SKELETAL" CPXN & ACTINOLITE)

Fluid Inclusions ABUNDANT IN STAGE 2 QTZ; NO UNAMBIGUOUS PRIMARIES; AVG. 2-30 DIA., UP TO 60 IN DIA., COMMONLY ROUNDED-APPEARING; DOM. VAPOR-RICH; LIQ-RICH INCL'S. HAVE LIQ/VAP RATIOS OF 2-35/1

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

trace — > 1-5% — > 15-50%

< 1% (vol.) — > 5-15% — > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL L'ESP-2, SMPL. G	JEFF HULEN 01/11/91

Rock Type SILTY TO SANDY, BIOTITE-RICH HORNFELSIC ARGILLITE, POSS. W/MINOR HYDROTH. BX AT ONE END OF SAMPLE.

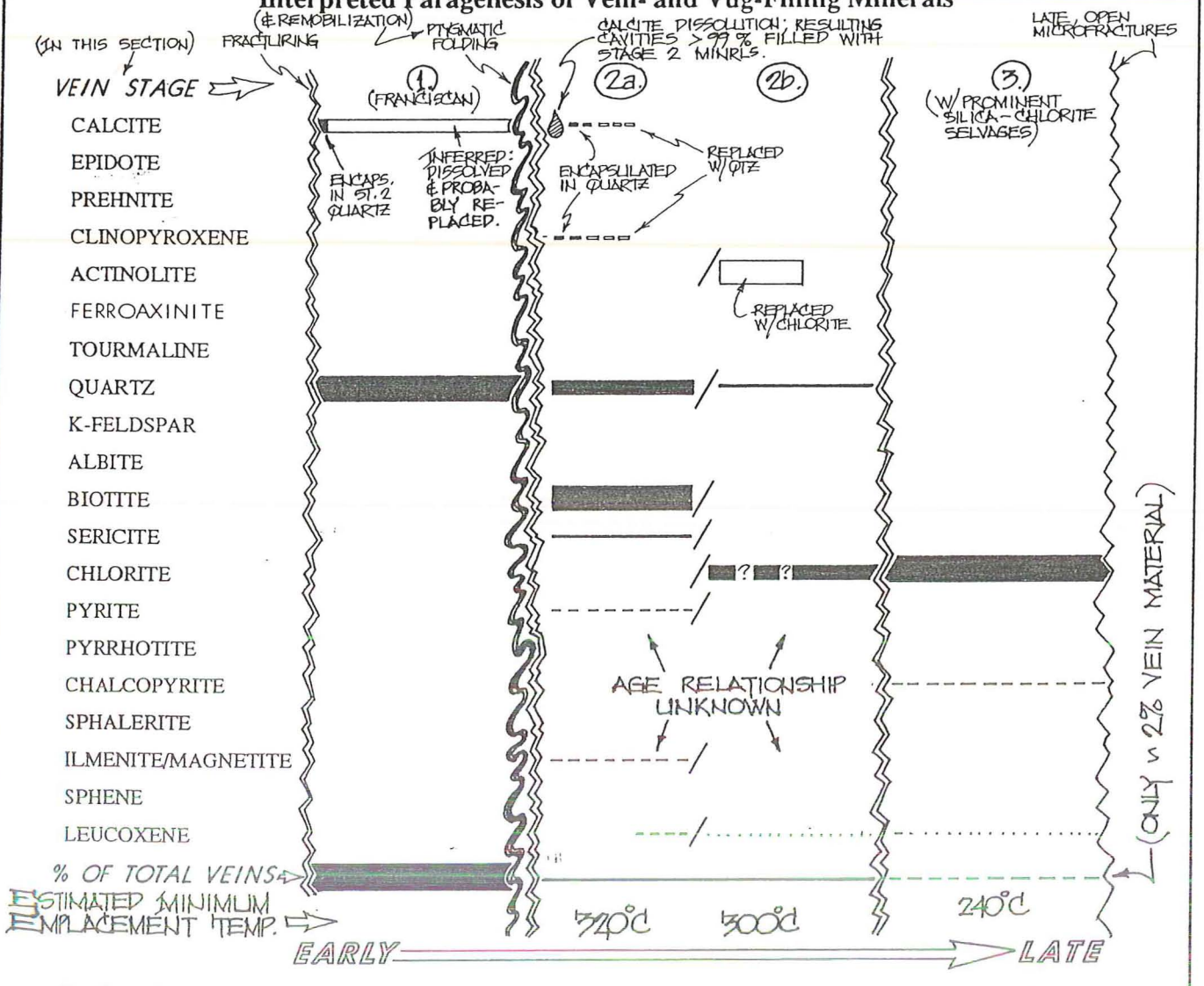
Fracturing/Brecciation/Veining and Vug-Filling SPARSELY VEINED (≈2%); EARLIEST PROB. FRANCISCAN QTZ-CAL.; CAL. DISSOLVED, INFILLED WITH LATER HYDROTH. MINRLS.; NOTE WELL-XLZD. STAGE 2 BIOTITE; STAGE 1 VEINLETS COMMONLY FOLDED PTYGMATICALLY

Porosity Summary <0.5% MOSTLY INTERGRANULAR µØ IN VEIN QTZ.; ALSO LATE, OPEN µFRACTURES.

Alteration/Metamorphism INTENSE RXLZN. OF ORIGINAL ILLITE/CHL TO BIOTITE & BROWN PHENGITE; INTENSE CHLTZN. & BLEACHING OF BIOTITE ADJACENT TO STAGE 3 CHLORITE VEINLETS; TR. DISS. GARNET; ≈1% DISS. PY, MOST COMMONLY AS LOOSE, ANH. XL. CLUSTERS INTERGROWN WITH & POSS. REPLACING METAMORPHIC PLAGIOCLASE.

Fluid Inclusions ABUND. VAPOR-RICH IN STAGE 2 QUARTZ; COMMONLY ROUNDED, <2µ DIAMETER; RARE LIQ-RICH W/L:V ≈ 3/1

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

..... trace — — — — > 1-5% > 15-50%

- - - - - - - - < 1% (vol.) ——— > 5-15% > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL DX-84, A_h	JEFF HULEN JAN. 17, 1991

Rock Type HYDROTHERMALLY ALTERED, SPARSELY VEINED, FINE- TO COARSE-GRAINED LITHIC METAGRAYWACKE

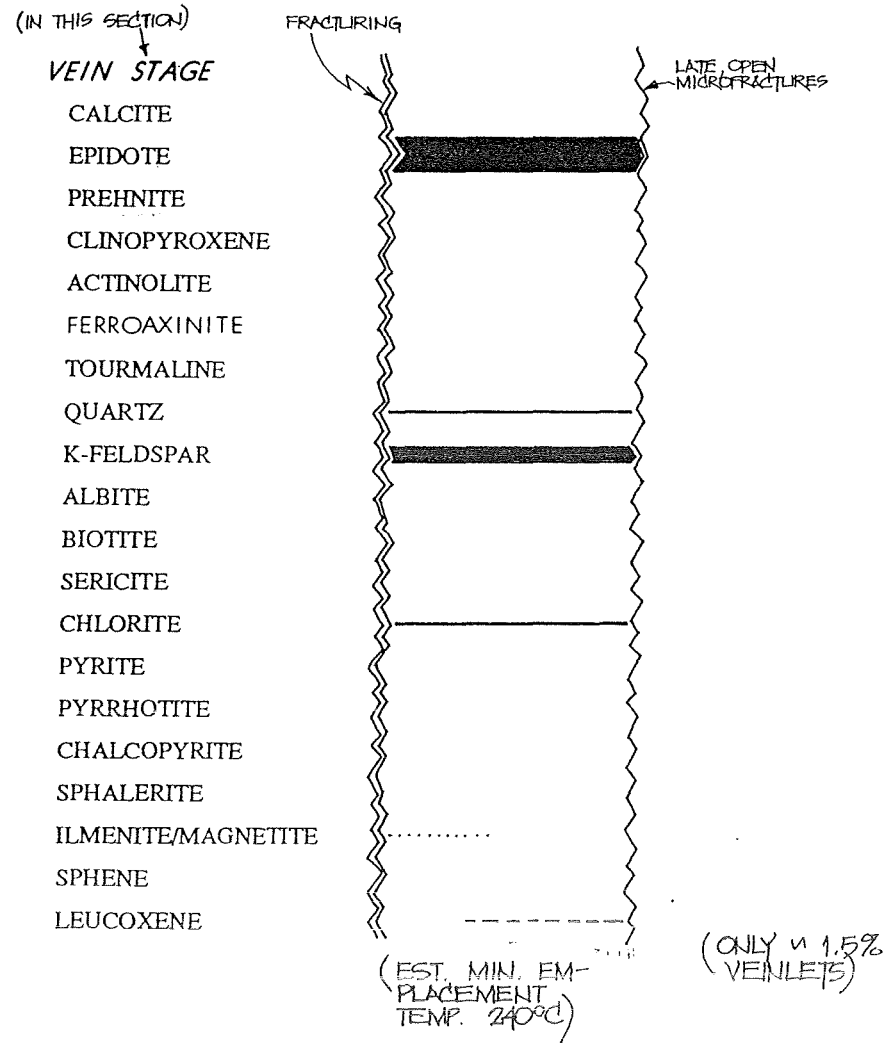
Fracturing/Brecciation/Veining and Vug-Filling ~ 1.5% VEINS, NONE OF WHICH APPEARS TO BE FRANCISCAN-AGE OR TEXTURE; SELVAGES ON VEINS QUITE POROUS, QUITE EXTENSIVE

Porosity Summary 2%, MOSTLY DISSOLUTION MICRO-POROSITY IN SELVAGES, PATCHES ASSOC. W/ VEINLETS; ALSO μΦ IN LAYER SIL., CHERT, VRF'S; & VOIDS IN VEINLETS.

Alteration/Metamorphism "PATCHY, μXLN. "FLOODING" OF MATRIX, SOME FRAMEWORK GRAINS WITH QTZ-KFSP-EP-CHL → THIS COMMONLY ACCOMPANIED BY DEVELOPMENT OF SPONGY-TEXTURED DISSOLUTION μΦ; OVERALL 5-6% DISS. EPIDOTE, 1.5% DISS. LEUCOXENE PLUS ILMENITE/MAGNETITE; <0.5% DISS. FERROAXINITE REPLACING PLAG. IN FRAMEWORK GRAINS (WITH EP)

Fluid Inclusions USABLE INCLUSIONS ONLY IN QTZ (VNLT); BOTH LIQ. & VAP.-RICH; IRREG. TO ROUNDED; L-RICH VARIETIES HAVE L/V ≈ 3/1; DIA. < 7μ (AVG. 1.5μ) (BOILING INDICATED)

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

..... trace	— — — — > 1-5%	▬▬▬ > 15-50%	
- - - - - - - - < 1% (vol.)	———— > 5-15%	▬▬▬ > 50%	

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL DX-84, SMPL. Bh	JEFF HULEN JAN. 17, 1991

Rock Type FINE- TO COARSE-GRAINED, UNSORTED, LITHIC METAGRAYWACKE, HYDROTHERMALLY VEINED & ALTERED

Fracturing/Brecciation/Veining and Vug-Filling 4-5% VNLTS.; EARLY FRANCISCAN VEINLETS CONTORTED, GALIZY-APPEARING → CALCITE INITIALLY PRESENT IN THESE DISSOLVED, RESULTING VUGS IN-FILLED W/ YOUNGER HYDROTHERMAL PHASES; STAGE 2 & 3 VEINLETS FORM A STOCKWORK

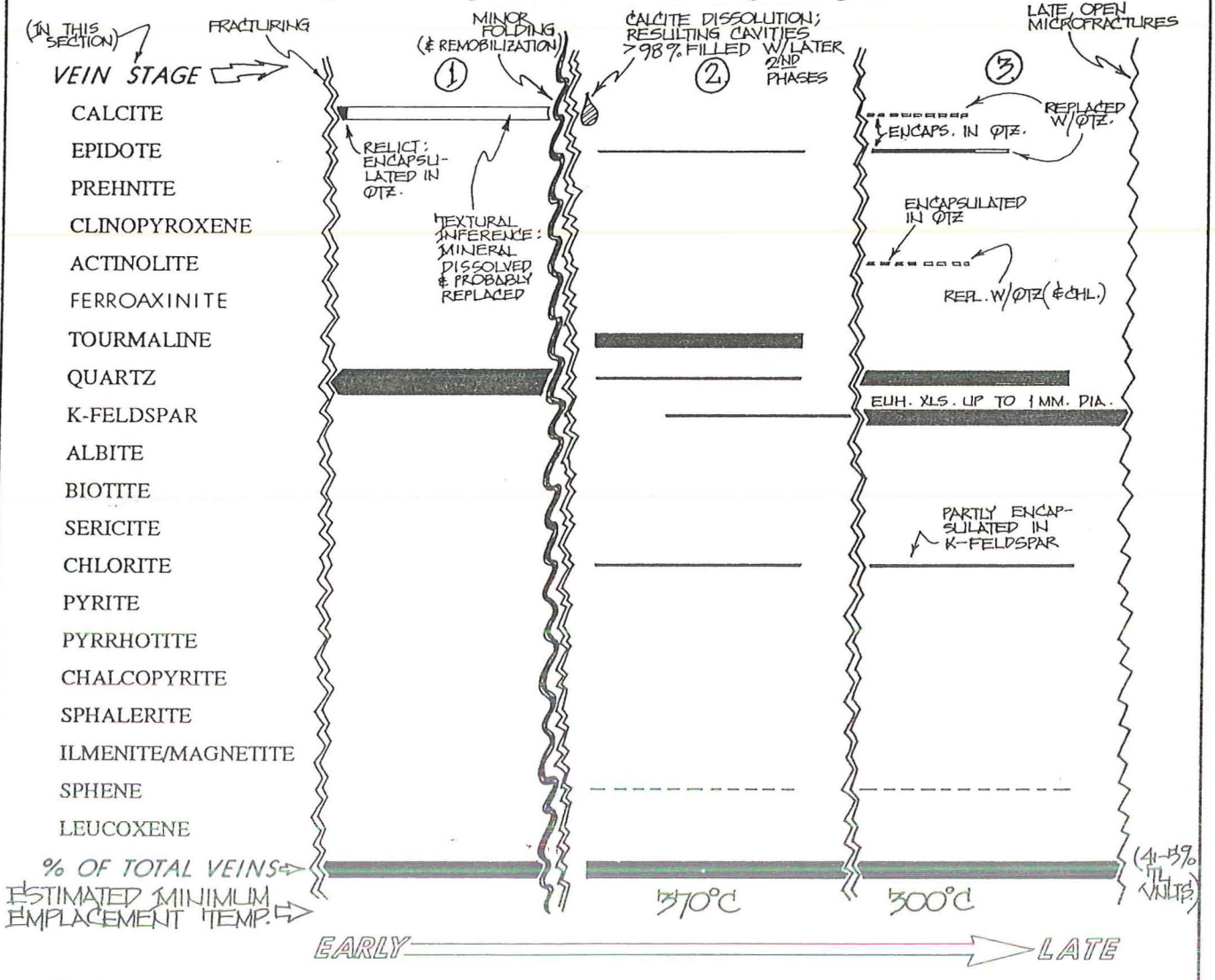
Porosity Summary EST. 25% Δ INTERXLN. VOIDS IN ST. 2 & (ESP.) ST. 3 VEINLETS & MASSES; μΦ IN LAYER SILICATE AGGREGATES; DISSOLUTION μΦ IN SOME PLAG. & VOLC. GRAINS

Alteration/Metamorphism QTZ.-KFSP ± EP, CHL "FLOODING" ADJACENT TO & BETWEEN STAGE 2 & 3 VEINLETS & MASSES; IN STAGE 3 VNLTS., SOME EARLY CALCITE & EPIDOTE REPLACED BY & ENCAPSULATED IN QTZ.; (TR) DETRITAL ALLANITE PARTIALLY REPLACED BY STAGE 2 OR 3 EPIDOTE

Fluid Inclusions IN ST. 3 QTZ.- ABUND V & L-RICH INCL., <1-6μ DIA., IRREG.-ROUNDED; L-RICH (NON-LEAKED) AVG. L/V ≈ 3/1; IN ST. 3 KFSP, ABUN., IRREG TO SQUARISH TO PRISMATIC, COMM. ELONGATE VAP-RICH INCLUSIONS <5μ (AVG. <1μ) DIA.

NO UNAMBIGUOUS PRIMARIES (INCLUSIONS INDICATE BOILING)

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

.....	trace	— — — —	> 1-5%
- - - - - - - -	< 1% (vol.)	———	> 5-15%
			> 15-50%
			> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL DX-84, SMPL. Ch	JEFF HULEN JAN. 16, 1991

Rock Type INTENSELY HYDROTHERMALLY ALTERED & VEINED, FINE- TO COARSE-GRAINED, HIGHLY UNSORTED, LITHIC METAGRAYWACKE

Fracturing/Brecciation/Veining and Vug-Filling STOCKWORK-VEINED (∿ 10%); OLDER, CONTORTED, FRANCISCAN QTZ-(CAL?) VNLTS, FROM WHICH CALCITE DISSOLVED, RESULTING CAVITIES INFILLED W/ OTHER PHASES

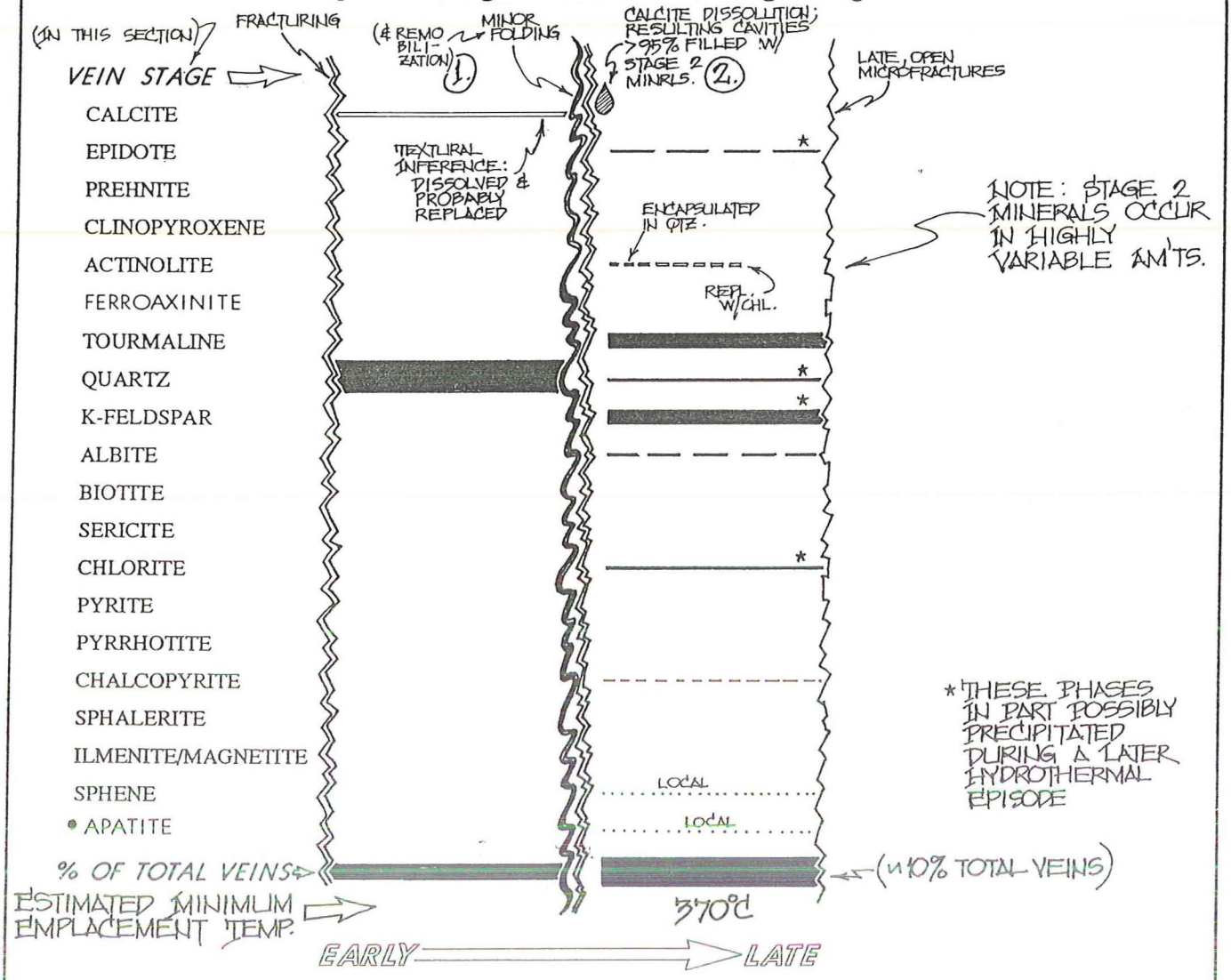
Porosity Summary ∿ 2%, LATE, OPEN ∥ FRX, & INTER-CRYSTALLINE VUGS IN ST. 2 VEINLETS & MASSES; DISSOLUTION ∥∅ IN K-SPAR "FLOODED" ZONES.

Alteration/Metamorphism #
MASSIVE REPLACEMENT OF MATRIX, FELDSPAR FRAMEWORK GRAINS, & VOLCANIC ROCK FRAGMENTS W/ MICROXLN. K-FELDSPAR ± QTZ, EPIDOTE; DETRITAL BTE. ALT. TO CHL. ± LEUCOXN.; MINOR DISSEM. TOURMALINE

THESE ARE THE "BLEACHED" AREAS APPARENT IN HAND SAMPLE

Fluid Inclusions (RECONN.)
ABUNDANT IN STAGE 2 QTZ, MOSTLY VAPOR-RICH; IRREG. TO ROUNDED, AVG 1.5∪ DIA., RARE LIQ-RICH INCLUSIONS W/ L:V IN NON-LEAKED INCLUSIONS ∿ 3/1.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL DX-84, SMPL. D_h	JEFF HULEN NOV. 26, 1990

Rock Type SILTY, ARGILLACEOUS VERY FINE TO MED. GRAINED LITHIC METAGRAYWACKE

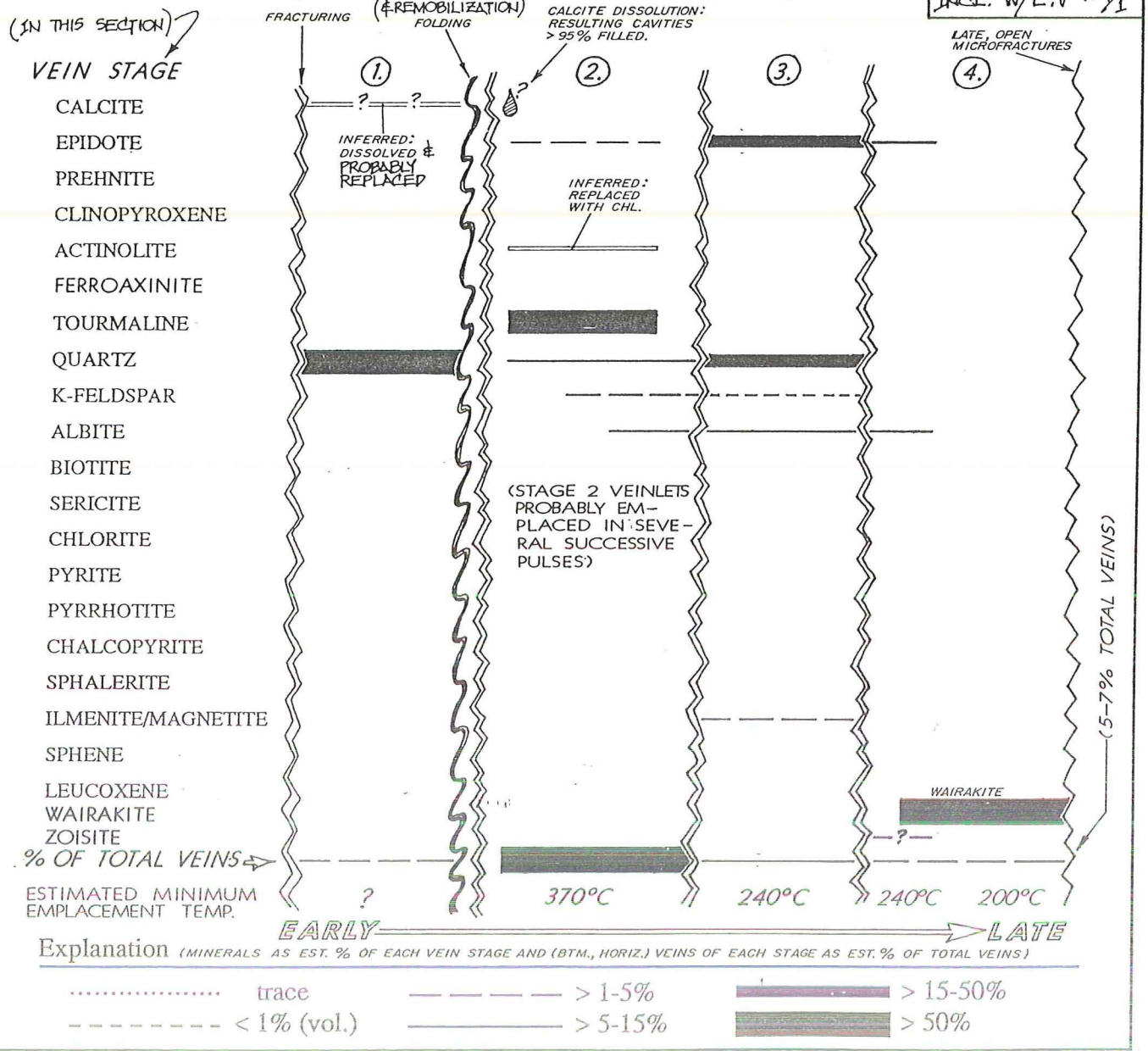
Fracturing/Brecciation/Veining and Vug-Filling 5-7% VEINS ROCK IS DISRUPTED BY A STOCKWORK OF VEINLETS EMPLACED IN FOUR MAJOR STAGES; STOCKWORK IS ROUGHLY ORTHOGONAL; LATE, OPEN MICROFRACTURES BOTH FOLLOW AND CROSSCUT VEINS.

Porosity Summary ≈ 1.5%, AS SCATTERED, PRIMARY INTERCRYST. VOIDS IN ST. ③ & ② VNLTS., ∪Φ IN VEIN ALBITE, CHL.; LATE, OPEN ∪ FRX.

Alteration/Metamorphism ORIGINAL GREENSCHIST-GRADE REGIONAL METAMORPHISM; SOME SILICIFICATION ADJACENT TO STAGE ② & ③ VEINLETS; WIDESPREAD DISS. TOURMALINE; CHLTZN. OF DETRITAL BIOTITE; 2% DISSEMINATED LEUCOXENE; OUTER CHLORITIC SELVAGE ADJ. TO STAGE ③ VEINLET IS HIGHLY POROUS.

Fluid Inclusions ABUND. IN STAGE ② QUARTZ & ALBITE, MOSTLY VAP.-RICH, ≪1-25∪ IN DIA. (LARGEST ONLY IN ALBITE); FEW L∪-RICH INCL'S. W/ L:V ≈ 3/1
IN STAGE ④ WAIRAKITE, INCLUSIONS ARE MOSTLY ≪1∪ IN DIA. & ARE VAPOR-RICH
STAGE ③ QTZ. SOME L-RICH INCL. W/ L:V ≈ 4/1

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL DX-84, SMPL. E_h	JEFF HULEN, JAN. 17, 1991

Rock Type HYDROTHERMALLY ALTERED & VEINED, UNSORTED, FINE- TO COARSE-GRAINED LITHIC METAGRAYWACKE

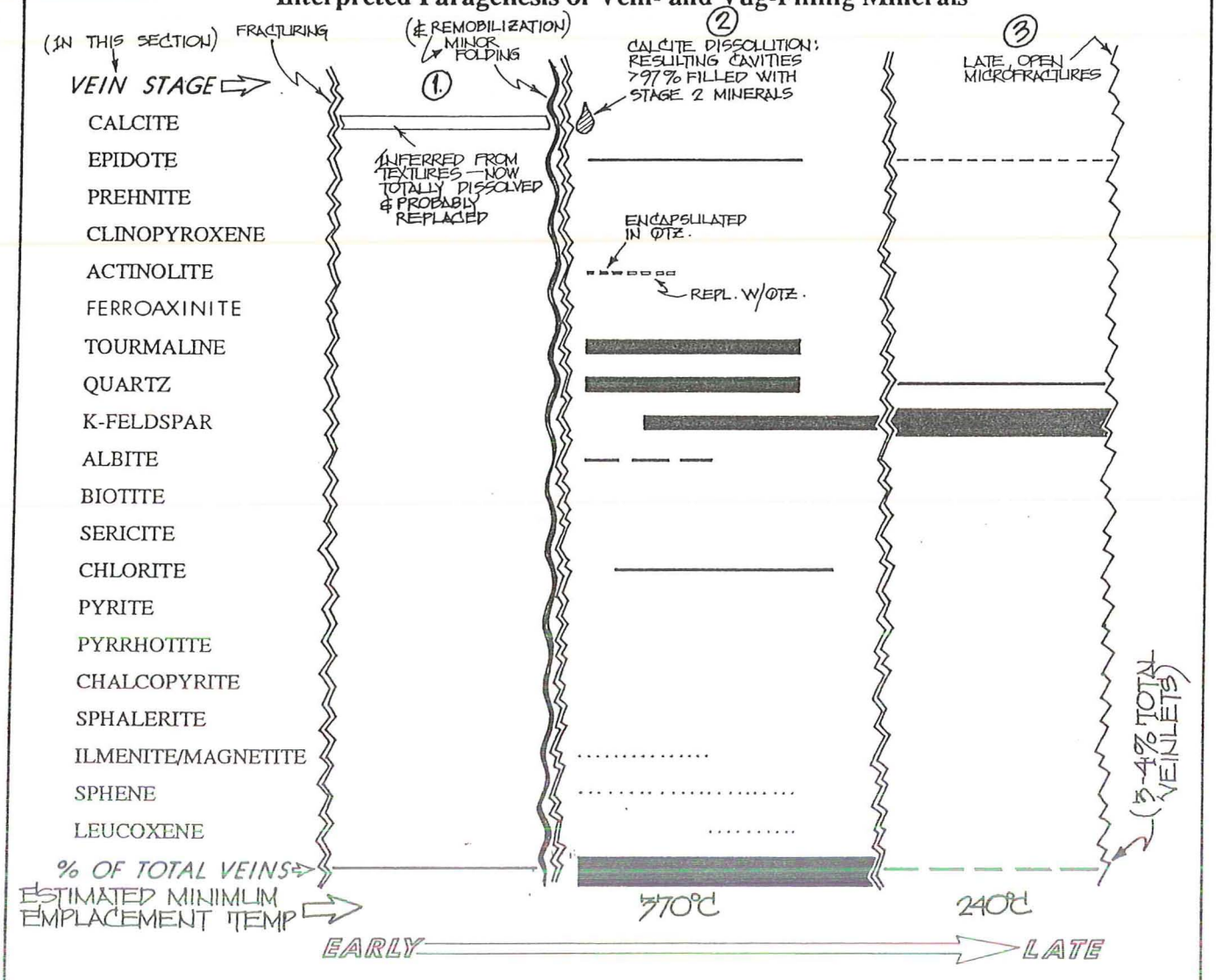
Fracturing/Brecciation/Veining and Vug-Filling 3-4% VEINLETS; SUB-//, ANASTAMOSING; A FEW COMPOSITE VNLTS. FORMED WHEN CALCITE IN STAGE 1 VNLTS. DISSOLVED, THEN INFILLED W/ STAGE 2 MINERALS; STAGE 2 VNLT SET PROB. FILLS FRACTURES OF TECTONIC ORIGIN

Porosity Summary EST. 1.5% MOSTLY LATE, OPEN μFRX, DISSOLUTION μΦ IN ALTN. SELVAGES; μΦ IN CHERT, VRF's, & LAYER SIL. AGGR.

Alteration/Metamorphism STRONG QTZ-KFSP ± EP, CHL "FLOODING" ADJACENT TO & BETWEEN STAGE 2 VNLTS.; AT ONE END OF SECTION, "FLOODING" DOMINATED BY CHL, ALSO W/ MINOR, EUHEDRAL, BROWN TO INDIGO TOURMALINE; WEAK SERICITIZATION OF PLAGIOCLASE. TOTAL ALTN. OF DETRITAL BTE. TO CHL. & LEUCOXENE.

Fluid Inclusions BOILING INDICATED
ABUND. IN STAGE 2 QTZ., <1-6μ DIA., IRREG TO ROUNDED; DOM. VAPOR-RICH; L-RICH VARIETIES (NON-LEAKED) HAVE L/V ≈ 3/1 (2.5-3.5/1); INCL. IN KFSP. DOM. <2μ DIA. & VAPOR-RICH

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

trace — > 1-5% — > 15-50%
< 1% (vol.) — > 5-15% — > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL DX-84, SMPL. Fh	JEFF HULEN JAN. 17, 1991

Rock Type HYDROTHERMALLY ALTERED & VEINED, UNSORTED, FINE- TO COARSE-GRAINED LITHIC METAGRAYWACKE

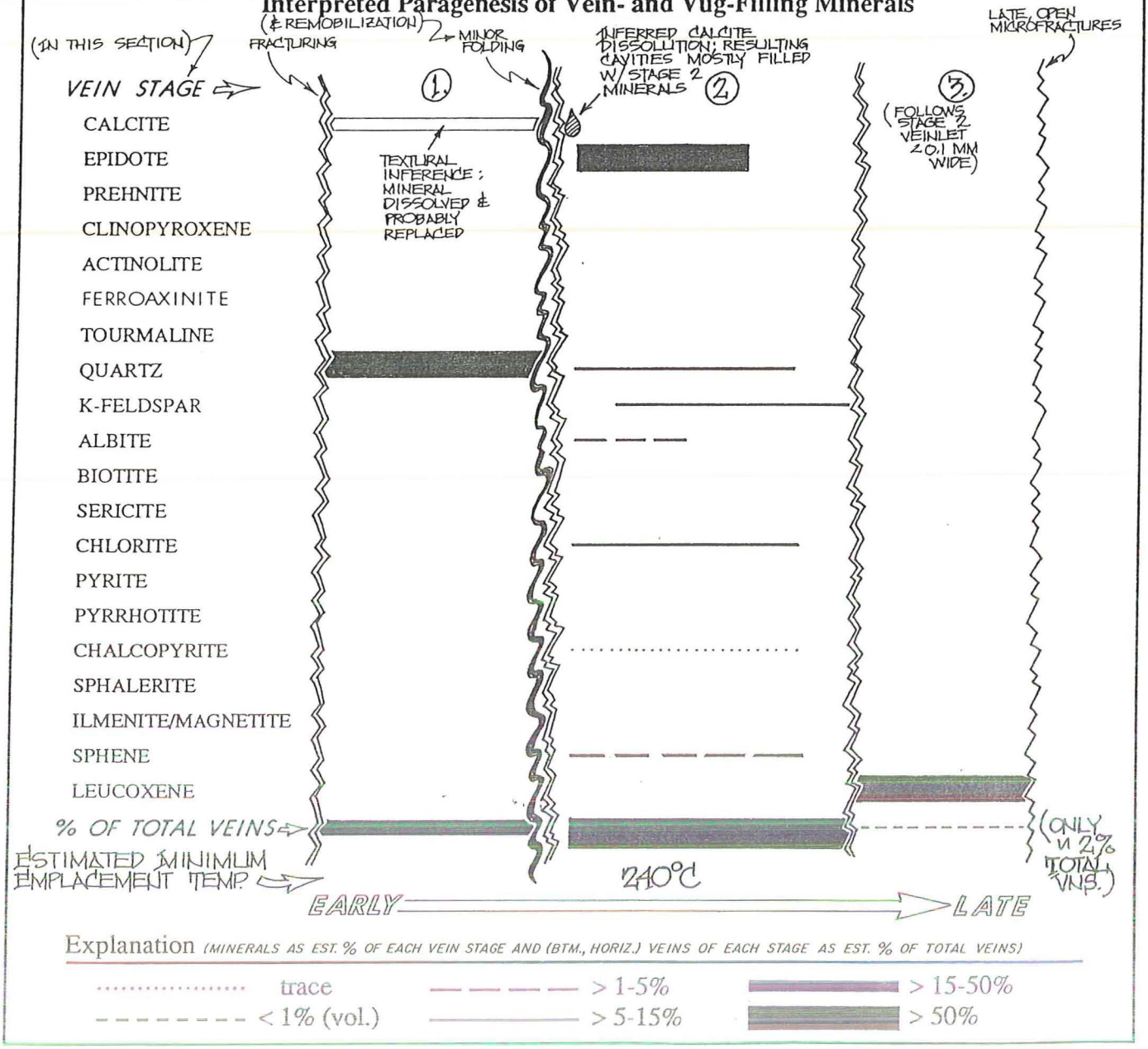
Fracturing/Brecciation/Veining and Vug-Filling ~ 2% VNS., TWO MAJOR GENERATIONS; EARLY FRANCISCAN VEINS CONTORTED → CALCITE IN THESE DISSOLVED, RESULTING CAVITIES INFILLED WITH YOUNGER, SECONDARY PHASES; MAJOR STAGE 2 VEIN HAS VERY POROUS SELVAGES.

Porosity Summary EST. 1.5% Σ INTERXLN. VOIDS IN LARGER, STAGE 2 MASSES; DISSOLUTION μΦ IN STAGE 2 VEIN SELVAGES; OTHER, MINOR μΦ

Alteration/Metamorphism
PROMINENT SELVAGES ADJ. TO STAGE 2 VNLTS. CONSIST OF QTZ-KFSP-CHL-EP → THESE ARE HIGHLY POROUS; SCATTERED, DISS. CLOTS OF TOURMALINE-QTZ-KFSP-EP → THE APPEAR TO BE IN PART OF REPLACEMENT ORIGIN, IN PART OPEN-SPACE FILLING (NOTE THAT THESE MINERALS OCCUR AS VEINLETS IN OTHER SAMPLES OF THIS CORE).

Fluid Inclusions
ABUNDANT IN STAGE 2 QTZ., IRREG. TO ROUNDED, UP TO 15μ DIA. (AVG. ~ 2μ); BOTH VAP. & LIQUID-RICH; UNLEAKED L-RICH HAVE L/V ≥ 3/1; NO UNAMBIGUOUS PRIMARIES.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-30, SMPL. A_h	JEFF HULEN JAN. 08, 1991

Rock Type INTENSELY VEINED, VERY FINE- TO MEDIUM-GRAINED LITHIC METAGRAYWACKE, LOCALLY INTENSELY SHEARED, ALTERED.

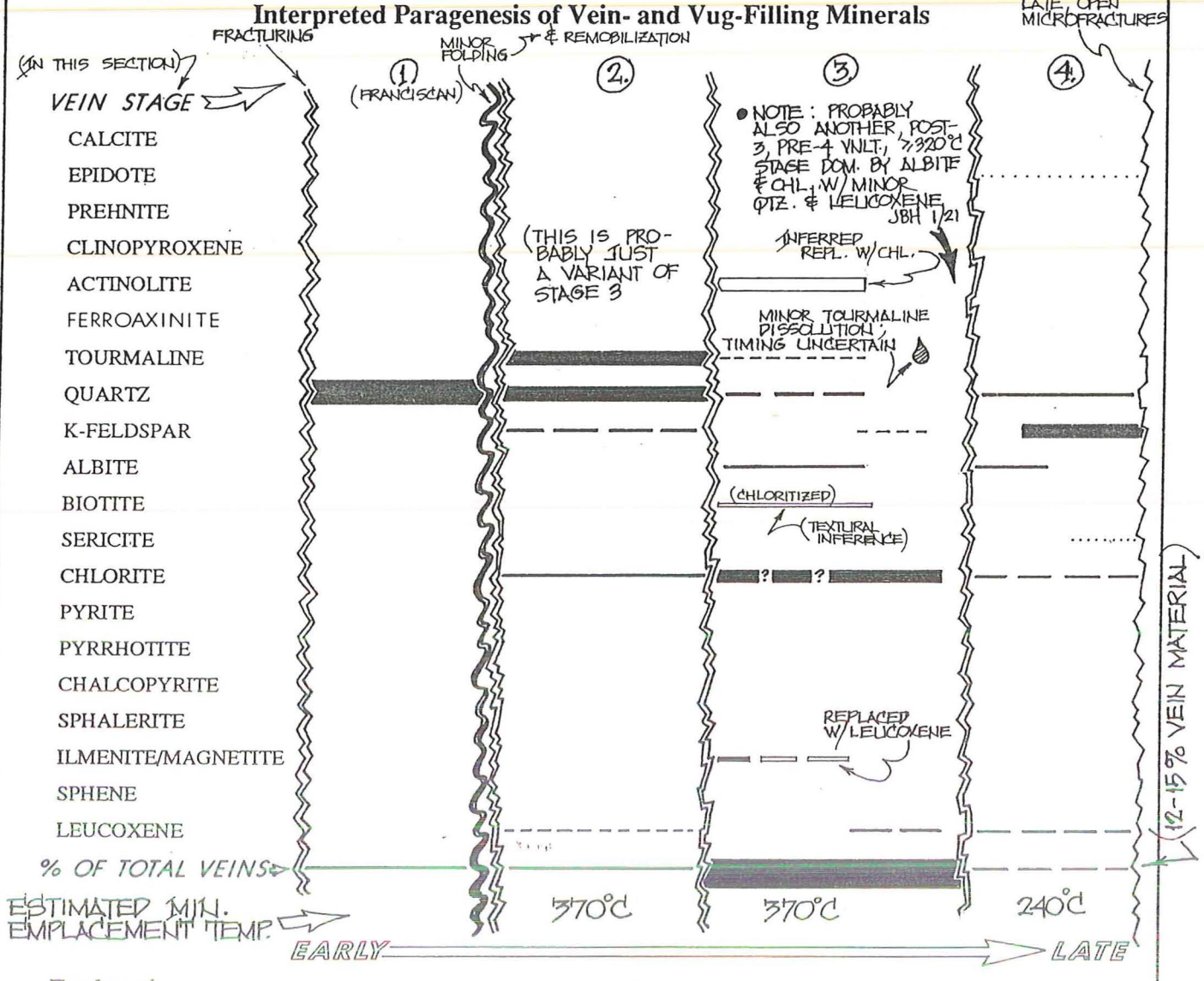
Fracturing/Brecciation/Veining and Vug-Filling 12-15% VEIN MATERIAL; 4 GENERATIONS OF VEINS; NO GOOD EVIDENCE, AS IN OTHER SAMPLES, FOR DISSOLUTION OF FRANCISCAN CALCITE.

Porosity Summary 4-5% TOTAL Φ, MOSTLY 2 INTERCRYSTALLINE VOIDS IN STAGE 2 VNLTS; MINOR vΦ IN SILICA-FLOODED AREAS; ALSO CONSPICUOUS 2ND Φ IN PARTIALLY DISSOLVED TOURMALINE XLS

Alteration/Metamorphism 3-4% DISSEMINATED TOURMALINE XLS. SINGLE & COMPOSITE, SUBH.-EUH., COMMONLY INTERGROWN WITH MINOR QTZ. & KFSP. WIDESPREAD vXLN. SILICA (± KSP?) APP. ASSOCIATED WITH STAGE 2 VEINLETS; ABUND., DISS., vXLN. LEUCOXENE; WIDESPREAD CHLTZN. NOTE DISSOLUTION Φ IN TOURMALINE

Fluid Inclusions ABUNDANT ELONGATE, VAP.-RICH, INCLUSIONS IN ST. 3 ALBITE; ALSO ABUNDANT, <3u VAPOR & LIQ-RICH INCLUSIONS IN STAGE 2 QTZ — LIQ-RICH INCL. HAVE L/V ≈ 2.5-3/1

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

trace — > 1-5% — > 15-50%

< 1% (vol.) — > 5-15% — > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-30, SMPL. Av	JEFF HULEN; JANUARY 08, 1991

Rock Type INCIPIENTLY RECRYSTALLIZED, LOCALLY SILTY ARGILLITE WITH CONSPICUOUS PORPHYROBLASTIC TOURMALINE

Fracturing/Brecciation/Veining and Vug-Filling SPARSELY VEINED (≈3%); ORIGIN OF THE CONTROLLING FRACTURES UNCERTAIN

NOTE: TOUR. PORPHYROBLASTS CONNECTED BY NETWORK OF ST. 3 VNLTS. & CHLTZN.

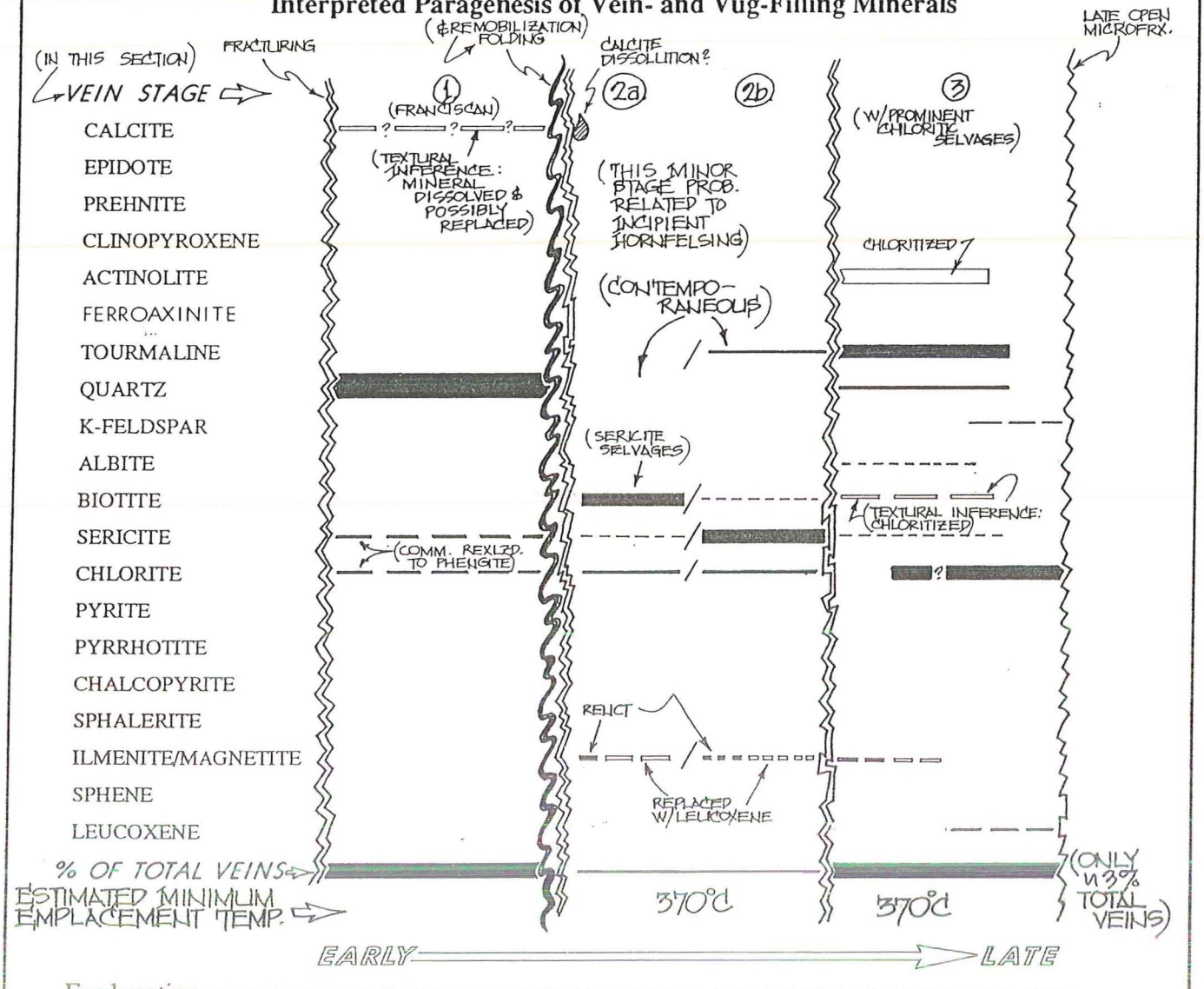
Porosity Summary ≈1.5%, MOSTLY IN ONE, VUGGY, STAGE 3 VEINLET (MAY HAVE BEEN DISRUPTED DURING DRILLING); ALSO LATE, OPEN, μ FRX.; PROMINENT DISSOL. Φ IN TOURMALINE

Alteration/Metamorphism INCIPIENT HORNFELSIC RE-XLZN., W/ IRREG. DIST. MOSAIC AGGREGATES OF QTZ., OLIGOCLASE(?), BROWN PHENGITE, & LEUCOXN; COMMON, SCATTERED, SINGLE & COMPOSITE, EUHEDRAL, SIEVE-TEXTURED, BROWN & BLUE TOURMALINE PORPHYROBLASTS, COMMONLY RIMMED WITH CHLORITE ± K-FELDSPAR; ≈4% DISSEMINATED, MICROCRYSTALLINE LEUCOXENE.

IN SELVAGES ADJACENT TO ST. 3 VNLTS, MASSIVE CHLORITIZATION ± QTZ, ALBITE. (& W/ MAJOR LEUCOXN). ALSO: PROMINENT TOURMALINE DISSOLUTION

Fluid Inclusions NO USABLE INCLUSIONS FOUND DURING RECONNAISSANCE

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

trace; < 1% (vol.); > 1-5%; > 5-15%; > 15-50%; > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-30, SMPL. B_h	JEFF HULEN; JAN. 8, 1991

Rock Type VERY FINE- TO MEDIUM-GRAINED LITHIC METAGRAYWACKE

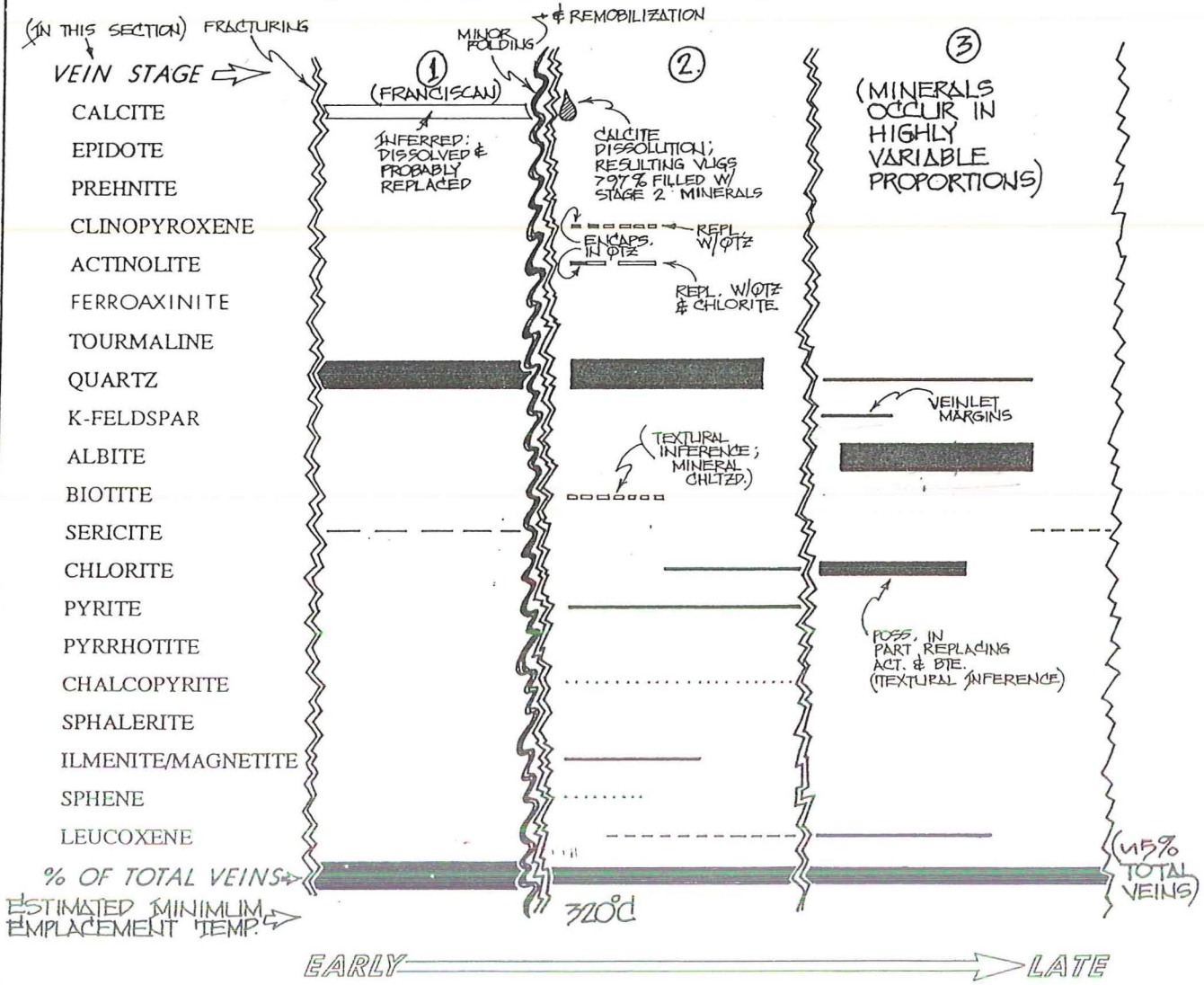
Fracturing/Brecciation/Veining and Vug-Filling ≈5% TOTAL VEINS ORIGIN UNCLEAR (CONTROLLING FRACTURES); STAGE 2 & 3 VEINLETS VUGGY/POROUS

Porosity Summary EST. 1.5-2% AS VUGS IN STAGE 2 & 3 VEINLETS, AS MICROPOROSITY IN STAGE 3 ALBITE & CHERT FRAGS. & LAYER SIL. MATRIX

Alteration/Metamorphism
PARTIAL RECRYSTALLIZATION OF MATRIX TO BROWNISH PHENGITE; RARE, <0.1 MM, BLUE-BROWN TOURMALINE PORPHYROBLASTS; MINOR SILICIFICATION/ALBITIZATION OF MATRIX ADJACENT TO STAGE 2 & 3 VEINLETS

Fluid Inclusions
ABUNDANT VAPOR-RICH INCLUSIONS IN STAGE ② QTZ; RARE LIQ-RICH INCLUSIONS W/ L:V ≈ 3/1 (ALSO ST. 2).

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

..... trace	— — — — > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-30, SMPL. B,	J. HULEN JAN. 9, 1991

Rock Type VERY FINE- TO MEDIUM-GRAINED LITHIC METAGRAYWACKE

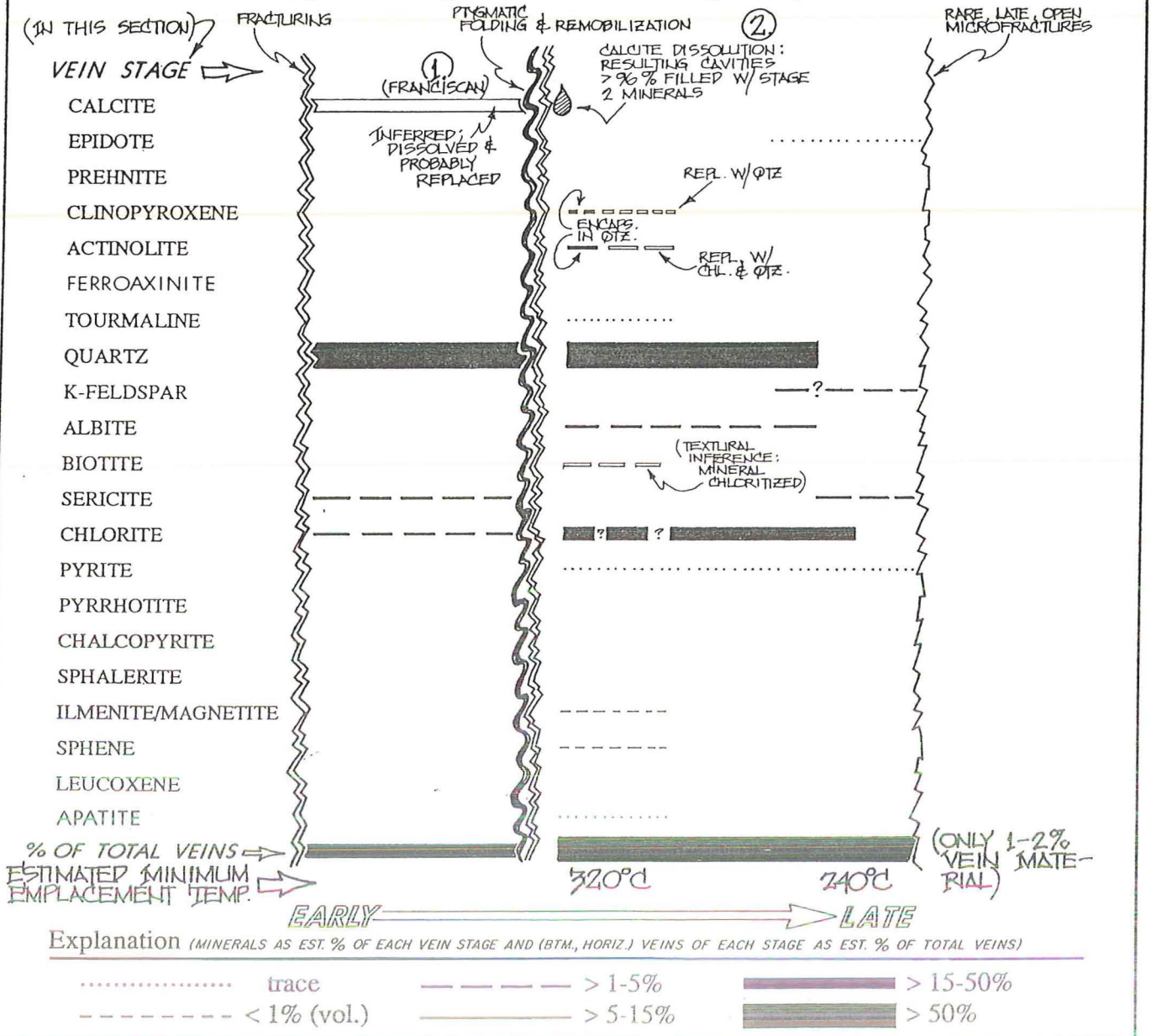
Fracturing/Brecciation/Veining and Vug-Filling SPARSELY VEINED (1-2%); CARBONATE, PROB. HYDROTH. DISSOLVED FROM STAGE 1 (FRANCISCAN) VEINLETS — RESULTING VUGS INFILLED W/ STAGE 2 MINERALS (SEE BELOW)

Porosity Summary EST. 1-1.5% MOSTLY ANGULAR INTER-CRYSTALLINE VUGS IN STAGE 2 VEINLETS; SOME VUGS IN LAYER SIL. & CHERT

Alteration/Metamorphism
PARTIAL REXLZN. OF ORIGINAL ILLITE-CHL. MATRIX TO BROWNISH PHENGITE; SPARSELY DISSEMINATED INDIGO TO BLUE, EUHEDRAL TOURMALINE, PREF. REPLACING PLAG. IN FRAMEWORK GRAINS; 1-1.5% DISS. ILMENITE/MAGNETE, PARTIALLY ALTERED TO LEUCOXENE; TR. EPIDOTE, MINOR SER. & CHL./PLAG. PATCHY SILICIFICATION, CHLTZN. ADJ. TO ST. 2 VEINLETS

Fluid Inclusions
ABUND. LIQ-RICH & VAP-RICH INCLUSIONS, < 5 μ DIA., IN STAGE 2 QTZ; L/V IN RELIABLE LIQ-RICH INCL. = 3/1; NO USABLE INCLUSIONS IN STAGE 1 QTZ.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-30, SMPL C_h	JEFF HULEN; JAN. 9, 1991

Rock Type COMPOSITE HYDROTHERMAL VEIN, VERY VUGGY, DISRUPTING V.F.-MED. GR. LITHIC METAGRAYWACKE & ARGILLACEOUS GRAYWACKE METASILTSTONE

Fracturing/Brecciation/Veining and Vug-Filling
65% OF THIS SAMPLE IS THE COMPOSITE VEIN, IN PART DEVELOPED THROUGH CARBONATE DISSOLUTION FROM STAGE 1 VEINLETS, INFILLING OF VUGS W/ STAGE 2 MINRLS.

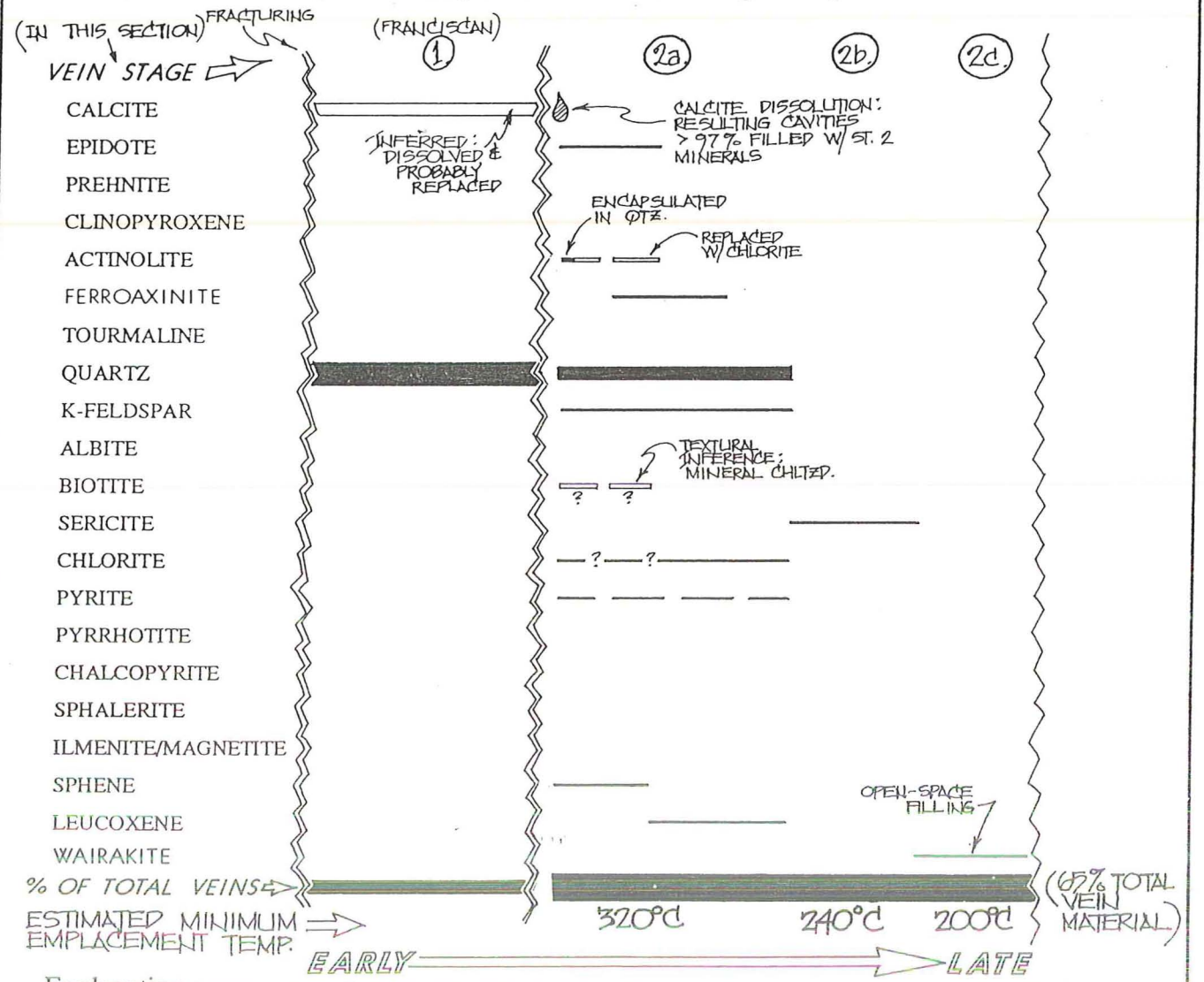
Porosity Summary EST. 7-8% MOSTLY ANGULAR INTER-CRYSTALLINE VOIDS IN STAGE 2 VEIN-FILLINGS; ALSO $\mu\phi$ IN μXLN. STAGE 2 QTZ; MINOR DISSOLUTION $\mu\phi$ IN SELVAGES OF STAGE 2 VEINS

Alteration/Metamorphism
IN ROCK: MINOR SILICIFICATION, CHLTZN., DEVELOPMENT OF DISSOLUTION $\mu\phi$ IN SELVAGES ADJACENT TO STAGE 2 VEIN MINERALS

IN VEIN: FERROAXINITE LOCALLY REPLACED PERIPHERALLY WITH CHLORITE; EARLY ACTINOLITE REPL. MOSTLY W/ CHLORITE & LEUCOXENE.

Fluid Inclusions
ABUND. LIQUID- & VAPOR-RICH IN STAGE 2 QTZ.; ROUNDED-APPEARING, < 7μ (MOST < 3μ); LIQ-RICH VARIETIES HAVE L/V = 2.5-3/1.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

..... trace	— — — — > 1-5%	> 15-50%	
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%	

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-30, SMPL. Cv	JEFF HULEN; JAN. 09, 1991

Rock Type VERY FINE- TO MEDIUM-GRAINED LITHIC METAGRAYWACKE

• ALSO MINOR DISSOL. ϕ IN TOURMALINE

Fracturing/Brecciation/Veining and Vug-Filling 3-4% TOTAL VEINS; EARLIEST ARE PROBABLY FRANCISCAN & ARE TEXTURALLY DISTINCTIVE (UNDULOSE, AMOEBOID) V. MINOR LATE, OPEN MICROFRACTURING

Porosity Summary EST. < 1% MOSTLY vϕ IN LAYER SILICATE AGGREGATES & CHT.; V. LOCAL & INTERXLN. VUGS UP TO .07 MM. DIA., IN STAGE 3 VEIN MINERALS. SOME LATE, OPEN vFRX.

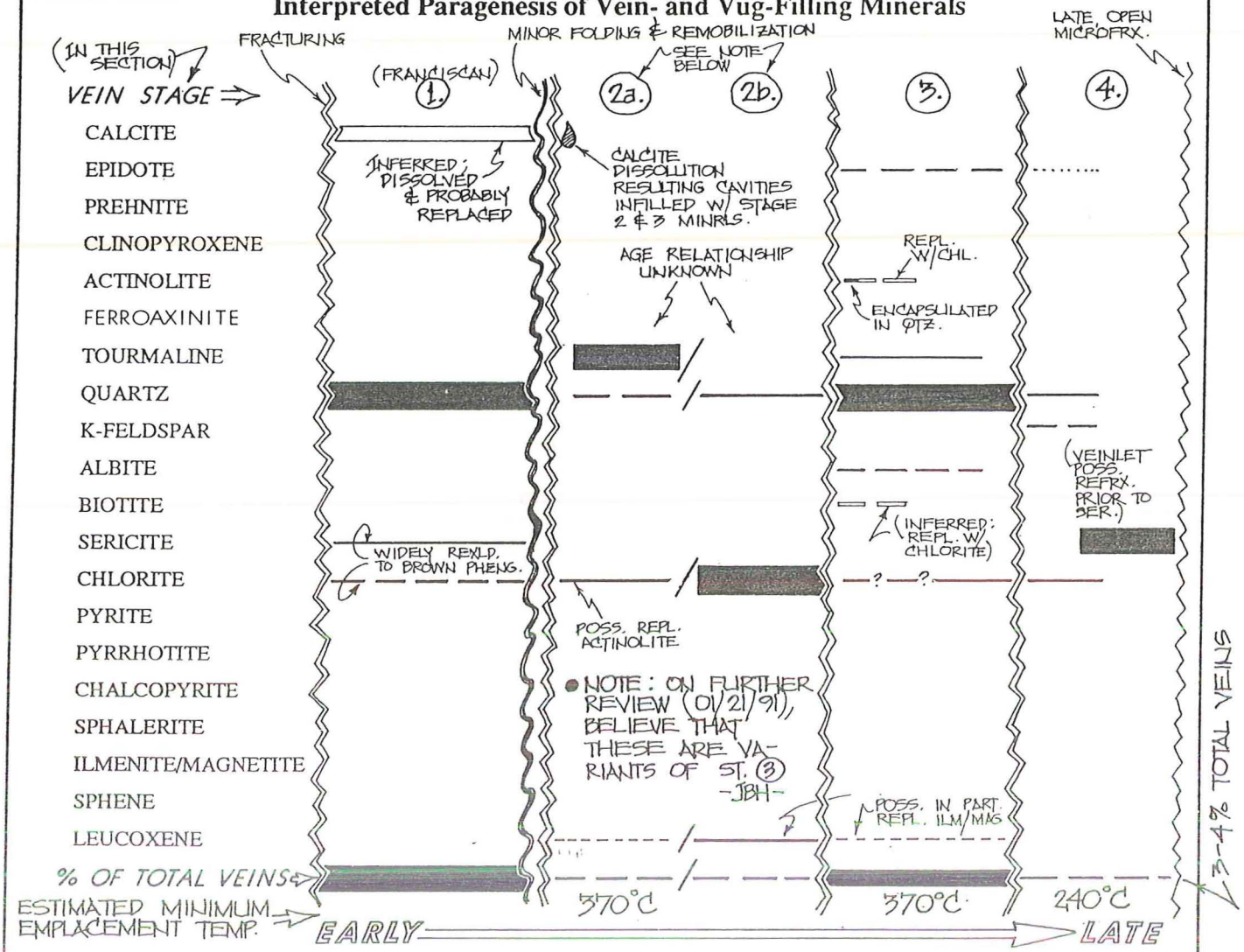
Alteration/Metamorphism

PATCHY REXLZN. OF ILLITE/CHL MATRIX TO BROWNISH PHENGITE; WEAK SERICITIZATION OF FRAMEWORK PLAGIOCLASE; SPARSELY DISSEMINATED < 0.2 MM. DIA., INDIGO TO BROWN TOURMALINE XLS. → SOME OF THESE ARE PARTIALLY DISSOLVED; CHLTN., SILICIFICATION IN SELVAGES ADJ. TO ST. 3 VNLTS.; TR. DISS. ALLANITE PTLY REPL. W/ EPIDOTE.

Fluid Inclusions

LOCALLY ABUNDANT IN STAGE 3 QTZ.; BOTH VAPOR- & LIQUID-RICH; LIQ-RICH VARIETIES HAVE L/V RATIOS RANGING FROM 2.5/1 TO 4/1; AVG. v 2μ DIA.; NO OBVIOUS PRIMARIES

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

.....	trace	— — — —	> 1-5%
- - - - - - - -	< 1% (vol.)	———	> 5-15%
			> 15-50%
			> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-30. SMPL. Dh (u5013.5')	JEFF HULEN, OCT. 25, 1990

Rock Type u½ THE SECTION IS ARGILLACEOUS LITHIC METAGRAYWACKE; THE OTHER ½ IS ARGILLITE; ROCK IS INCIPIENTLY RECRYSTALLIZED (CONTACT METAMORPHISM)

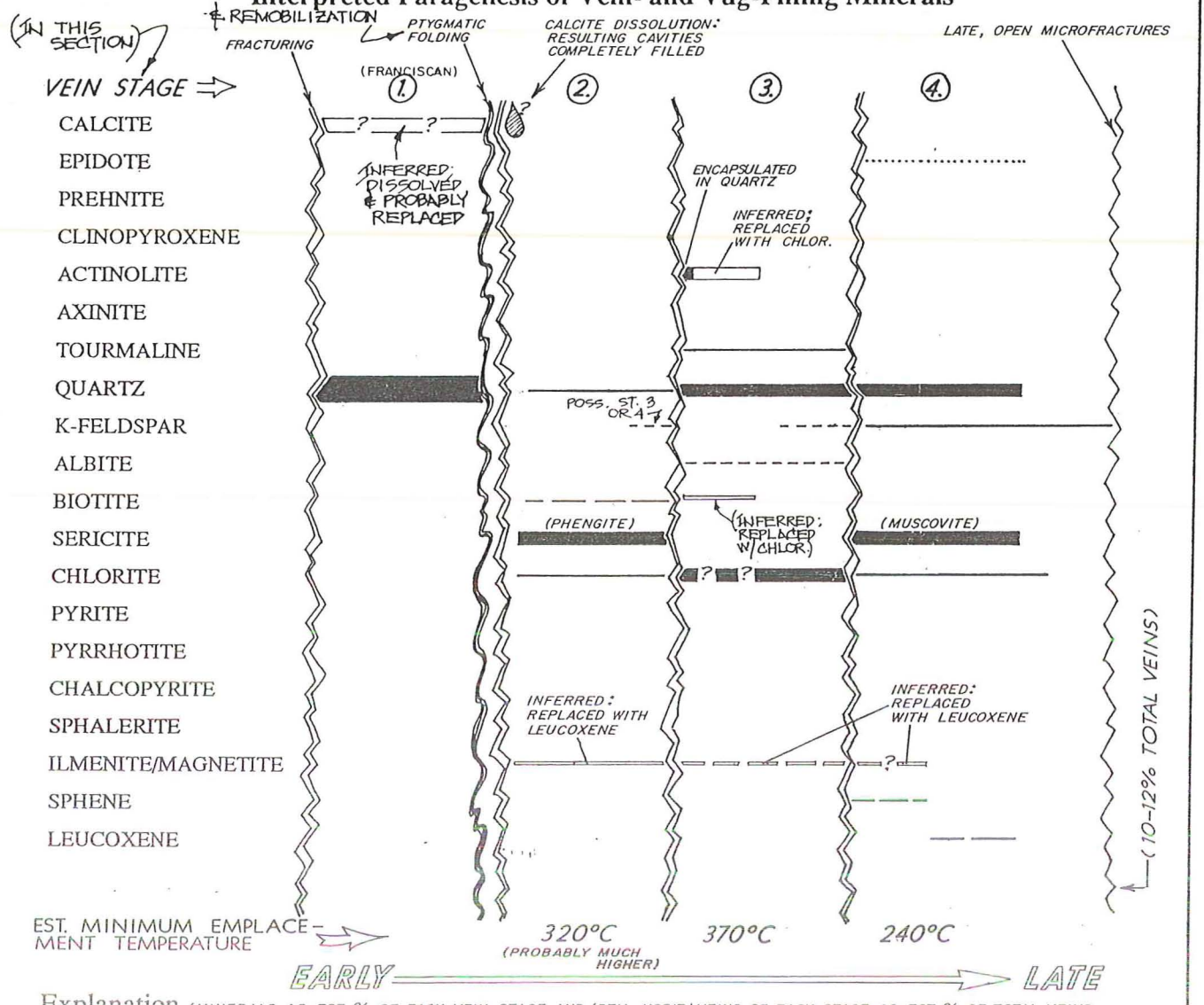
Fracturing/Brecciation/Veining and Vug-Filling HEAVILY VEINED (10-12%); GRAYWACKE MUCH MORE SO THAN ARGILLITE; 4 STAGES MINRLZ; STAGE ② MOSTLY IN ARGILLITE; LATE, OPEN MICROFRACTURING

Porosity Summary u 2% DOMINANTLY AS PRIMARY INTERCRYSTALLINE VOIDS IN STAGE ④ VEINLETS; ALSO MPOR. IN LAYER SILICATES, CHERT, K-FELDSP.-QTZ. AGGR.

Alteration/Metamorphism
ARGILLITE IS INCIPIENTLY HORNFELSED—MOSNC AGGREGATES OF QTZ, OLIGOCLASE/ANDESINE; SOME TOURMALINE PORPHYROBLASTS; EARLY STAGE ③ ACTINOLITE IS CHLORITIZED; SILICIFICATION & SECONDARY K-SPAR ADJACENT TO STAGE ④ VEINLETS.
* NOTE ALSO SOME DISSOL. Φ IN TOURMALINE.

Fluid Inclusions
STAGE 3 QTZ—ABUNDANT VAPOR-RICH INCLUSIONS, RARE LIQ-RICH INCL'S. W/ L:V u 3/1 (280°C?); STAGE 4 QTZ → UNCOMMON INCLUSIONS, A FEW LIQ-RICH W/ L:V u 4/1 (250°C+?) STAGE 4 K-SPAR INCLUSIONS RARE, <2μ DIA., VAPOR-RICH

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS

..... = trace
– – – – – – – – < 1% (vol.)
— — — — > 1-5%
——— > 5-15%
▬▬ > 15-50%
▬▬ > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-30, SMPL. Eh	JEFF HULEN JAN. 20, 1991

Rock Type VERY FINE- TO COARSE-GRAINED, POORLY SORTED, TOURMALINE-RICH, LITHIC METAGRAYWACKE

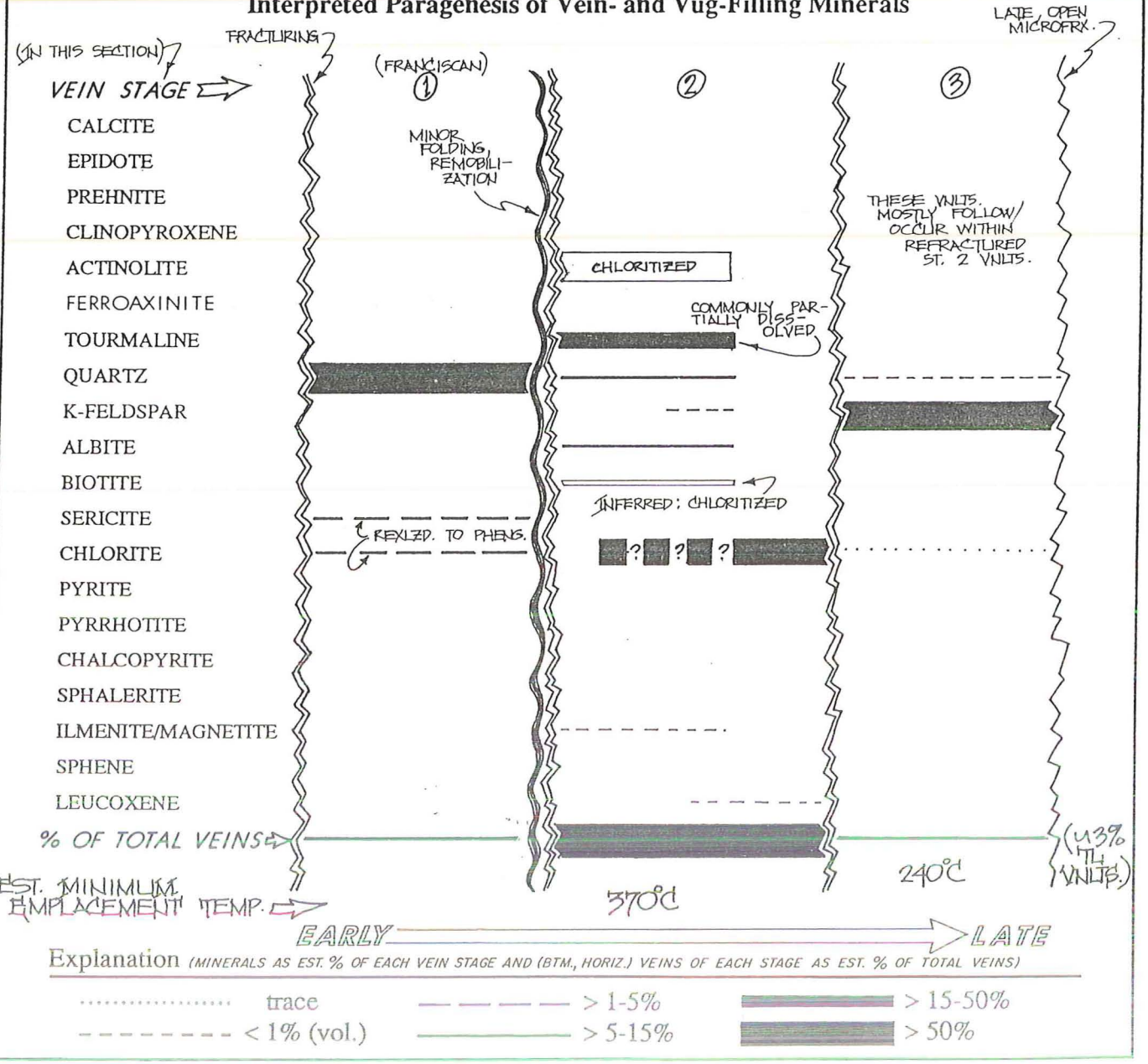
Fracturing/Brecciation/Veining and Vug-Filling ∪ 3% VEINS, STWK, MOSTLY < 0.5 MM. WIDE; MOSTLY CHL-TOURM (CHL. REPLACES ACTINOLITE); V. FEW OLDER, CONTORTED/REMOBILIZED FRANCISCAN-AGE QTZ. VNLTS.

Porosity Summary ∪ 1%; LATE, OPEN ∪ FRX; DISSOL. Φ IN TOURM.; ∪ Φ IN LAYER-SIL. AGGR.

Alteration/Metamorphism PROMINENT PARTIAL DISSOLUTION OF VEIN- & DISS. TOURMALINE, LEAVING THIN SEPTA PARALLEL TO THE C-AXES; PATCHY RECRYSTALLIZATION OF ORIGINAL IL/CH MATRIX TO GREENISH-BROWNISH PHENGITE; ABUND. SUBH.-EUH. DISS. TOUR., COMMONLY INTERGROWN WITH OR RIMMED BY CHL., QTZ, TR. KFSP.; "FLOODING" OF MATRIX ADJACENT TO STAGE 2 VNLTS. W/ QTZ, CHL., POSS. MINOR ALBITE; ∪ 1.5% DISS. LEUCOX. ± ILM/MAG.

Fluid Inclusions ABUNDANT, IRREG. TO RND., <1-3 μ DIA., VAPOR-RICH INCLUSIONS IN ST. 2 QTZ; ONE LIQ-RICH INCL. W L/V ∪ 2.5-3/1; INCLUSIONS IN ST. 3 KFSP > 99% V-RICH & <1 μ DIA. → ONE LIQ-RICH, 4 μ DIA., W/ L:V ∪ 3.5/1

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-30 SMPL. F_h	JEFF HULEN JAN. 9, 1991

Rock Type HYDROTHERMALLY ALTERED & VEINED, TOURMALINE-RICH, VERY FINE- TO COARSE-GRAINED LITHIC METAGRAYWACKE

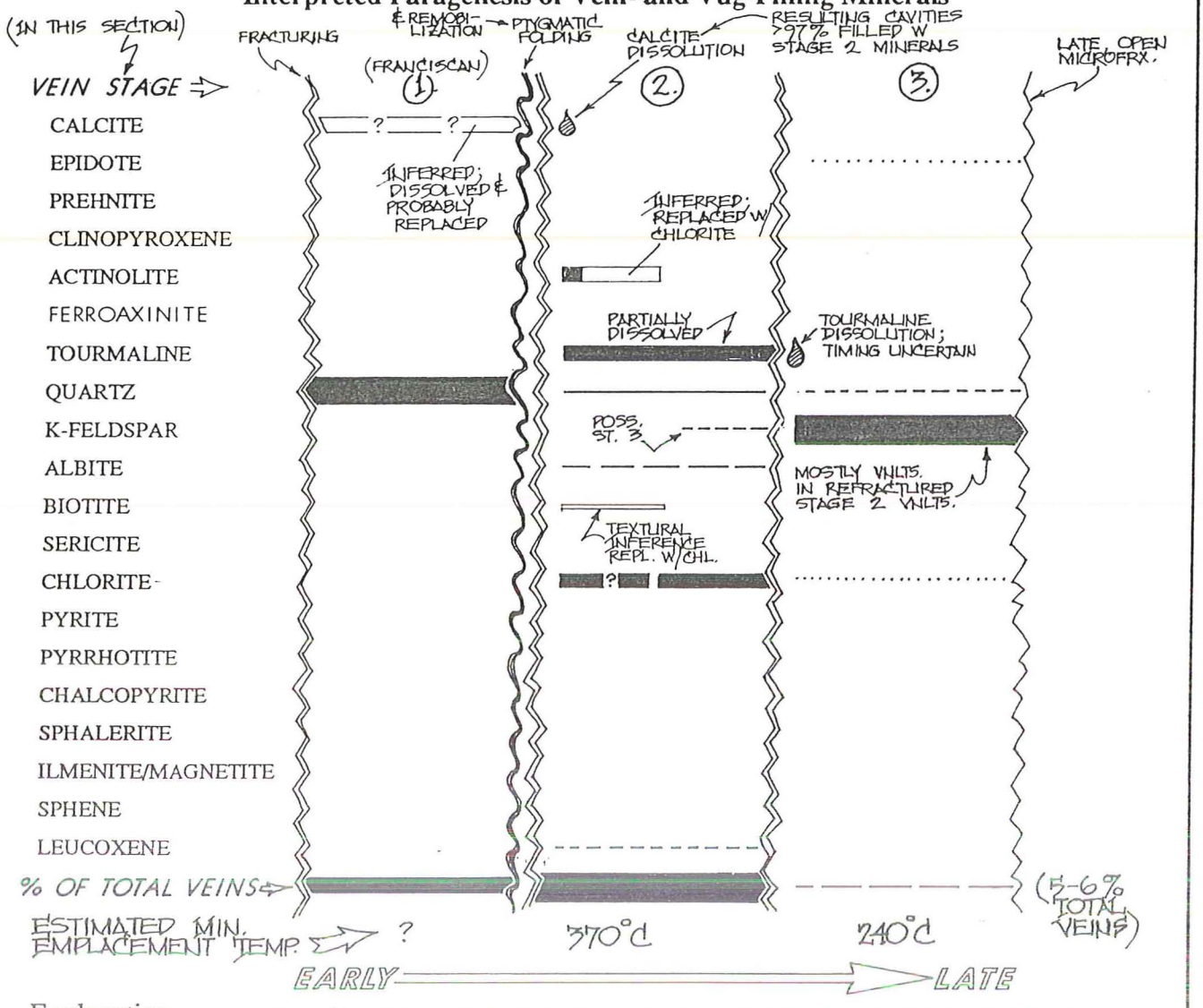
Fracturing/Brecciation/Veining and Vug-Filling
5-6% STOCKWORK VEINLETS, SEVERAL DIFFERENT GENERATIONS; MOST < 0.7 MM WIDE, UP TO 2 MM. WIDE

Porosity Summary
∿ 1%, MOSTLY μΦ IN LAYER SILICATE AGGR., SOME DISSOLUTION Φ IN TOURMALINE

Alteration/Metamorphism
PARTIAL REXLN. OF ORIGINAL ILLITE/CHL. MATRIX TO BROWNISH PHENGITE; WK. SERICITIZATION OF FRAMEWORK PLAG.; MANY TOURM. XLS. ARE SKELETAL, ETCHED-APPEARING, W/ THIN SEPTA // TO C AXIS — THIS COULD BE THE SOURCE OF BORON FOR LATER-FORMED FERROAXINITE. (NOT PRESENT IN THIS SAMPLE)

Fluid Inclusions
ABUNDANT IN STAGE 2 QTZ., AVG. 2μ (< 7μ) DIAMETER, ↗ TO ROUNDED, LIQ. & VAP.-RICH; LIQ-RICH INCLUSIONS HAVE LIQ/VAP. = 2.5-3/1; INCLUSIONS IN STAGE 3 KFSP ARE < 1μ, UNUSABLE.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

..... trace	— — — — > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-30, SMPL. Fv	JEFF HULEN JAN. 20 & 21, 1991

Rock Type FINE- TO VERY COARSE-GRAINED LITHIC METAGRAYWACKE; CLASTS UP TO 3 MM. IN DIA.; TOURMALINE-RICH ARGILLITE/METASHALE STRINGER AT ONE END OF SECTION

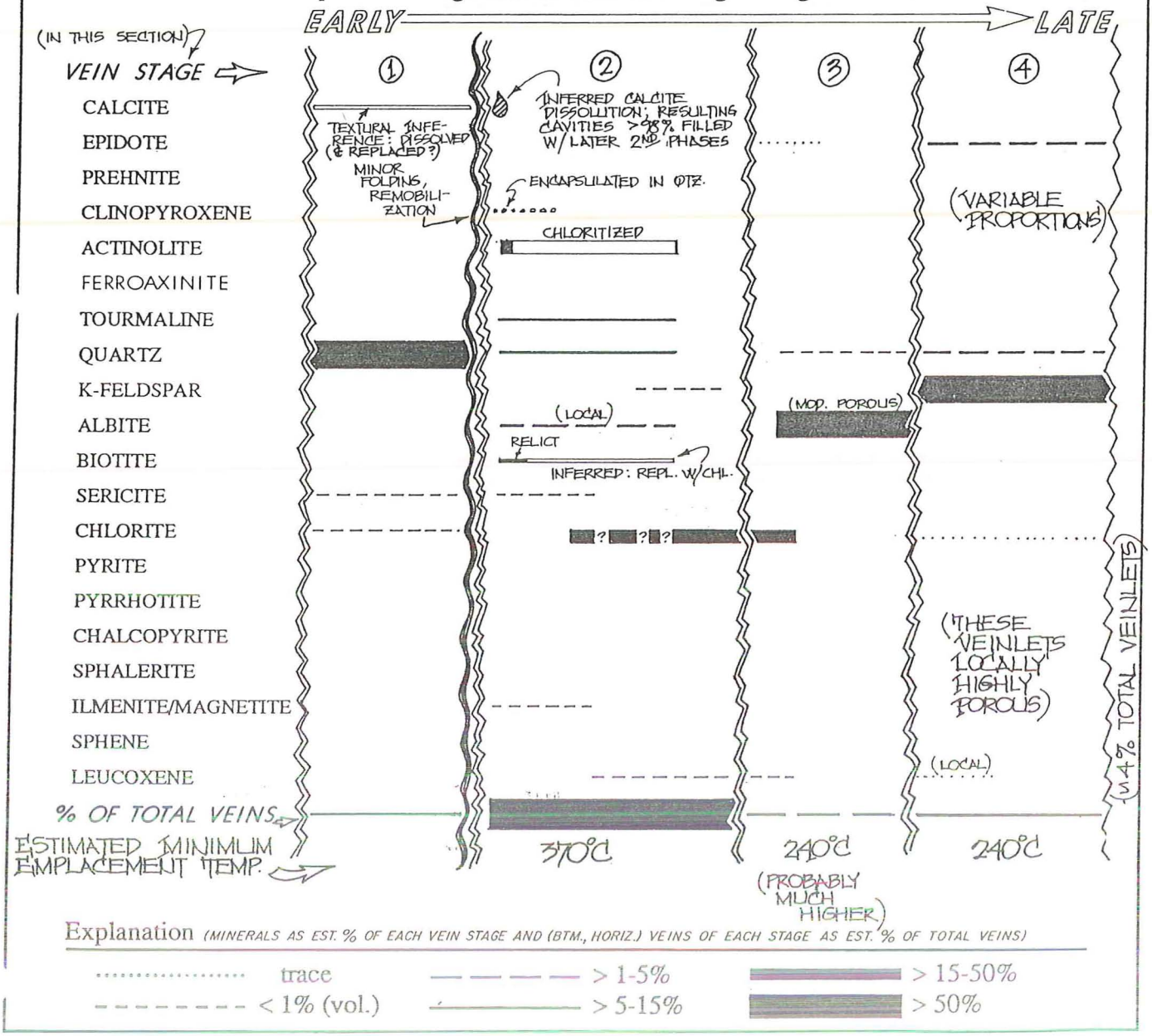
Fracturing/Brecciation/Veining and Vug-Filling 3-4% TOTAL VNLTS. MOST < 0.5 MM. WIDE, FORMING A STOCKWORK; DOM. BY CHL-TOUR-QTZ-AB VNLTS → CHL IN THESE IS LATE-ST. AFTER BOTH BTE. & ACTINOLITE

Porosity Summary 1.5% EST. DISSOL. Φ IN DISS. TOUR.; LATE, OPEN FRX; Φ IN LAYER SILICATE AGGREGATES; STAGE 4 KFSP. VNLTS HIGHLY POROUS

Alteration/Metamorphism
PATCHY REXLN. OF ORIG. IL-CH-RICH MATRIX TO BROWNISH & GREENISH PHENGITE; TR. DISS., TRANSP., GREENISH GARNET, ANH.-ELIH. XLS. < 0.02 MM. DIA.; XL. AGGREGATES UP TO 0.04 MM. DIA; PATCHY "FLOODING" (MASSIVE REPLACEMENT) OF MATRIX ADJACENT TO ST. 2 VNLTS. W/CHL, QTZ, POSS. AB; 2-3% DISS. TOURMALINE (± CHL, QTZ, tr. KFSP) ALMOST ALWAYS ALONG OR NEAR A STAGE 2 VNLT

Fluid Inclusions
VERY ABUND. VAPOR-RICH INCL'S IN STAGE 3 ALBITE; ELONGATE, IRREGULAR; ALSO ABUND. V-RICH, RNDED-APPEARING INCL'S. IN ST. 2 QTZ — RARE, ASSOCIATED, LIQ-RICH INCL'S. HAVE L/V ≅ 2.5-3/1; NO OBVIOUS PRIMARIES (BOILING INDICATED)

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC-30, SMPL. H_b	JEFF HULEN, JAN. 10, 1990

Rock Type HYDROTHERMALLY ALTERED & VEINED, TOURMALINE-RICH, VERY FINE- TO MEDIUM-GRAINED LITHIC METAGRAYWACKE * ALSO DISSOL. Φ IN TOURM. XLS.

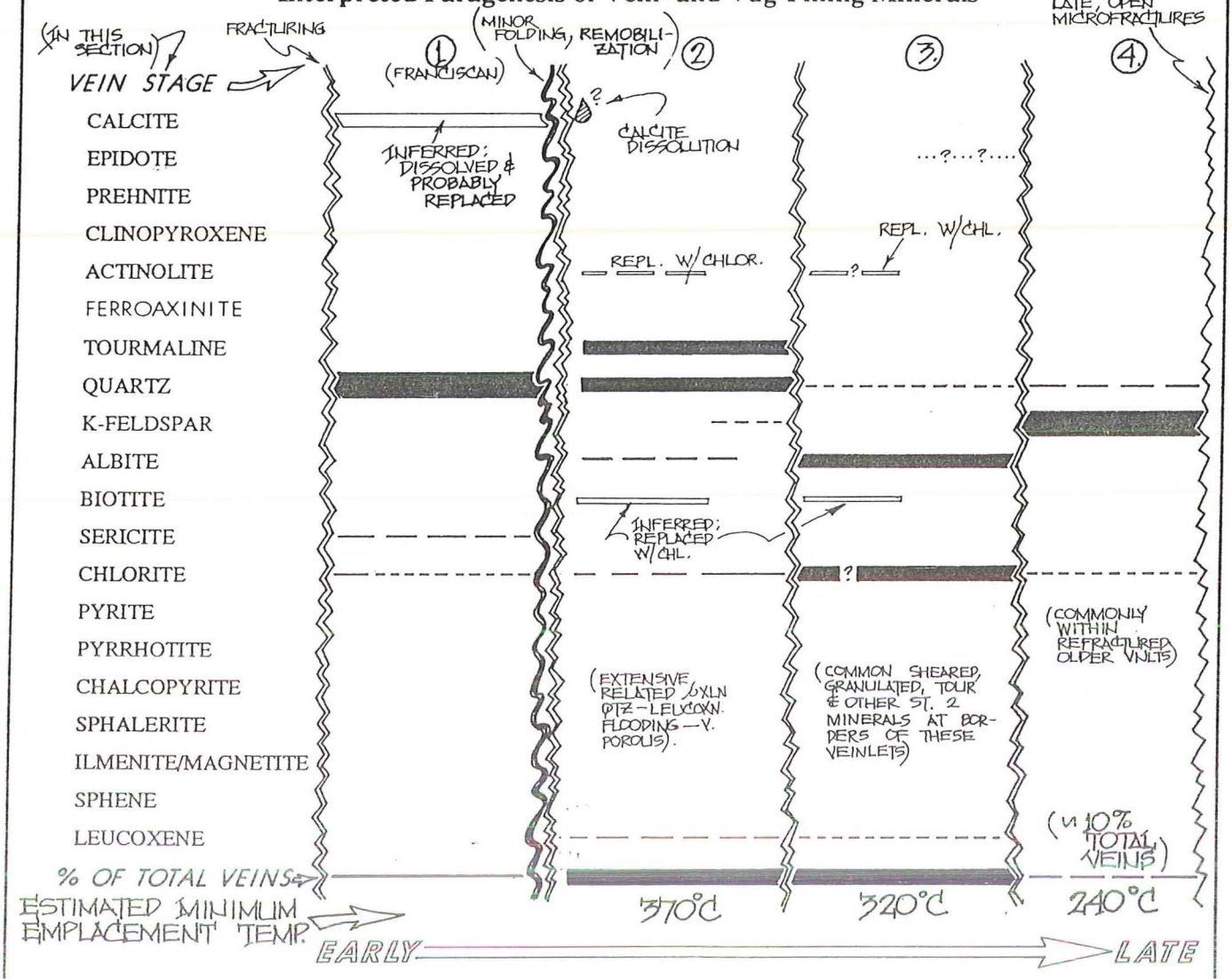
Fracturing/Brecciation/Veining and Vug-Filling HEAVILY STOCKWORK-VEINED (TEXTURE SUGGESTS HYDRAULIC FRACTURING) ∿10% OPEN-SPACE-FILLING SECONDARY MINERALS — OF AT LEAST 4 GENERATIONS

Porosity Summary 3-4% MOSTLY μΦ IN μXLN. QTZ-LEUCOXN. MASSES & VUGS IN STAGE 2 QTZ-TOURM. VEINLETS — ALSO LATE, OPEN, μ FRX & μΦ IN LAYER SILICATES & CHERT FRAMEWORK GRAINS.

Alteration/Metamorphism PARTIAL REXLZN. OF ORIGINAL ILLITE/CHLORITE MATRIX TO BROWNISH PHENGITE; ∿7% DISS. TOURMALINE, SINGLE & COMPOSITE, SUBH.-EUH. XLS. UP TO 0.5 MM DIAMETER, COMM. INTERGROWN WITH MINOR CHL., QTZ., TR. K-FSP. & COMMONLY ETCHED-APPEARING; EXTENSIVE μXLN. QTZ + LEUCOXENE "FLOODING", PROB. RELATED TO STAGE 2 QTZ-TOUR-CH VEINLETS

Fluid Inclusions STAGE 3 ALBITE HAS ABUNDANT, ELONGATE, VAPOR-RICH INCLUSIONS < 3μ LONG ALSO ABUND. VAPOR-RICH INCLUSIONS IN ST. 2 QTZ

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

..... trace	— — — — > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDHS-7, SMPL. A	JEFF HULEN JAN. 23, 1991

Rock Type HYDROTHERMALLY VEINED, POORLY SORTED, V. FINE- TO MED. GR. LITHIC METAGRAYWACKE

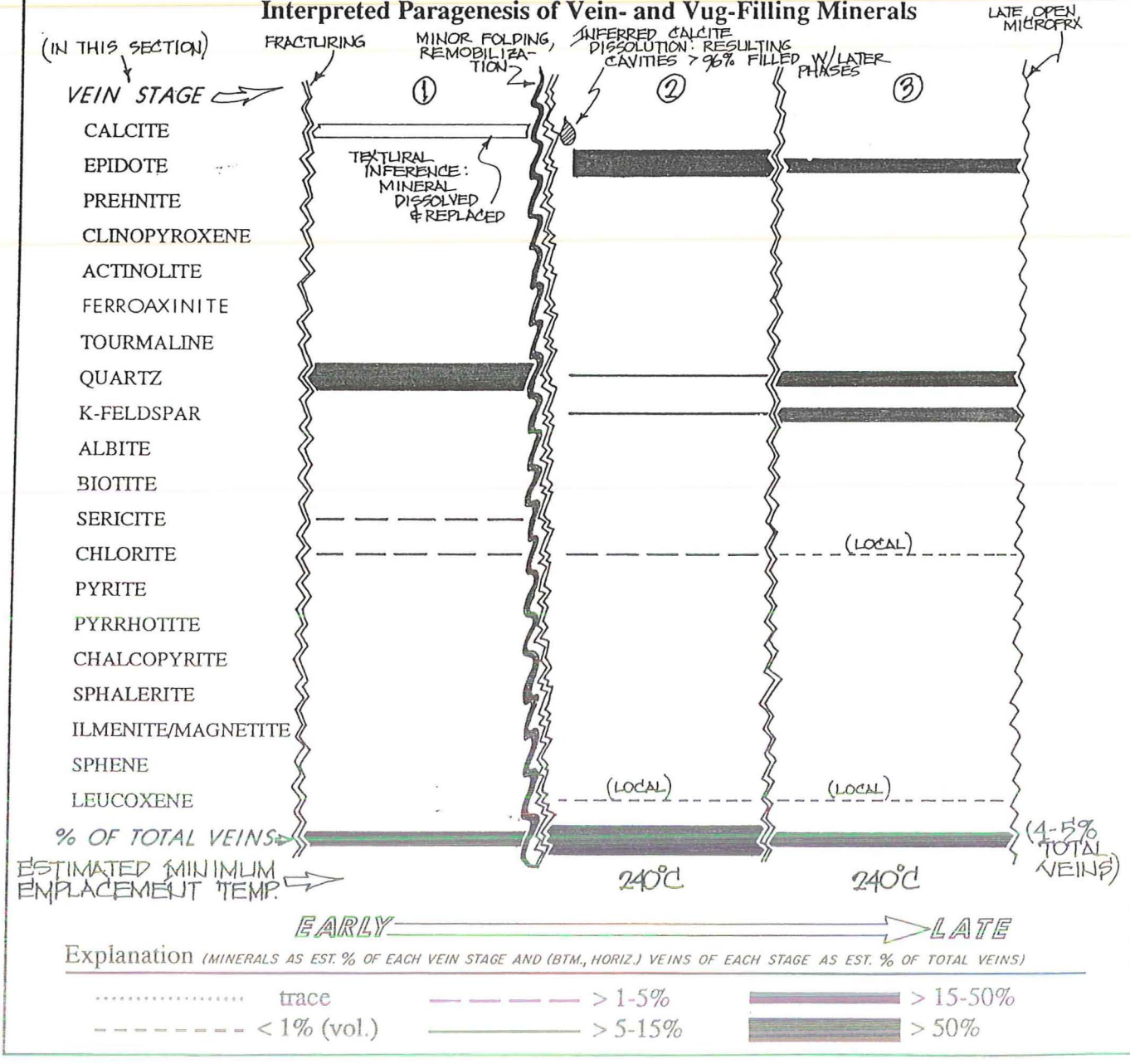
Fracturing/Brecciation/Veining and Vug-Filling 4-5% VEINS, THE TWO DOMINANT OF WHICH FORM THE SUBPARALLEL "RUNGS" OF A SET OF LADDER VEINLETS (Q-EP-KFSP); CONTORTED, REMOBILIZED, & REMINERALIZED FRANCISCAN QUARTZ VEINS ALSO PRESENT

Porosity Summary ~2% MOSTLY ± INTERXLN. VOIDS IN STAGE 2a & 2b VEINLETS; ALSO LATE, OPEN μFRX.

Alteration/Metamorphism
"FLOODING" OF WALLROCK ADJACENT TO STAGE 2 VEINLETS W/ PATCHY K-FSP, ± QTZ, EP; ~2-3% DISS. ANHEDRAL EPIDOTE GRAINS & GRAIN AGGREGATES AVG. ~0.1 MM. DIA.; 1-5% DISS. LEUCOXENE

Fluid Inclusions
ABUND. IN STAGE 2a & 2b QTZ. & KFSP; <1-10μ (AVG 1.5-2μ) DIA., IRREGULAR, DOM. VAPOR-RICH; RARE LIQ-RICH INCL'S W/ L:V ~ 3.5/1; NO ABSOLUTELY UNAMBIGUOUS PRIMARIES.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDHS-7, SMPL. (2)	JEFF HULEN; JAN. 22, 1991

Rock Type HYDROTHERMALLY FRACTURED, BRECCIATED, & VEINED, INTERBEDDED SILTY ARGILLITE/METASHALE, SANDY GRAYWACKE METASILTSTONE, LOCALLY W/ CELLULAR ORGANIC DEBRIS.

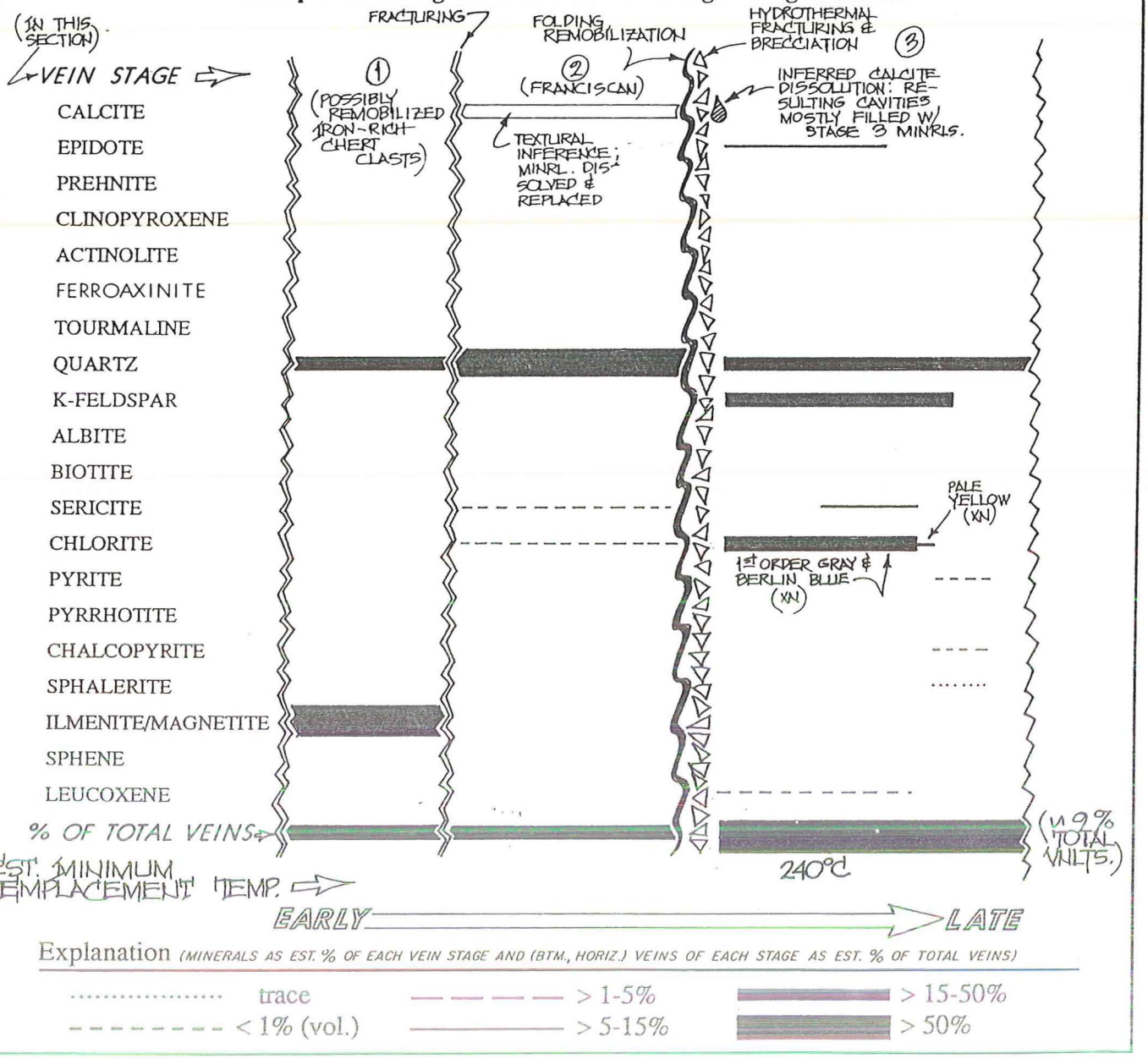
Fracturing/Brecciation/Veining and Vug-Filling
COMPLEXLY VEINED; SEVERAL GENERATIONS; EARLY QTZ-ILM/MAG (+ ORGANIC?) STRINGERS & MASSES CONSIST OF ILM/MAG (-ORG?) CLAST IN COMMONLY RIBBON-TEXTURED CHALCEDONIC-APPEARING QTZ - MANY OF THE MORE STUBBY LENTICULAR MASSES LOOK LIKE FOSSILS; STAGE 3 VNLTS OCCUPY HYRALILIC FRACTURES → MANY OF THESE FORM "JIGSAW-PUZZLE TEXTURES; LOCAL ROCK-FLOUR, NON-SHEARED CEMENTED BRECCIAS; ∩ 9% TL VEINLET MATERIAL

Porosity Summary EST. ∩ 1% MOSTLY LATE, OPEN MICROFRACTURES

Alteration/Metamorphism
VEIN SELVAGES VERY POORLY DEVELOPED, CONSIST OF WK, PATCHY KFSP ± EP REPL. OF MATRIX & PLAG.; MINOR OVERALL DISS. EP. & LEUCOXENE; CHLTZN. OF DETRITAL BTE.

Fluid Inclusions
ABUND. IN ST. 3 QTZ. & (ESP) KFSP; <1-7μ (AVG. ∩ 1.5-2μ) DIA., IRREG., 2ND OR AMBIGUOUS ORIGIN; DOM. VAPOR-RICH, BUT A FEW LIQ-RICH W/L:V ∩ 3.5/1 (EST T_h ∩ 240-250°C)

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

trace; < 1% (vol.); > 1-5%; > 5-15%; > 15-50%; > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDHS-7, SMPL. C	JEFF HULEN, NOV. 28, 1990

Rock Type HYDROTHERMALLY FRACTURED & BRECCIATED, INTERBEDDED LITHIC METAGRAYWACKE & SILTY, ORGANIC-RICH ARGILLITE/METASHALE (POSSIBLE SMALL-SCALE RIPPLE LAMINATION IN METASHALE/ARGILLITE).

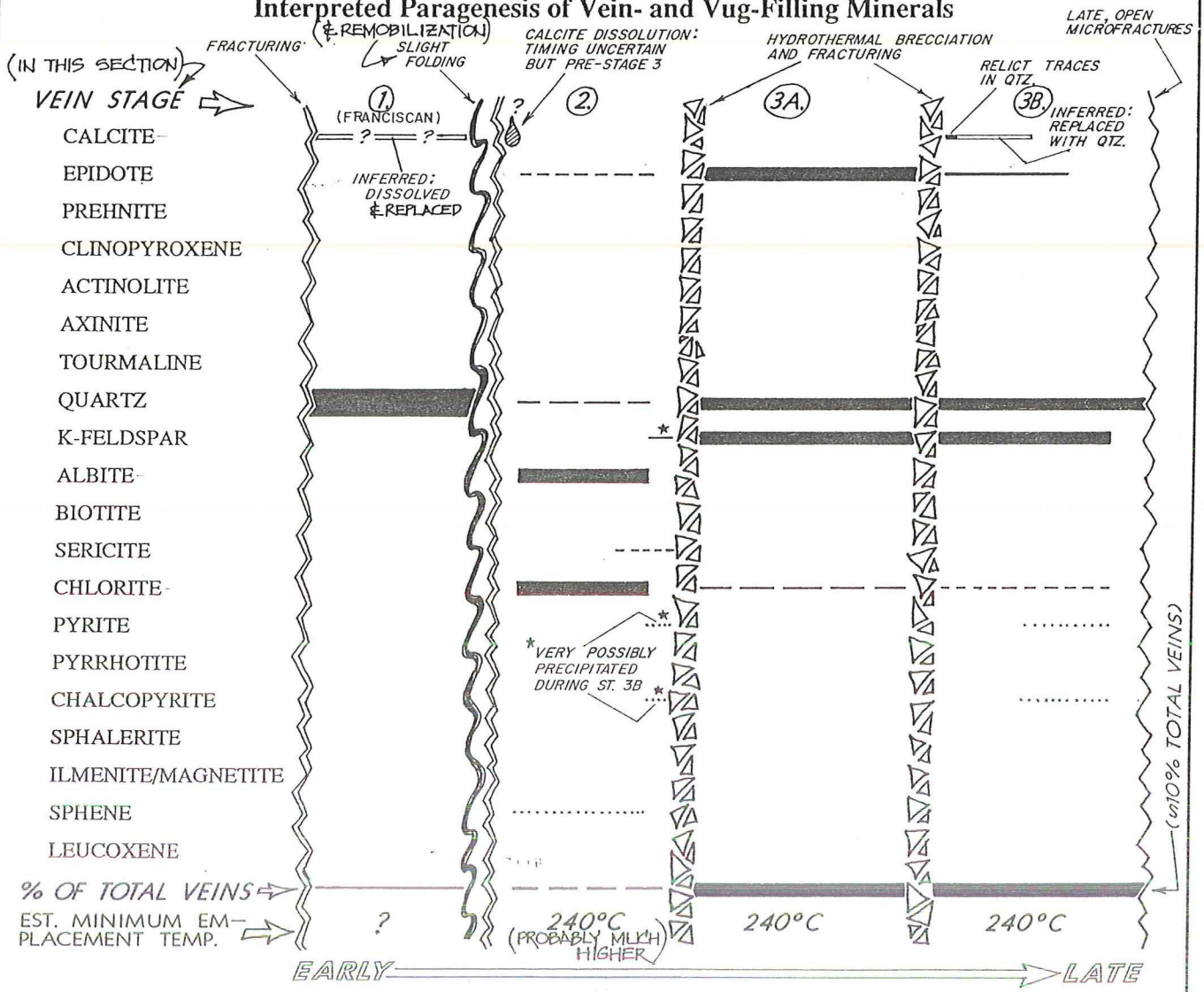
Fracturing/Brecciation/Veining and Vug-Filling OBVIOUS "JIG-SAW PUZZLE" BRECCIA VEIN POSS. DEVELOPED ALONG TECTONIC FRACTURE WHICH DISPLACED ARGILLITE AGAINST GRAYWACKE; THIS BRECCIA AND THE VEIN STOCKWORK WITH WHICH IT IS ASSOCIATED ARE OF HYDROTHERMAL ORIGIN; 3 OBVIOUS GENERATIONS OF VEINLETS THE LATTER WITH 2 SUB-STAGES; MINOR LATE MICROFRACTURING; ~10-11% SECONDARY MINERALS

Porosity Summary EST. <0.5% ROCK IS TIGHTLY-SEALED BY SECONDARY MINRLS. MOST Φ IS AS LATE, OPEN MICROFRACTURES.

Alteration/Metamorphism AFTER ORIGINAL GREENSCHIST-GRADE MET. (ILLITE-CHL-ALBITE) MINOR SILICIFICATION & K-SPAR, CHLTZ., DISS. EPIDOTE RELATED TO EMPLACEMENT OF STAGE ③ VEINLETS & BRECCIA CEMENTS.

Fluid Inclusions (RECONN.) ABUNDANT IN STAGE ③ QTZ., MOSTLY VAPOR-DOMINANT, <1-10μ IN DIAMETER; FEW LIQ-DOM. ARE L/V ≈ 3/1 (EST T_h ~ 260°C); ABUND. INCLUSIONS IN STAGE ③ K-FSP, BUT MOSTLY VAPOR-RICH & <2μ DIA.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS % OF TOTAL VEINS).

..... trace	———— > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	———— > 5-15%	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDHS-7, SMPL. (4)	JEFF HULEN 01/23/91

Rock Type SCHISTOSE, ARGILLACEOUS, POORLY-SORTED, V. FINE- TO COARSE-GRAINED LITHIC METAGRAYWACKE; ARGILLITE AT ONE END OF SECTION; IN GRW, COMMON, ELONGATE, METASHALE CLASTS.

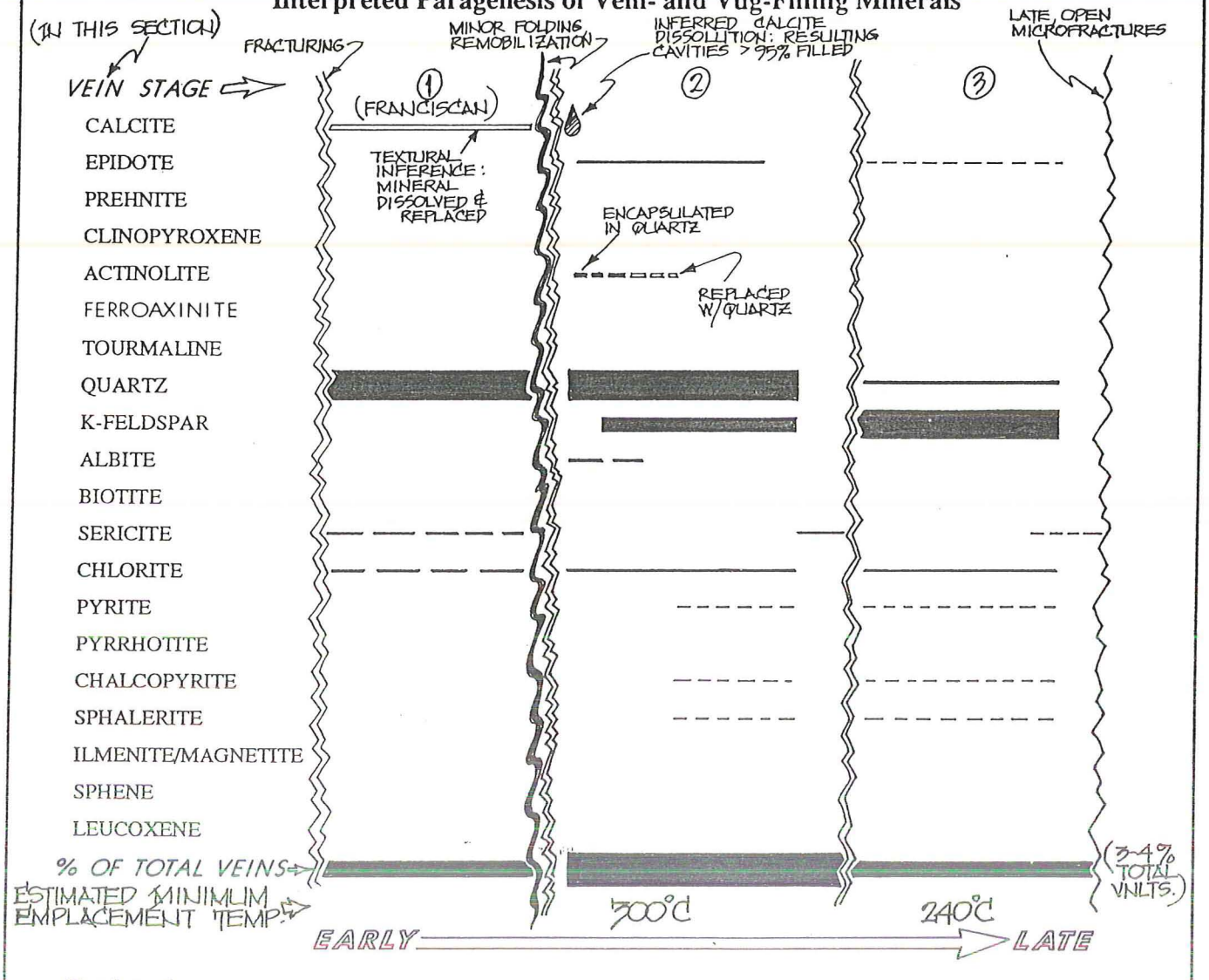
Fracturing/Brecciation/Veining and Vug-Filling
3-4% TOTAL VEINLETS; CONTORTED, REMOBILIZED FRANCISCAN VEINS CONCENTRATED IN ARGILLITE AT ONE END OF SECTION; YOUNGER VEINLETS V. ±-APPEARING, CHANGE STRIKE ABRUPTLY (HYDRAULIC FRACTURING?)

Porosity Summary 2-1.5%; ± INTERXLN. VOIDS IN ST. 2 VEINLETS; ϕ IN LAYER SILICATES, CHERT, VRF'S; LATE, OPEN MICROFRACTURES.

Alteration/Metamorphism
POORLY-DEVELOPED, PATCHY, THIN SELVAGES OF KSP±QTZ, EP. ADJACENT TO ST. 2 VEINLETS; MINOR DISS. EPIDOTE & LEUCOXENE.

Fluid Inclusions SUPER-ABUNDANT IN ST. 2 QTZ & KFSP, IN THE LATTER COMMONLY ACCOUNTING FOR 3% OF THE MINERAL; IRREG., <1-10μ (AVG. 2μ) DIAMETER, DOM. VAP.-RICH; RARE, NON-NECKED OR LEAKED LIQ-RICH INCL'S HAVE L:V ≈ 3/1

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

..... trace	— — — — > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDHS-7, SMPL.(5)	JEFF HULEN 01/23/91

Rock Type HIGHLY ARGILLACEOUS, SCHISTOSE, V.F.-M. GR. LITHIC METAGRAYWACKE, RICH IN DETRITAL BTE; LOCALLY HIGHLY SHEARED

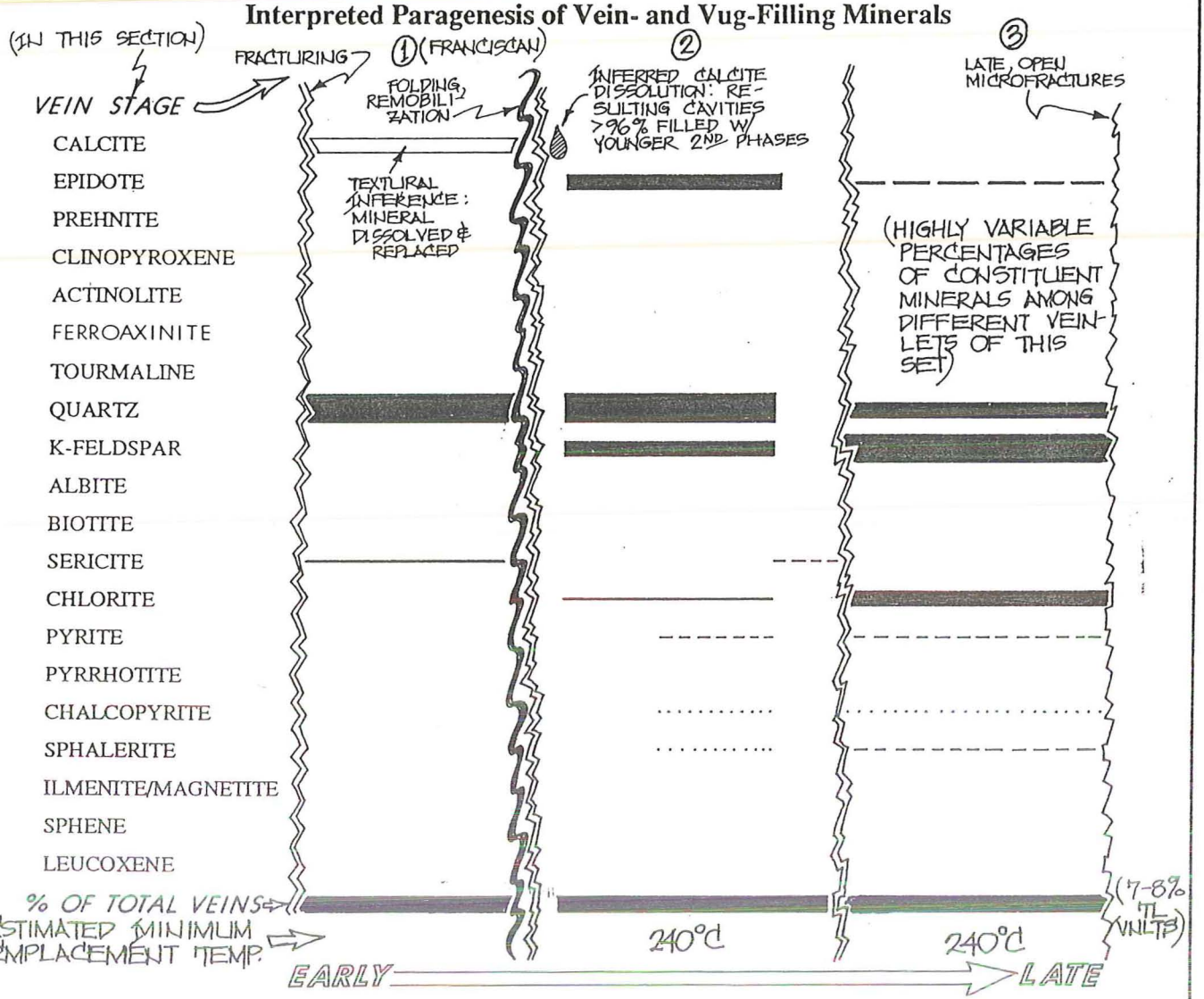
Fracturing/Brecciation/Veining and Vug-Filling COMPLEXLY VEINED, 7-8% TL VNLTS. INCL. CONTORTED, REMOBILIZED, REMINERALIZED, FRANCISCAN(?) QTZ. VNS; SOME STAGE 2 & 3 VNLTS CLEARLY EMPLACED ALONG SHEARED FRACTURE SETS; ST. 3 VNLTS COMMONLY AT HIGH ∠ TO BEDDING, SUB-//, ∠0.15 MM. WIDE

Porosity Summary 1-1.5% MOSTLY LATE, OPEN μFRX.

Alteration/Metamorphism
SELVAGES ADJACENT ST. 2 VNLTS; REPL. OF WALLROCK W/μXLN. EPIDOTE, KFSP, QTZ; ALSO MINOR DISS. EP. & LEUCOXENE THROUGHOUT.

Fluid Inclusions ABUND. IN ST. 2 QTZ & KSP, DOM. VAP-RICH, BUT RARE LIQ-RICH W/L:V ≈ 3/1 (<1-10 [AVG. 2μ] DIA.; IRREG.)
ALSO ABUND. IN ST. 3 KFSP, BUT >99% <10 DIA., & VAPOR-RICH

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDHS-7, SMPL. (6)	

Rock Type ½ THE SLIDE IS SCHISTOSE, ARGILLACEOUS, V. FINE- TO MEDIUM-GRAINED LITHIC METAGRAYWACKE; REMAINDER IS HIGHLY SHEARED, TECTONICALLY INTERLAM., ORGANIC-RICH SILTY ARGILLITE

Fracturing/Brecciation/Veining and Vug-Filling 6-7% VEINS; OLDER, CONTORTED, REMINERALIZED FRANCISCAN VEINLETS; YOUNGER QTZ-KF-EP-CHL VNLTS & MASSES (THE LATTER SEEMINGLY DEPOSITED IN VOIDS CREATED BY DISSOLUTION OF FRANCISCAN CALCITE)

Porosity Summary 1.5-2% ± INTERXLN VOIDS IN ST. 2 VNLTS; ND IN LAYER SIL. AGGREGATES, CHERT, VRF'S; LATE, OPEN μFRX.

Alteration/Metamorphism
STAGE 2 VNLTS. HAVE PROMINENT, IRREGULAR, DISCONTINUOUS, μXLN TO FINE-XLN. EPIDOTE SELVAGES; PATCHY, LOCAL REPLACEMENT OF MATRIX AS WELL AS FRAMEWORK PLAG. & VRF'S; PERVASIVE, MINOR, DISS. EPIDOTE & LEUCOXN.

Fluid Inclusions MYRIAD <1μ 2ND VAPOR-RICH INCLUSIONS IMPART A GALLEY BROWNISH APPEARANCE TO FRANCISCAN QUARTZ; ABUND, AVG. 1.5-2μ DIA. VAP.-RICH INCL'S. IN STAGE 2 QTZ. & KFSP. → RARE, ASSOCIATED LIQ-RICH INCL'S. W/ L:V ≈ 3/1

Interpreted Paragenesis of Vein- and Vug-Filling Minerals

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL NEGU-17, SMPL. A (≈8539')	JEFF HULEN OCT. 23, 1990

Rock Type LITHIC METAGRAYWACKE

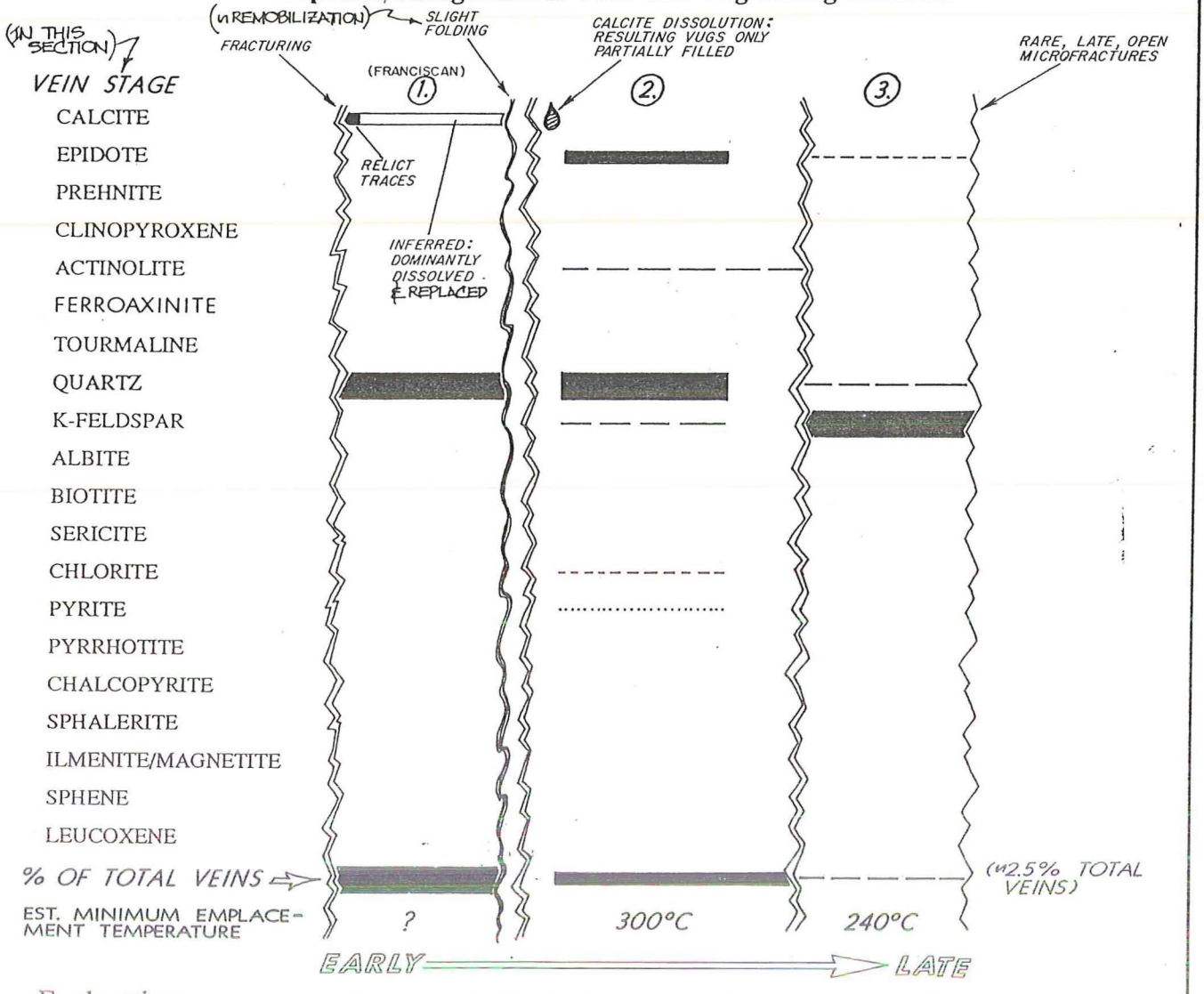
Fracturing/Brecciation/Veining and Vug-Filling ROCK IS SPARSELY VEINED (EST. ≈ 2.5% OF TOTAL THIN-SECTION AREA); 3 STAGES OF VEINING — EARLIEST IS FRANCISCAN; PROMINENT, PARTIALLY FILLED DISSOLUTION VUGS (DISSOLUTION OF STAGE 1 CALCITE)

Porosity Summary ≈3% ≈1.5% AS PARTIALLY-FILLED CALCITE-DISSOLUTION VUGS; REMAINDER AS MICRO-Φ & LATE, OPEN MICROFRACTURES

Alteration/Metamorphism PLAGIOCLASE SPARSELY SERICITIZED, LOCALLY ALT. TO K-FELDSPAR, EPIDOTE. DETRITAL BTE. ALT. TO CHL. + LEUCOXENE. WIDESPREAD DISS. EPIDOTE. 1-2% DISS. LEUCOXENE. PRIOR TO THIS, ORIGINAL ARGILLACEOUS MATRIX OF ROCK METAMORPHOSED TO (PRINCIPALLY) ILLITE & CHLORITE.

Fluid Inclusions (RECONN.) STAGE (2) QUARTZ HOSTS ABUND. VAPOR-RICH & LIQ.-RICH INCLUSIONS (BOILING INDICATED; LIQ./VAP. IN LIQ.-RICH INCLUSIONS ≈ 3/1 — EST T_h ≈ 275°C; INCLUSIONS <1-10μ DIAMETER

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	———— > 1-5%	▬▬ > 15-50%	
- - - - - - - - < 1% (vol.)	———— > 5-15%	▬▬ > 50%	

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL NEGU-17, SMPL. B	JEFF HULEN JAN. 14, 1991

Rock Type VERY FINE- TO COARSE-GRAINED, HYDROTHERMALLY VEINED, LITHIC METAGRAYWACKE

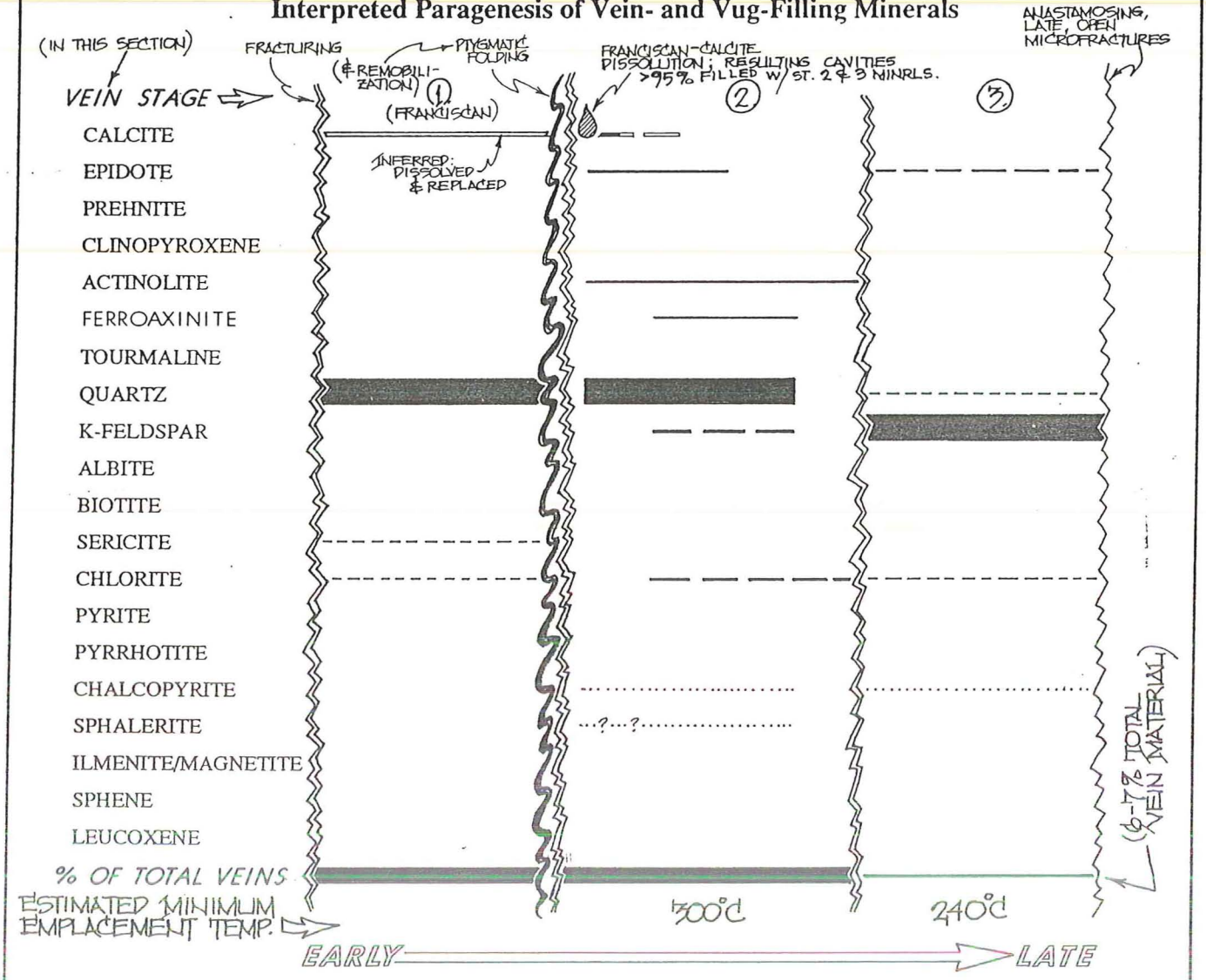
Fracturing/Brecciation/Veining and Vug-Filling 6-7% TOTAL VEIN MINERALS; OLDER, CONTORTED, FRANCISCAN (?) QTZ (-CAL) VNS FROM WHICH BULK OF CALCITE DISSOLVED—RESULTING VUGS INFILLED W/ LATER HYDROTH. PHASES.

Porosity Summary 2.5-3% DOM. INTERCRYST. VUGS IN STAGE 2 VNLTS. & MASSES; ALSO LATE, OPEN μ FRACTURES, "BRAIDED"

Alteration/Metamorphism MET. REXLZN. OF ORIGINAL ARGILLACEOUS MATRIX TO L-CHL-QTZ-ALBITE-LEUCOXENE; ∿1.5% DISS. EPIDOTE REPL. PLAG. & MATRIX; ∿1% DISS. LEUCOXENE; TR. DISS. TOURMALINE; MINOR MICROXLN. SILICA ADJACENT TO STAGE 2 VNLTS.; WEAK SERICITIZATION OF FRAMEWORK PLAGIOCLASE.

Fluid Inclusions
ABUND. IN STAGE 2 QTZ, <3μ, DOM. VAPOR-RICH, COMM. ROUNDED; RARE LIQ-RICH W/ L:V ≅ 2.5-3/1; INCLUSIONS IN ST. 3 KFSP. MOSTLY V-RICH, <1μ DIA., BUT A FEW 2-3μ PRIMARY VAPOR-RICH INCLUSIONS IN KFSP & ATTACHED TO STAGE 3 EPIDOTE.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

trace — > 1-5% — > 15-50%
< 1% (vol.) — > 5-15% — > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL NEGU-17, SMPL. C	JAN. 15, 1991 JEFF HULEN

Rock Type STRONGLY CRUSHED & SHEARED, INTENSELY HYDROTHERMALLY ALTERED & VEINED, VERY FINE- TO COARSE-GRAINED LITHIC METAGRAYWACKE

Fracturing/Brecciation/Veining and Vug-Filling 10-12% VEIN- & VUG-FILLING MINERALS; VEIN-CONTROLLING FRX. IN PART OF OBVIOUS TECTONIC ORIGIN (CRUSHING, SHEARING, MICRO-BRECCIATION); LATER VEINS HIGHLY POROUS.

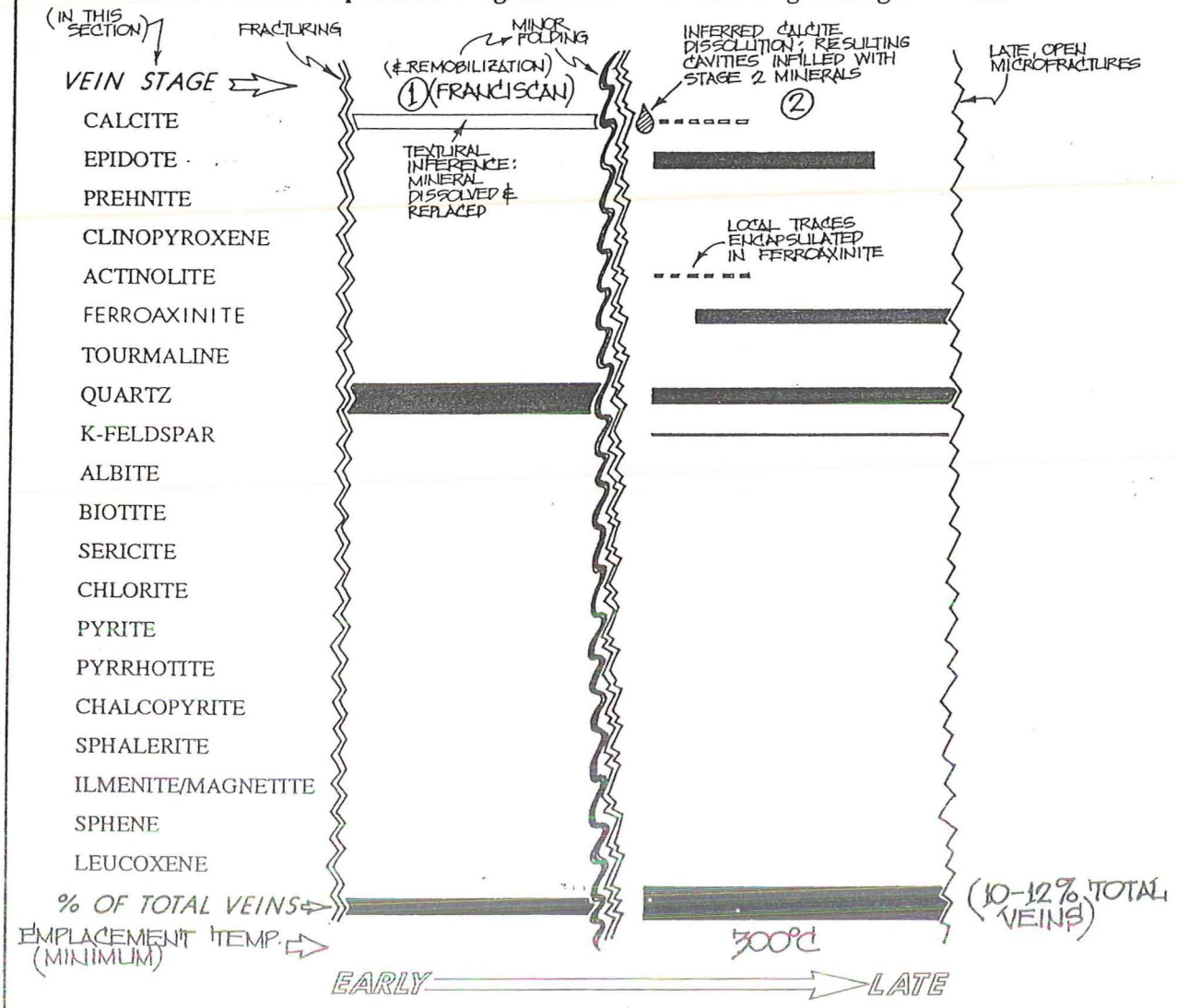
Porosity Summary ~5%, AS: ① ≠ INTERCRYSTALLINE VUGS IN STAGE 2 VEINLETS & MASSES; ② DISSOLUTION Φ IN FRAMEWORK FELDSPR; ③ UΦ IN 2ND QTZ-KFSP REPLACEMENTS, CHERT, LAYER SILICATE AGGREGATES

Alteration/Metamorphism WIDESPREAD ~VXLN QTZ-KFSP (± EP) REPLACEMENT OF MATRIX, ALSO PATCHY KFSP ALTN. & SPONGY-TEXTURED DISSOLUTION OF PLAG. IN FRAMEWK. GRAINS; ~4% DISS., ANH. EPIDOTE XLS. & XL. CLUSTERS UP TO 0.4 MM. IN DIA.; ~1% DISS., ~VXLN. LEUCOXENE; DETRITAL BTE. ALT. TO CHL. & LEUCOXENE.

NOTE: GOOD TEXTURAL EVIDENCE IN THIS SMPL. FOR DISSOLUTION OF FRANCISCAN CALCITE, INFILLING OF RESULTING CAV'S. W/ LATER 2ND MINRLS.

Fluid Inclusions ABUND. IN ST. 2 QTZ. <30, COMMONLY ROUNDED; MOSTLY VAPOR-RICH; SOME LIQUID-RICH W/ L:V ≈ 3/1

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	▬▬ > 15-50%	
- - - - - - - - < 1% (vol.)	——— > 5-15%	▬▬ > 50%	

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL NEGU-17, SMPL. D	JEFF HULEN JAN. 15, 1991

Rock Type INTERBEDDED & TECTONICALLY DEFORMED SILTY ARGILLITE & ARGILLACEOUS GRAYWACKE METASILTSTONE; MINOR ARG. LITHIC METAGRAYWACKE

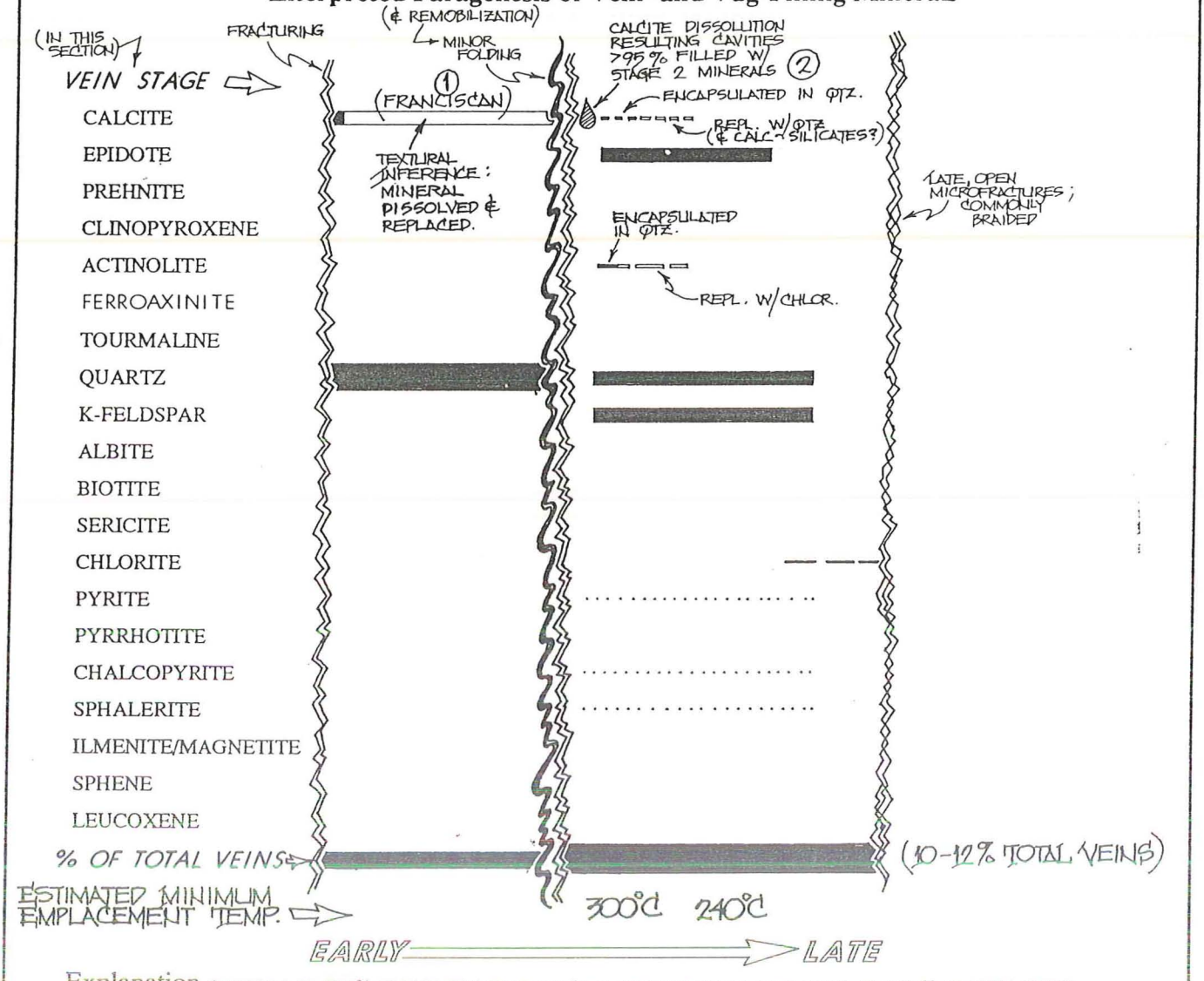
Fracturing/Brecciation/Veining and Vug-Filling PROMINENT HYDRAULIC-FRACTURE STOCKWORK W/ LOCAL "JIGSAW-PUZZLE" BXS, CEMENTED W/ 2nd PHASES (~10-12% OF ROCK); CALCITE DISSOLVED FROM FRANCISCAN VEINLETS; RESULTING CAVITIES INFILLED W/ LATER SECONDARY MINERALS (GREAT EXAMPLE)

Porosity Summary 2-2.5%; MOSTLY ± INTERXLN. VUGS IN STAGE 2 VEINLETS & MASSES; ALSO BRAIDED, LATE, OPEN MICROFRACTURES

Alteration/Metamorphism
WIDESPREAD, PATCHY, μXLN. QTZ-KFSP ± EP "FLOODING" ADJACENT TO & BETWEEN STAGE 2 VEINLETS; RELICT CALCITE FROM STAGE 1 VNLTS. & EARLY STAGE 2 CALCITE MOSTLY REPLACED WITH ST. 2 QUARTZ — THE CALCITE SURVIVES AS QTZ-ENCAPSULATED, <30-DIA., IRREGULAR FLAKES & SHREDS.

Fluid Inclusions
MYRIAD IN STAGE 2 QTZ & KFSP; <30 DIA., DOM. IRREGULAR, BUT SOME ROUNDED; ALL OBSERVED WERE VAPOR-RICH

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL SB-31, SMPL. G_h	JEFF HULEN JAN. 17, 1991

Rock Type SCHISTOSE, ARGILLACEOUS, LITHIC METAGRAYWACKE, V. FINE- TO CRS.-GRAINED, HIGHLY UNSORTED; SPARSELY VEINED; SCATTERED METASHALE/ARGILLITE STRINGERS & LENTICLES

Fracturing/Brecciation/Veining and Vug-Filling EXCLUDING DISCONTINUOUS QTZ-ILM/MAG. STRINGERS, ONLY ABOUT 1% VNLTS - THESE ARE IRREG.; ORIGIN OF FRX CONTROLLING THEM UNKNOWN.

Porosity Summary ∿1.5%; ANGULAR, INTERCRYSTALLINE VOIDS IN VNLTS, ASSOC. W/ CHL.; ∪Φ IN LAYER SIL. AGG., CHERT, & VRF'S; LATE ∪FRX.

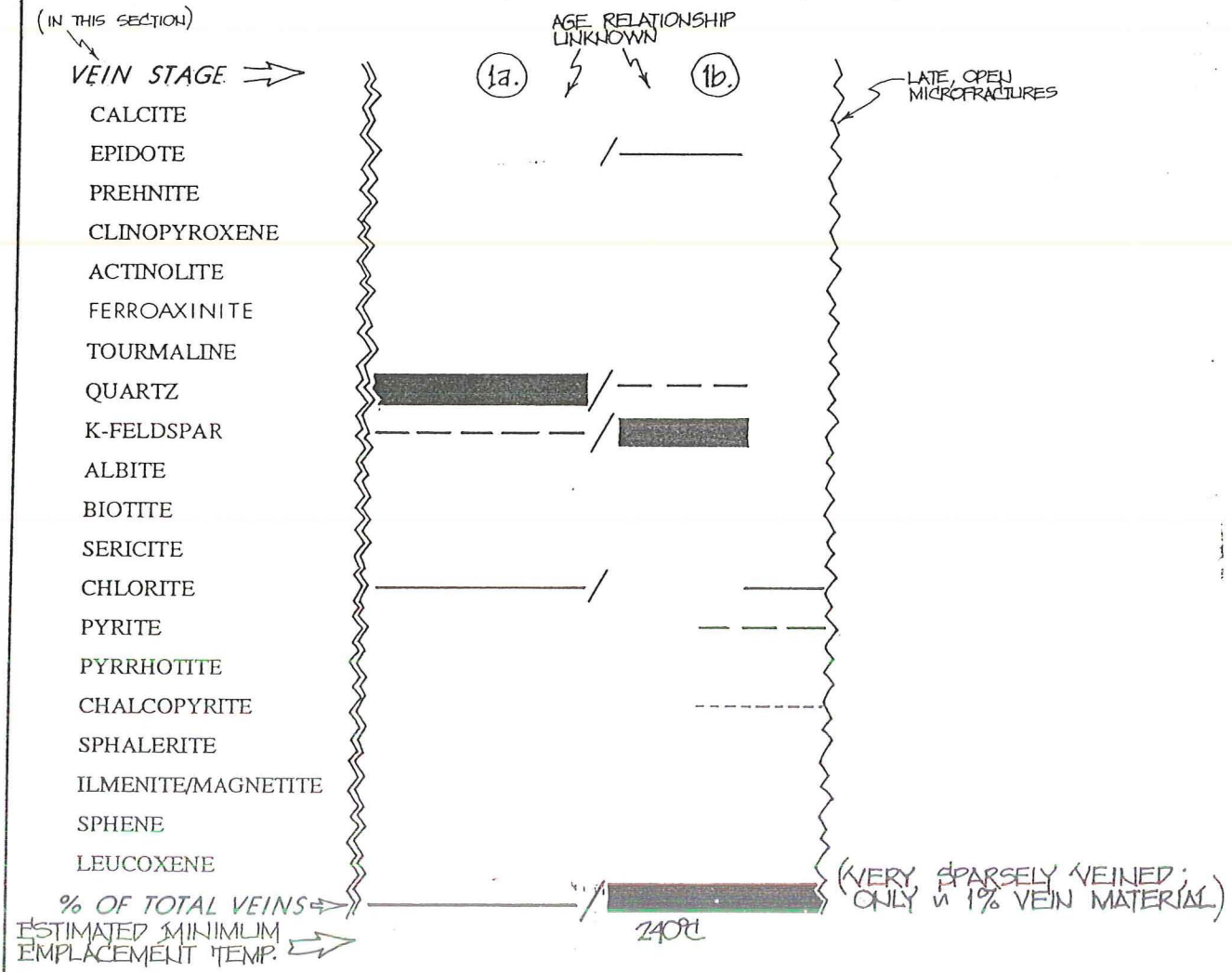
Alteration/Metamorphism

TR. DISS. EPIDOTE; TR. QTZ-KF REPL. OF MATRIX ADJACENT TO VEINLETS; CHLTZN. OF MUCH OF THE DETRITAL BTE.; MINOR SER. & TR. EP REPL. PLAG. IN FRAMEWORK GRAINS.

Fluid Inclusions

ABUNDANT IN VNLT. K-FELDSPAR; 98% VAPOR-RICH; AVG 1-1.5μ DIAMETER

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

..... trace	— — — — > 1-5%	▬▬▬ > 15-50%	
- - - - - - - - < 1% (vol.)	——— > 5-15%	▬▬▬ > 50%	

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL SB-31, SMPL. H_h	JEFF HULEN JAN. 19, 1991

Rock Type HYDROTHERMALLY VEINED & ALTERED, SCHISTOSE, ARGILLACEOUS, V.F.–M.GR., POORLY SORTED LITHIC METAGRAYWACKE

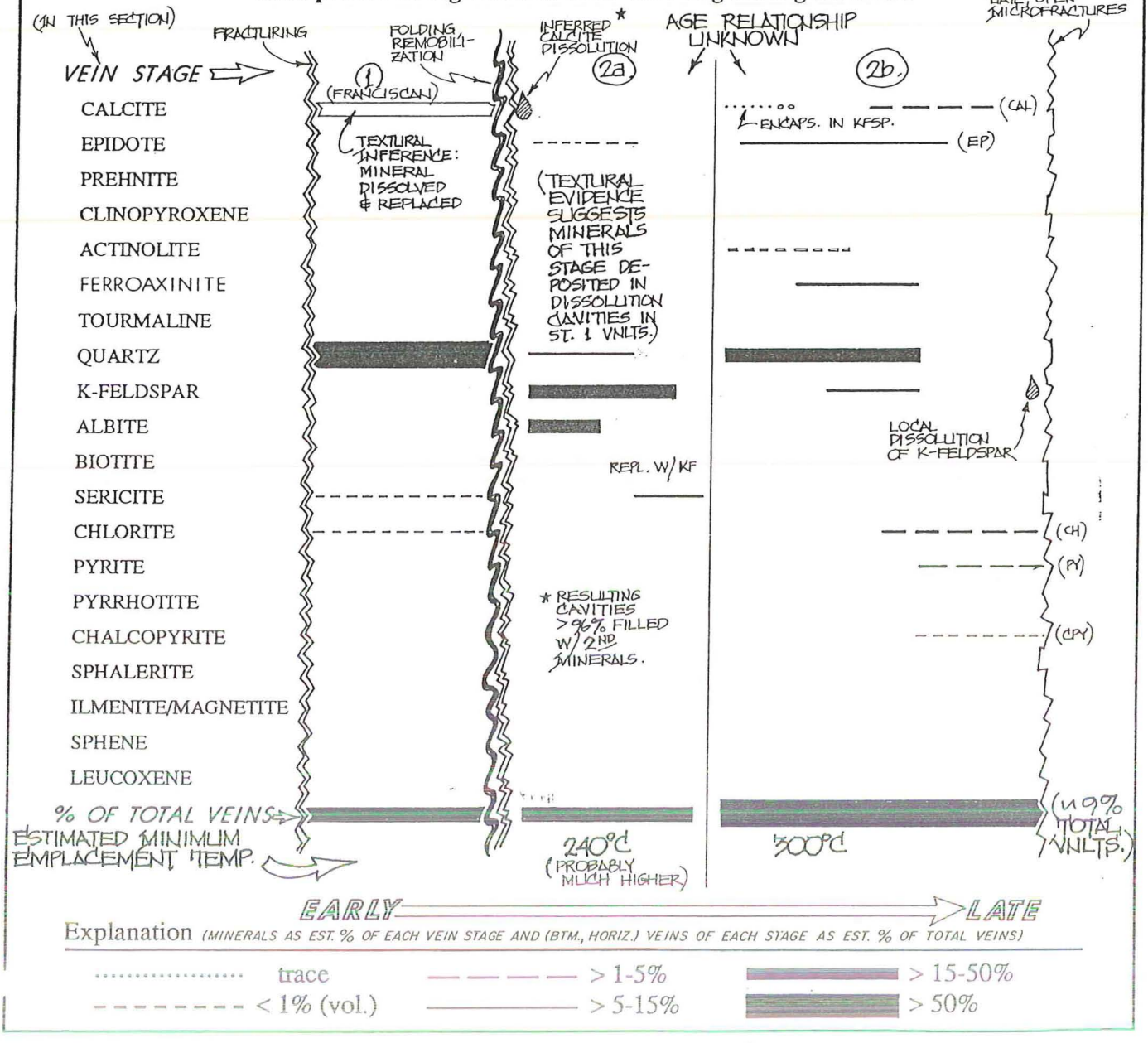
Fracturing/Brecciation/Veining and Vug-Filling ∪ 9% TL. VNLTS.· GOOD TEXTURAL EVIDENCE FOR DISSOLUTION OF CALCITE FROM EARLY, CONTORTED, FRANCISCAN VNLTS, THEN INFILLING OF RESULTING CAVITIES WITH YOUNGER 2ND PHASES; SOME ST. 3 VNLTS. CLEARLY EMPLACED ALONG SHEARED FRX.

Porosity Summary EST. 2-3% MOSTLY ∔ INTERXLN. VOIDS IN STAGE 3 VNLTS; ALSO ∪Ø IN LAYER SILICATES, CHERT, VRF'S

Alteration/Metamorphism
KFSP-QTZ-EP-CHL "FLOODING" IN SELVAGES ADJACENT TO SOME STAGE 3 VNLTS.; IN THESE, ILLITE APPEARS TO HAVE BEEN DESTROYED; MINOR, PERVASIVELY DISSEMINATED EPIDOTE & LEUCOXENE.

Fluid Inclusions
ABUND. IN STAGE 2 MINRLS. ONLY VAPOR-RICH VARIETIES OBSERVED; AVG. < 2 μ DIA. STAGE 1 QTZ. HAS GAUZY APPEARANCE DUE TO MYRIAD ≤μ1 DIA., 2ND VAPOR-RICH INCLUSIONS.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace — — — — > 1-5% > 15-50%
- - - - - - - - < 1% (vol.) ——— > 5-15% > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL SB-31, SMPL. Ih	JEFF HULEN JAN. 18, 1991

Rock Type HYDROTHERMALLY VEINED, VERY FINE- TO MEDIUM-GRAINED, SCHISTOSE, ARGILLACEOUS LITHIC METAGRAYWACKE

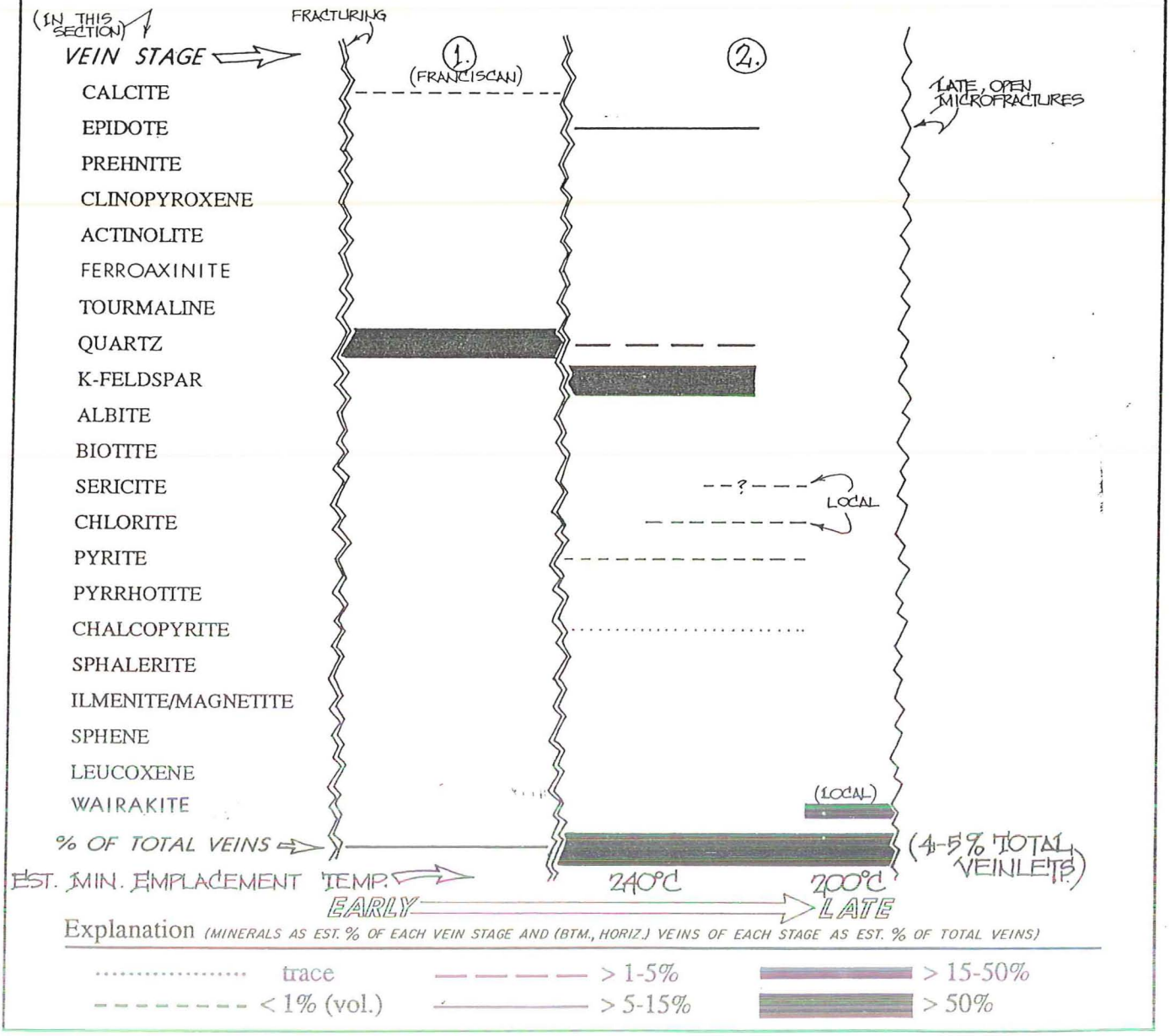
Fracturing/Brecciation/Veining and Vug-Filling 4-5% TOTAL VNLTS.; CONTROLLING FRACTURES OF BOTH TECTONIC & HYDRO-THERMAL ORIGIN; LOCAL "JIGSAW-PUZZLE" μBRECCIAS; DOMINANT VEINLETS ARE KFSP ± EP, WAIRAKITE

Porosity Summary EST. 1.5-2% 3 INTERXLN. VUGS IN ST. 2 VNLTS; μΦ IN LAYER SIL. AGGR., CHERT; LATE, OPEN μFRACTURES

Alteration/Metamorphism
μ1.5% DISSEMINATED EPIDOTE, ANH. GRAINS & GRAIN AGGREGATES < 0.07 MM. DIA.; V. LIMITED KFSP "FLOODING" ADJACENT TO STAGE 2 VNLTS.; WEAK SERICITIZATION OF PLAG. IN FRAMEWORK GRAINS; μ1% DISS. ILM/MAG, PARTLY REPLACED W/μXLINE LEUCOXENE.

Fluid Inclusions IN ST. 2 KFSP: ABUND. (UP TO 4 vol.%) VAP.-RICH. INCL., AVG. μ 3μ DIA (UP TO 25μ LONG) → RARE, ASSOC. LIQ-RICH, INCL'S. UP TO 14μ DIA., W/L:V = 3-4/1; IN ST. 2 WAIRAKITE- MOD. ABUND., ROUNDED, SUBEQUANT, VAPOR-RICH INCL.'S <1-4μ DIA; NO USEABLE INCL'S. FOUND IN EPIDOTE.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL SB-31, SMPL. J_h	JEFF HULEN JAN. 18, 1991

Rock Type INTERBEDDED AND (LOCALLY) TECTONICALLY INTERLAMINATED ARGILLITE; SILTY ARGILLACEOUS LITHIC METAGRAYWACKE; & ARGILLACEOUS GRAYWACKE METASILTSTONE; OBVIOUS GRADED BEDDING; ONE SS. BED W/ ORGANIC-RICH W/ OBVIOUS CELLULAR PLANT(?) DEBRIS.

Fracturing/Brecciation/Veining and Vug-Filling EST. 6-7% TOTAL VNS.; MANY OF THESE EMPLACED ALONG OBVIOUS SHEAR ZONES; OTHERS ARE COMPOSITE, FORMED BY REFRACTURING, RE-MINERALIZATION OF DISCONTINUOUS QTZ-ILM/MAG STRINGERS

APPEAR LIKE THIS ⇨  ILM/MAG → RELICT & LATER VEIN QTZ, VEIN KFSP ± EP

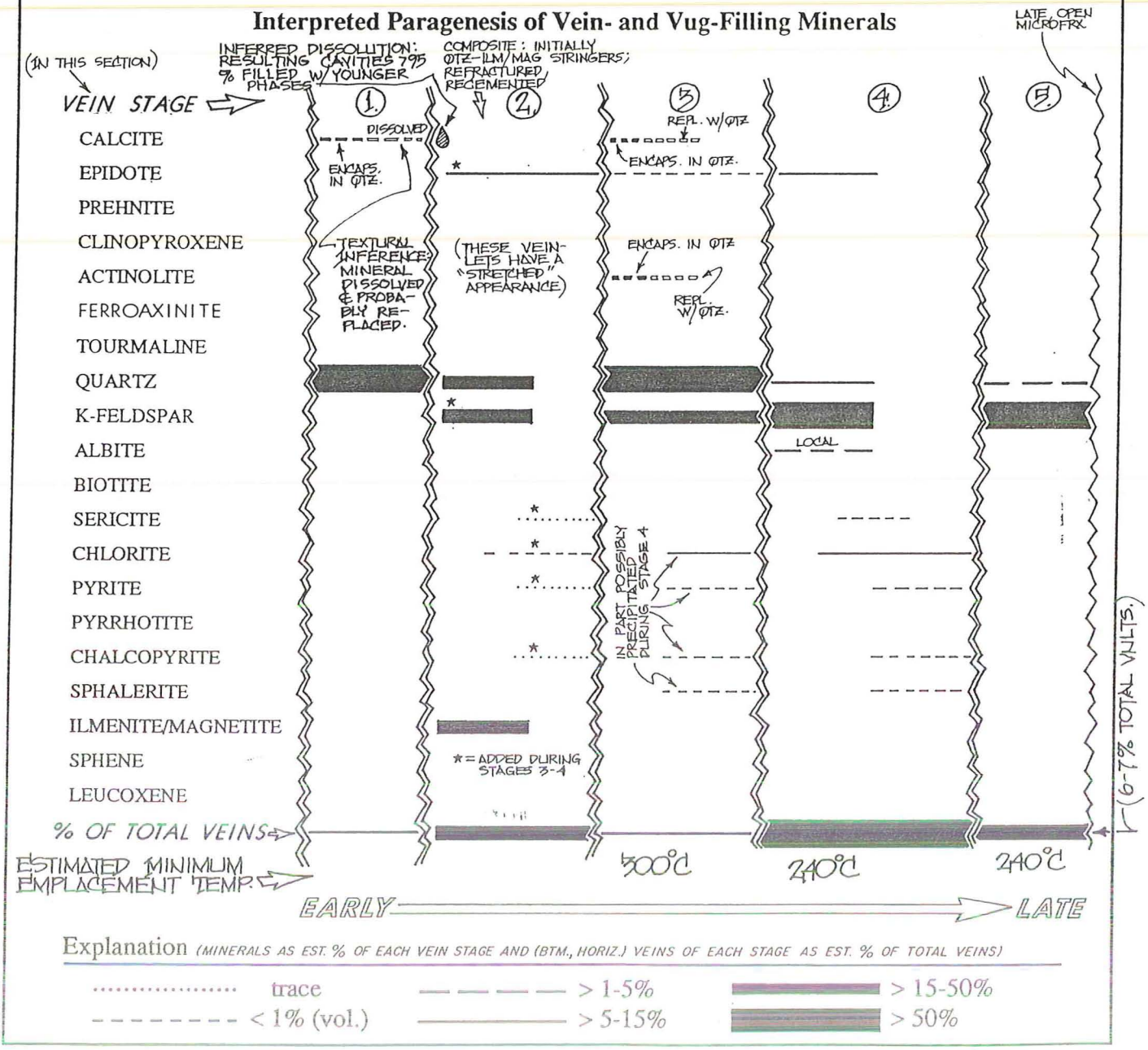
Porosity Summary ~ 1.5% 3 INTERXLN. VUGS IN ST. 3, 4, & 5 VNLTS; ∪Φ IN LAYER SILICATE AGGREGATES, CHERT, VRF'S; LATE, OPEN ∪ FRX.

Alteration/Metamorphism EXTENSIVE REPLACEMENT & INFILLING OF PORES IN PLANT DEBRIS W/ STAGE 4(?) MINERALS (AT ANY RATE, KFSP, QTZ, EP); LOCAL, MINOR KFSP "FLOODING"; 0.5-1% DISS. EPIDOTE; 1-1.5% DISS. LEUCOXENE ± ILM/MAG.

Fluid Inclusions

ABUND. VAPOR-RICH INCLUSIONS IN STAGE 3-5 K-FELDSPAR; AVG. ~ 1.5μ LENGTH OR DIA; IRREGULAR TO CRUDELY PRISMATIC; RARE LIQ-RICH INCL. W/ L:V ~ 3/1 (BOILING INDICATED)

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	——— > 1-5%	▬▬ > 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%	▬▬ > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL SB-31, SMPL. K_h	JEFF HULEN JAN. 19, 1991

Rock Type SCHISTOSE, ARGILLACEOUS, V. POORLY SORTED, V. FINE- TO MED.-GR. LITHIC METAGRAYWACKE

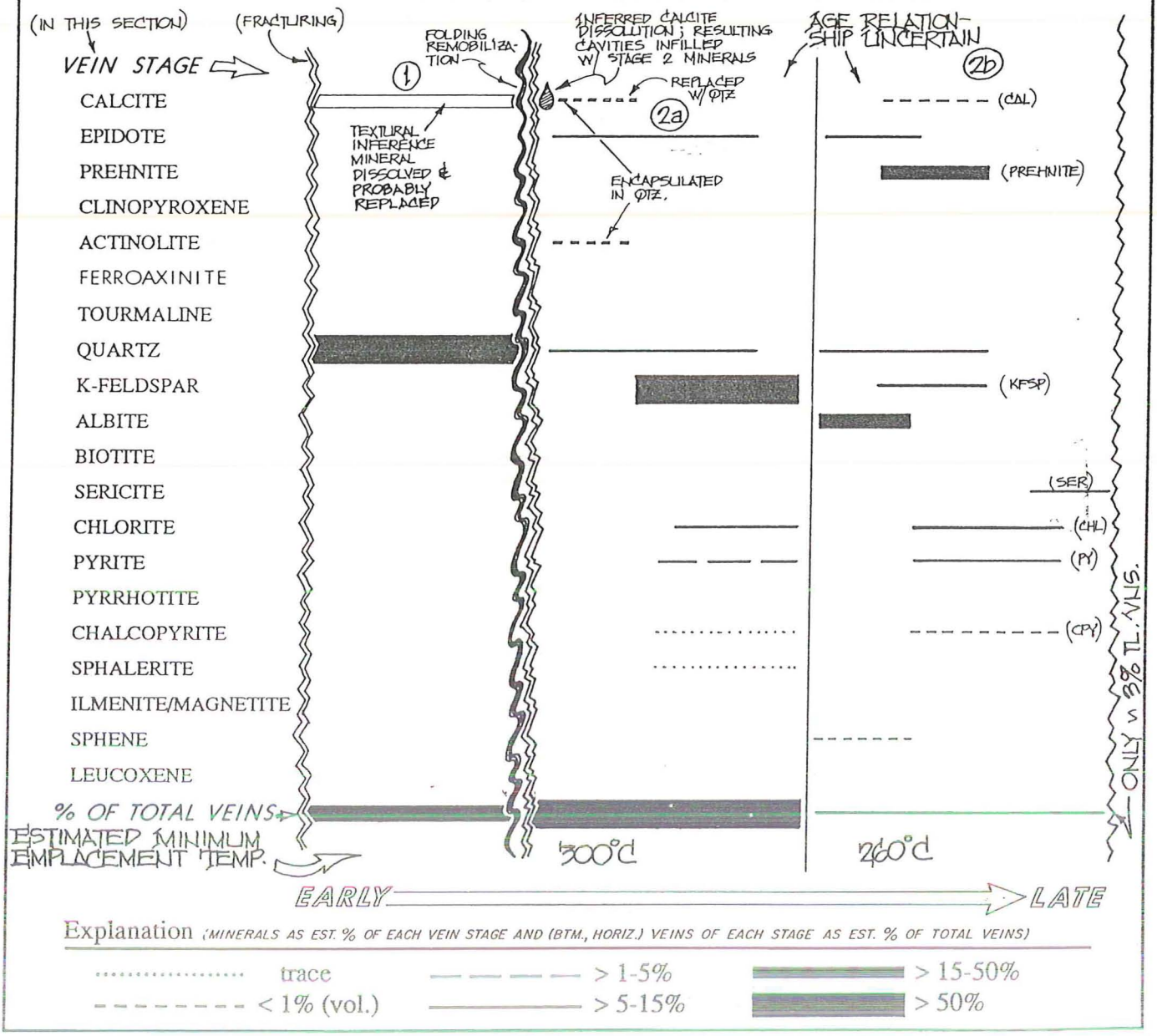
Fracturing/Brecciation/Veining and Vug-Filling ∿3% VNLTS.; EARLY, FRANCISCAN-AGE VNLTS. CONTORTED, REMOBILIZED; CAL. IN THESE DISSOLVED; MANY LATER VNLTS. CLEARLY EMPLACED ALONG SHEARED FRACTURES (TECTONIC ORIGIN)

Porosity Summary EST. 1.5-2% & INTERCRYSTALLINE VOIDS IN ST. 2 (ESP.) & 3 VNLTS; LATE, OPEN, ∿FRX; ∿Φ IN CHERT, VRFS, LAYER SIL. AGGR.

Alteration/Metamorphism SCATTERED FRAMEWORK GRAINS HAVE BEEN COMPLETELY DISSOLVED, LATER INFILLED W/KFSP, QTZ, SULFIDES, EPIDOTE; PLAG. IN FRAMEWORK GRAINS VARIOUSLY ALTERED TO DISS. SERICITE, CALCITE, EP→ ALSO LOCALLY IRREG. REPLACED W/KFSP. & SULFIDES; SOME PLAG. DISSOLVED TO YIELD SPONGY-TEXTURED ∿Φ; DETRITAL BTE. EXTENSIVELY ALTERED TO CHLOR. & LEUCOXENE; ∿1½% DISS. LEUCOXENE.

Fluid Inclusions
IN STAGE 2 & 3 MINRLS, MANY BUT >95% VAPOR-RICH; NO UNAMBIGUOUS PRIMARIES; ST. 3 ALBITE V. "DIRTY"-APPEARING DUE TO 4% V-RICH INCLUSIONS; RARE LIQ-RICH INCLUSIONS IN STAGE 3 QTZ HAVE L/V ≈ 3:1.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL SB-31, SMPL. Lh	JEFF HULEN JAN. 19, 1991

Rock Type HYDROTHERMALLY FRACTURED, BRECCIATED, & VEINED, SILTY ARGILLITE

Fracturing/Brecciation/Veining and Vug-Filling OBVIOUS HYDROTHERMAL BRECCIATION & FRACTURING, RESULTING OPEN SPACES FILLED/CEMENTED WITH KFSP/EP, FeAX ± WAIRAKITE; OLDER FRANCISCAN(?)-VINTAGE QTZ(-CAL?) VNLTS. CONSPICUOUSLY CONTORTED.

Porosity Summary 2% EST. MOSTLY ∠ INTERXLN. VOIDS IN ST. 2 VEINLETS

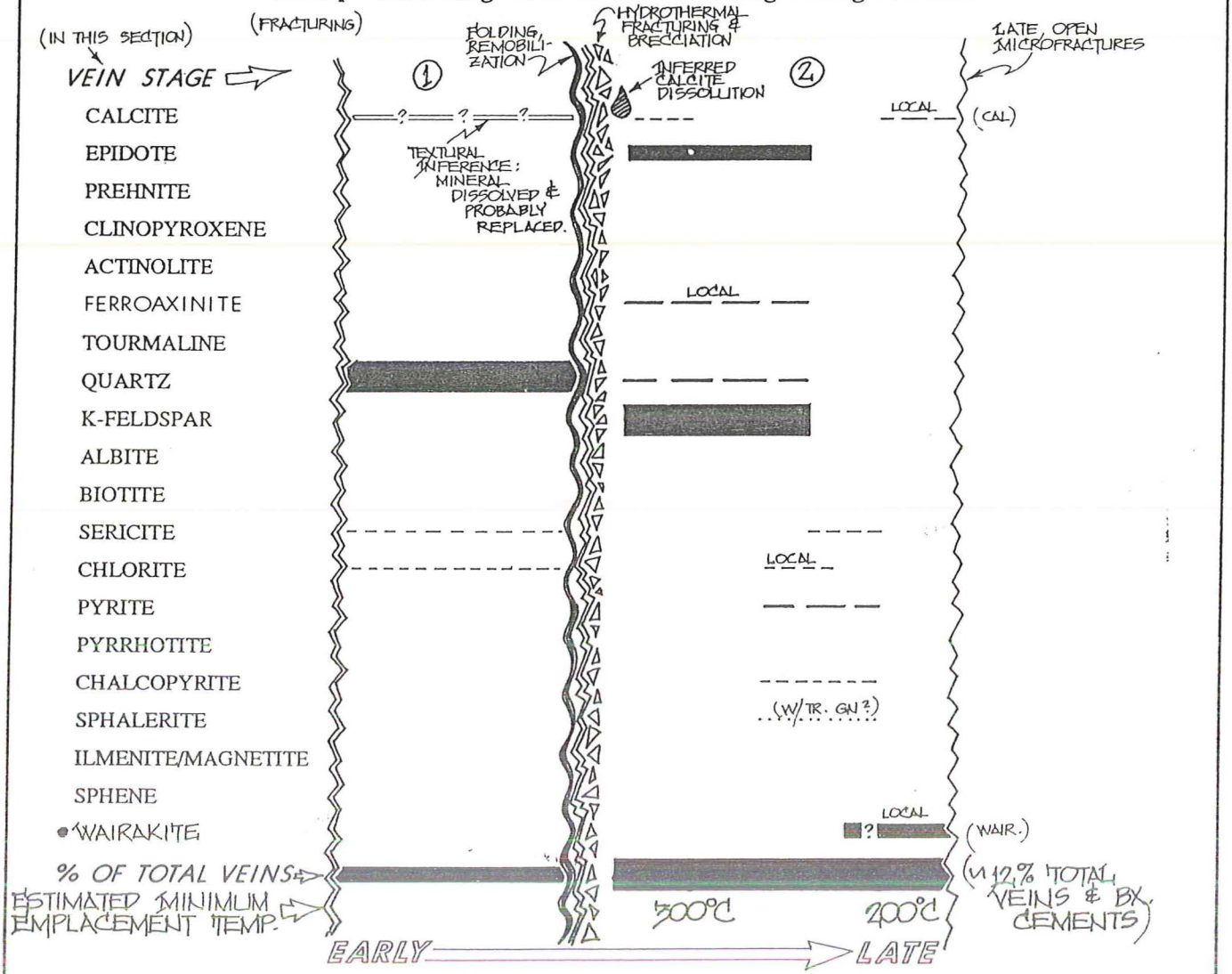
Alteration/Metamorphism

DIFFICULT TO SAY BECAUSE OF V. FINE GRAIN SIZE, BUT PROBABLE SELVAGES OF K-SPAR FLOODING ADJACENT TO STAGE 2 VNLTS.

Fluid Inclusions

ABUND. IN ST. 2 KFSP & WAIR., BUT APPARENTLY ALL VAPOR-RICH → THOSE IN WAIR. ARE SUBEQUANT, ROUNDED, AVG. ∠ 10 DIA.; NOTE THAT MYRIAD 2ND VAP-RICH INCLUSIONS IMPART A GALZY BROWNISH APPEARANCE TO ST. 1 QTZ IN TRANSM. LIGHT.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	> 15-50%	
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%	

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL SB-31, SMPL. M_h (≈3947.5')	JEFF HULEN, NOVEMBER 1, 1990

Rock Type LITHIC METAGRAYWACKE, MASSIVE, V.F.—MED. GR.

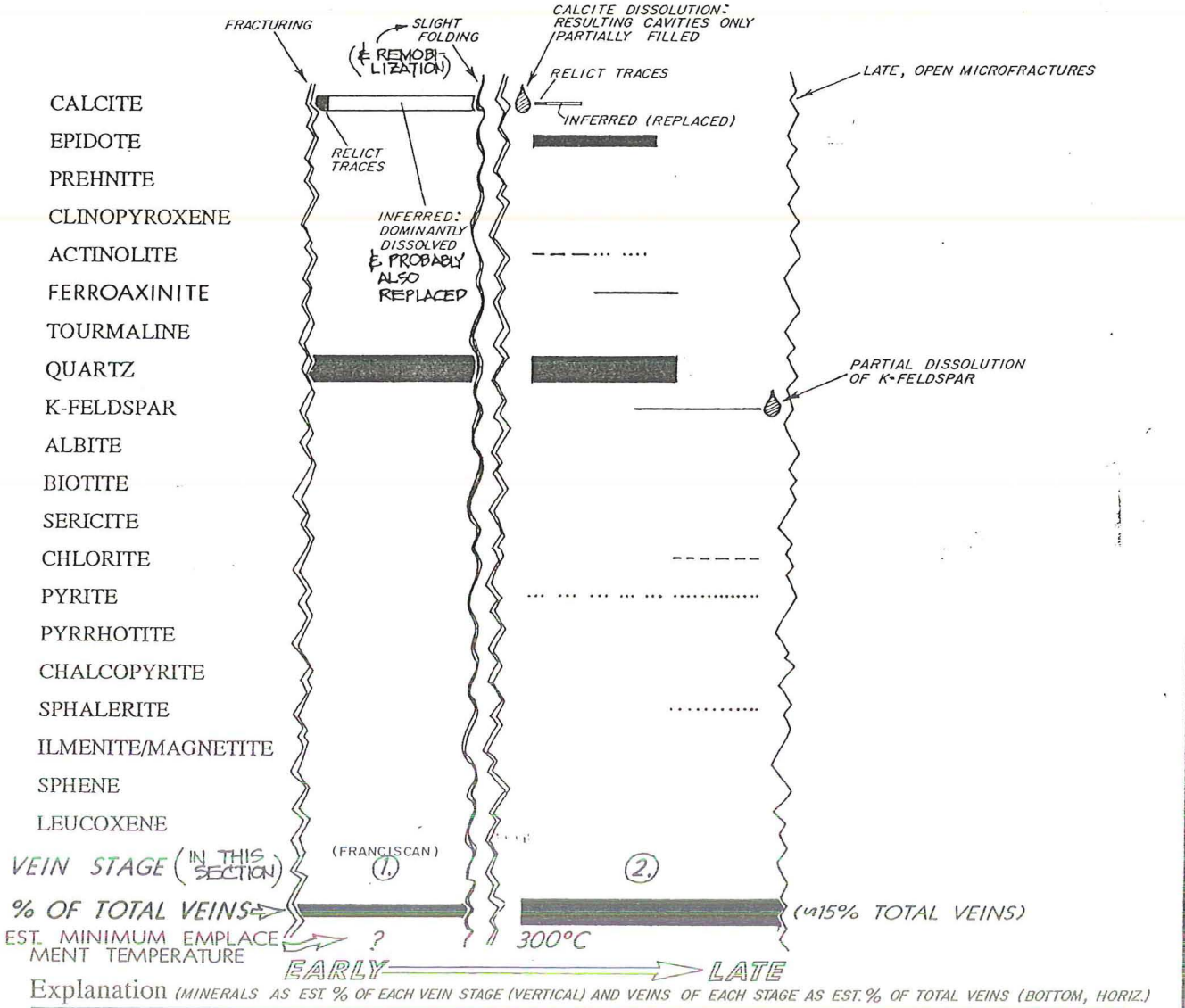
Fracturing/Brecciation/Veining and Vug-Filling ROCK IS INTENSELY VEINED (≈15% OF TOTAL THIN-SECT. AREA); STAGE ① CALCITE DISSOLVED, RESULTING VUGS ONLY PARTIALLY FILLED W/ STAGE ② MINRLS; MINOR LATEST-STAGE MICROFRACTURING

Porosity Summary ≈2% MOSTLY PRIMARY ANGULAR, INTERCRYSTALLINE VOIDS IN STAGE ② VEINS & VUG FILLINGS.

Alteration/Metamorphism
GREENSCHIST-GRADE METAMORPHISM OF ORIG. ARGILLACEOUS MATRIX TO ILLITE/CHLORITE/QTZ./LEUCOXENE/ALBITE(?); ≈4% DISS., HYDROTHERMAL EPIDOTE, PRESUMABLY RELATED TO STAGE ② MINERALIZATION; MINOR SILICIFICATION (& K-SPAR FLOODING?) ADJACENT TO STAGE ② VEINLETS.

Fluid Inclusions (RECONNAISSANCE) LIQ. & VAP.-RICH INCLUSIONS ABUND. IN STAGE ② QTZ. (BOILING INDICATED); LIQ/VAP. RATIOS AVG. ≈3/1 (EST. T_h ≈275°C); NO USABLE INCLUSIONS FOUND IN STAGE ② EPIDOTE OR FERROAXINITE; NO UNAMBIGUOUS PRIMARY INCLUSIONS FOUND.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL SB-31, SMPL. N_h	JEFF HULEN JAN. 20, 1991

Rock Type INTENSELY VEINED, SHEARED, ARGILLACEOUS LITHIC METAGRAYWACKE, V.F.-MED. GRAINED

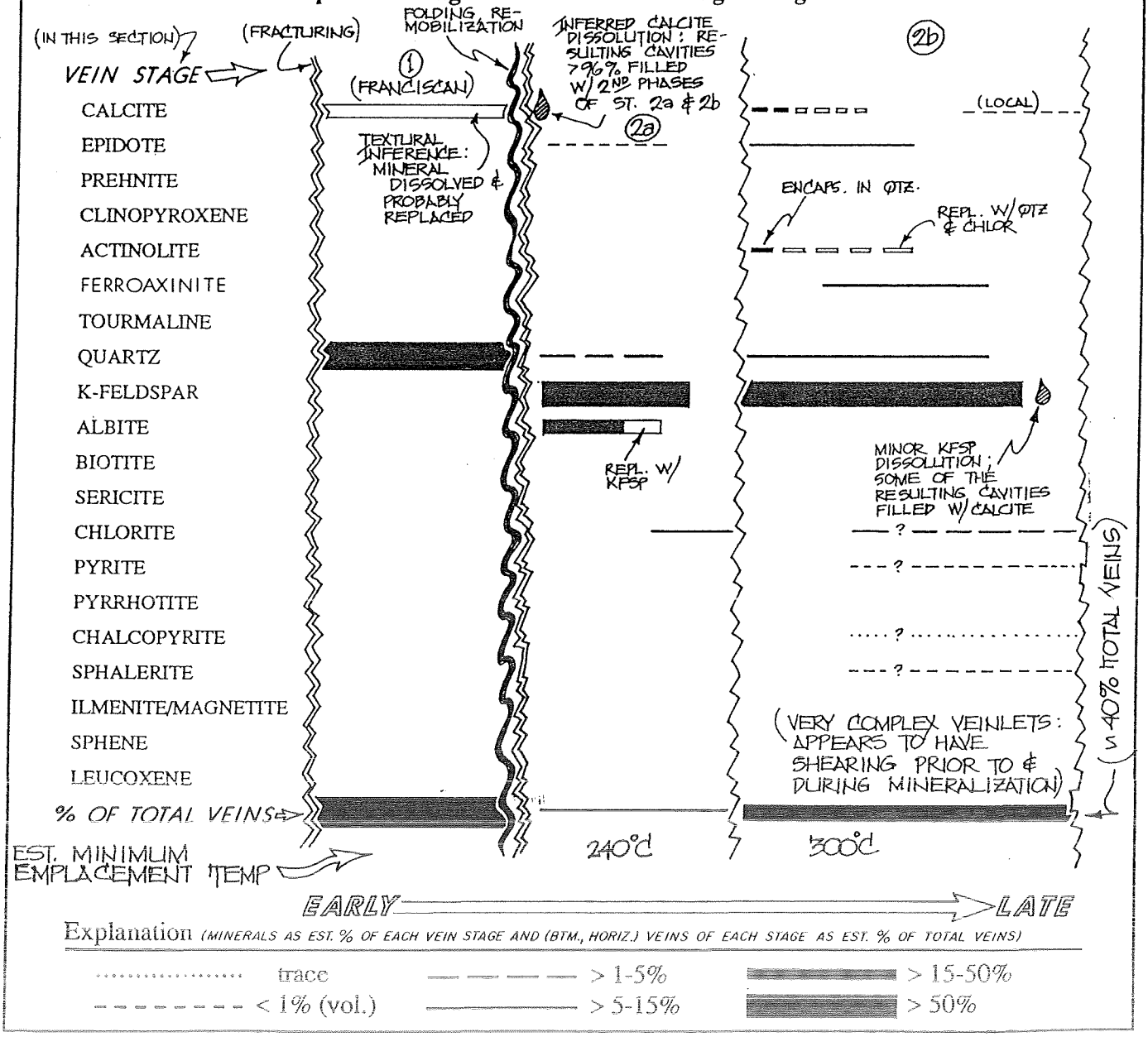
Fracturing/Brecciation/Veining and Vug-Filling 40% OF THE ROCK CONSIST OF VEINLETS & VUG-FILLINGS; MANY ARE CONTORTED FRANCISCAN(?) VNLTS. FROM WHICH CALCITE DISSOLVED, RESULTING CAVITIES INFILLED W/YOUNGER 2ND MIN'S.

Porosity Summary EST. 2.5-3%; MOSTLY ↓ INTERXLN. VUGS IN ST. 2 VNLTS; ALSO ↓ IN LAYER SIL. AGG.; LATE, OPEN ↓FRX.

Alteration/Metamorphism MASSIVE REPLACEMENT OF WALL-ROCK ADJACENT TO STAGE 2 VNLTS. & MASSES WITH KFSP, QTZ, EPIDOTE, CHL (ILLITE GONE); IN VNLTS → ALBITE IN EARLY ST. 2 ALBITE-KSPAR CLOTS REPLACED BY YOUNGER K-SPAR.; EARLY ST. 2 ACTINOLITE IS REPLACED BY CHLORITE; MINOR DISS. EPIDOTE & LEUCOXENE

Fluid Inclusions
ABUND. IN STAGE 2 MINRLS.; >99% VAPOR-RICH; RARE L-RICH INCL'S HAVE L/V ≈ 3/1. BEST, MOST USABLE INCLUSIONS IN STAGE 2 QTZ.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDCF-15D-28, SMPL. A	JEFF HULEN, NOV. 28, 1990

Rock Type FINE-MED. GR., MASSIVE TO CRUDELY FOLIATED, LITHIC METAGRAYWACKE

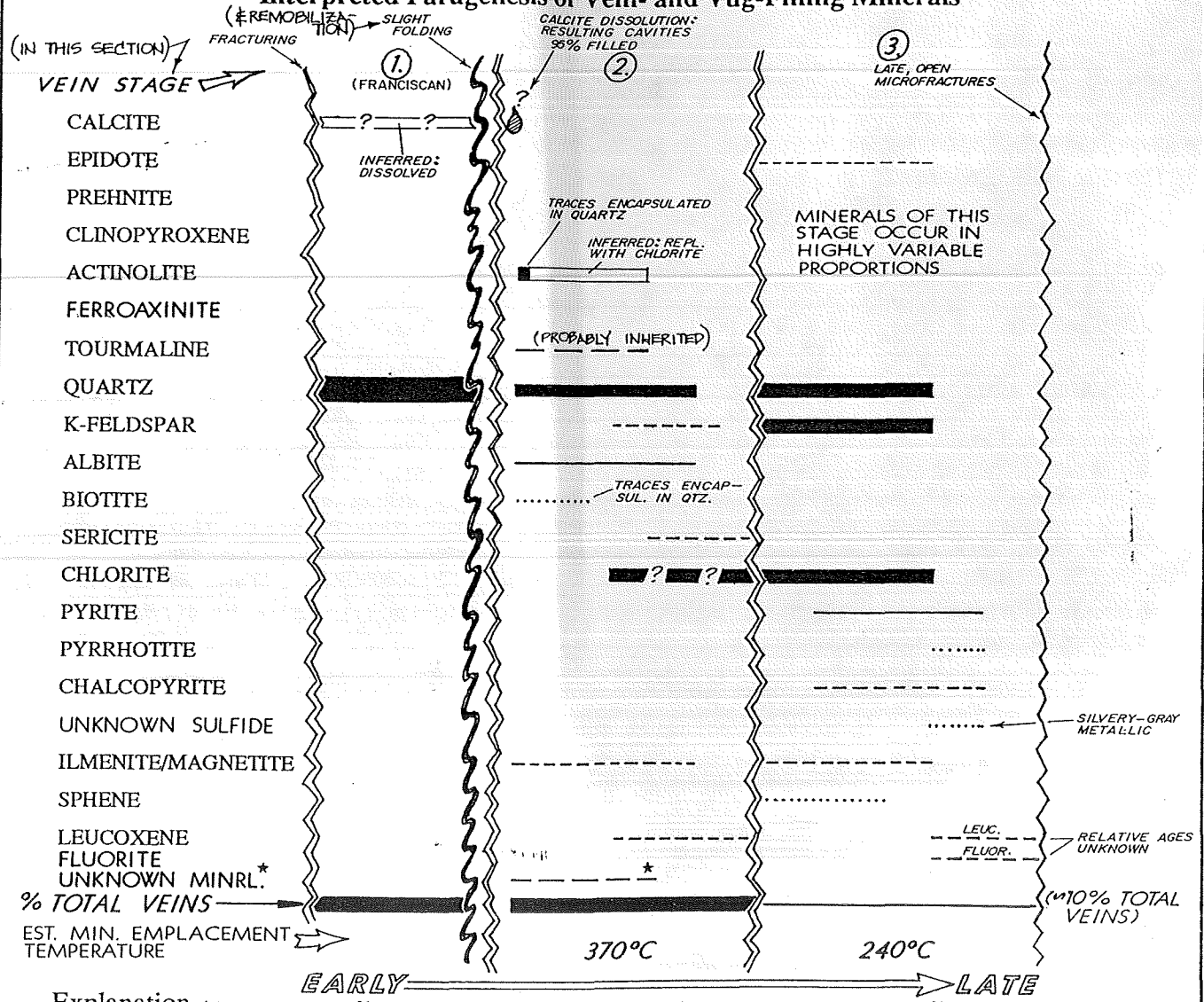
Fracturing/Brecciation/Veining and Vug-Filling ROCK IS INTENSELY STOCKWORK VEINED (≈10% OF ROCK); 3 OBVIOUS VEIN STAGES; YOUNGER VEINS COMMONLY FOLLOW OLDER ONES (CONFUSING COMPOSITE VEINS); A FEW LATEST-STAGE OPEN MICROFRACTURES BOTH X-CUT & // VEINS.

Porosity Summary ≈0.5%; A FEW INTERCRYSTALLINE VOIDS IN STAGE ② & ③ VEINS; MINOR OPEN ∥FRX; MINOR ∥D IN LAYER SILICATE AGGREGATES

Alteration/Metamorphism GREENSCHIST-GRADE METAMORPHISM OVERPRINTED BY HYDROTHERMAL ALTERATION: 1-2% DISS. LEUCOXENE (MET.?); 5-7% (LOCALLY 10%) DISS. IRREG. CLOTS & PARTIAL ROSETTES OF TOURMALINE; WEAK SERICITIZATION OF FRAMEWORK PLAG.; NEAR-TOTAL CHLORITIZATION OF STAGE ② ACTINOLITE; SILICIFICATION OF WALLROCK ADJACENT TO STAGE ② & ③ VEINLETS.

Fluid Inclusions ABUND LIQ-RICH & VAPOR-RICH IN STAGE ② QTZ., BUT VAP-RICH DOMINANT; LIQ-RICH L/V ≈ 3/1; NO UNAMBIGUOUS PRIMARY INCLUSIONS. (<1-10μ DIA.)

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%

* BLOCKY-TABULAR, HIGH RELIEF, LOW BIREFRINGENCE

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC 15D-28, SMPL. B	JEFF HULEN JAN. 16, 1991

Rock Type FINE- TO COARSE-GRAINED LITHIC METAGRAYWACKE; HYDROTHERMALLY ALTERED & VEINED

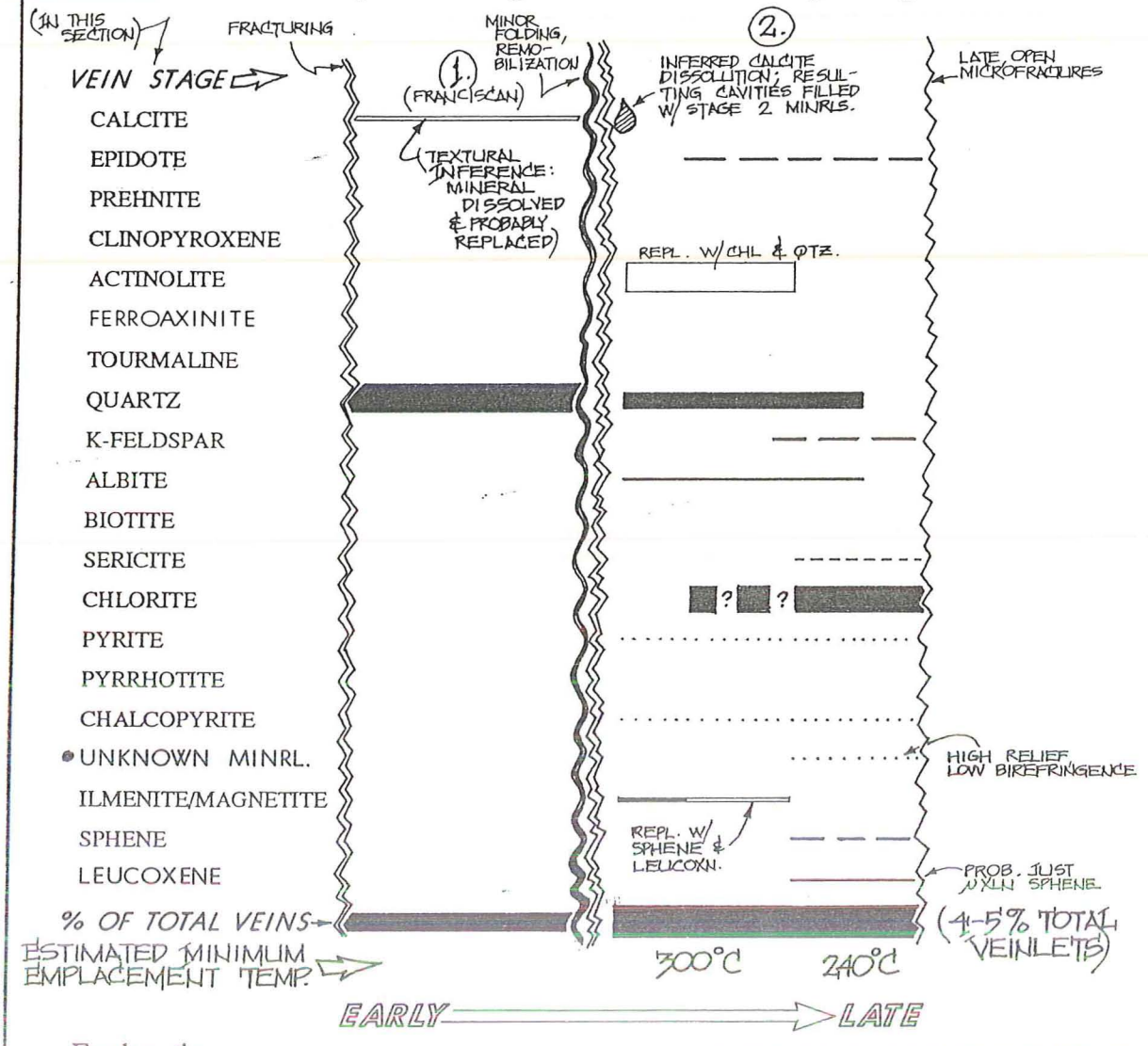
Fracturing/Brecciation/Veining and Vug-Filling 4-5% TL. VNLTS., MANY CLEARLY DEVELOPED ALONG SHEARED MICRO-FRACTURE SETS; GOOD TEXTURAL EVIDENCE FOR DISSOLUTION OF FRANCISCAN CALCITE, INFILLING OF RESULTING CAVITIES W/LATER HYDROTH. PHASES.

Porosity Summary <0.5%, MOSTLY SPARSE, OPEN MICROFRACTURES

Alteration/Metamorphism
ENTIRE ROCK HAS BLEACHED LT. GREENISH APPEARANCE; MUCH OF THE MATRIX HAS APPARENTLY BEEN CHLORITIZED ± QTZ, LEUCOXENE, SERICITE; VEIN ACTINOLITE CHLORITIZED; TR. DISS. TOURMALINE; THE "BLEACHING" (CHL/QTZ) IS APPARENTLY RELATED TO EMPLACEMENT OF STAGE 2 VEINLETS.

Fluid Inclusions
MYRIAD INCLUSIONS IN STAGE 2 QTZ; AVG. ~ 1.5μ DIA., UP TO 10μ DIA.; DOM. VAPOR-RICH, SOME LIQ-RICH W/ L:V RANGING FROM 2.5/1 TO 4/1; NO UNAMBIGUOUS PRIMARIES; A FEW OF THE L-RICH INCL'S CONTAIN BROWNISH-YELLOW LIQ. (HC?)

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	▬▬▬ > 15-50%	
- - - - - - - - < 1% (vol.)	——— > 5-15%	▬▬▬ > 50%	

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDC 15D-28, SMPL. C	JEFF HULEN JAN. 16, 1991

Rock Type INTENSELY HYDROTHERMALLY ALTERED, ORIGINALLY BIOTITE-RICH, ARGILLACEOUS LITHIC METAGRAYWACKE

Fracturing/Brecciation/Veining and Vug-Filling ~7% VEINS, MINOR, CONTORTED EARLY FRANCISCAN QTZ-(CAL?) VEINLETS W/CALCITE DISSOLVED, RESULTING CAVITIES INFILLED W/ LATER 2ND MINERALS

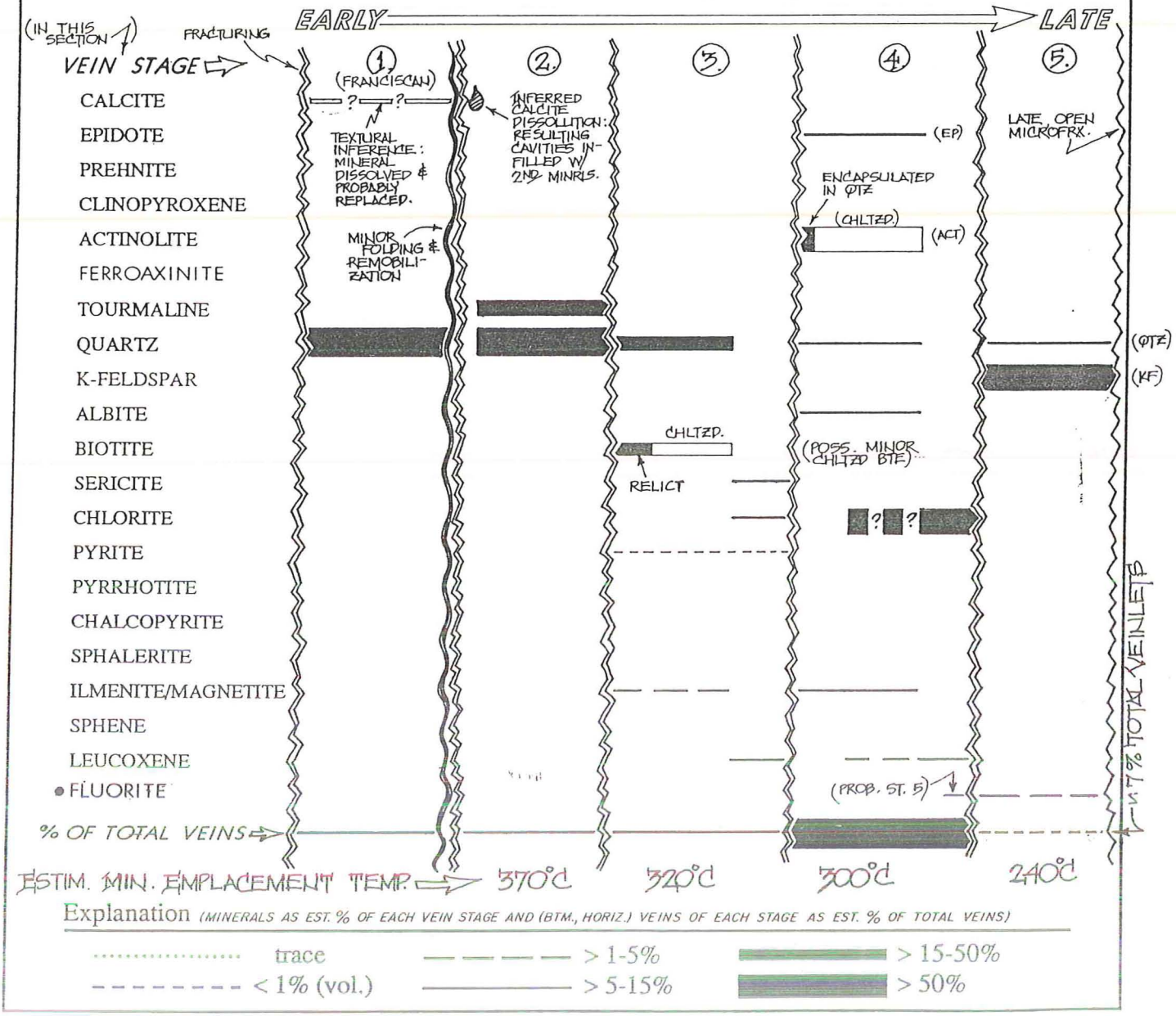
Porosity Summary ~0.5%; MOSTLY LATE, OPEN ~FRX, SOME OF WHICH FOLLOW VNLTS.

Alteration/Metamorphism MET. REXLZN. OF ORIGINAL IL/CH-MATRIX TO ORANGE-BROWN BTE. & PALE BROWN PHENGITE; MINOR DISS. TOURMALINE; 2/3 OF THE ROCK IS BLEACHED-APPEARING DUE TO SILICA FLOODING & CHLORITIZATION OF MATRIX BIOTITE; ~1% DISS. PYRITE; IN STAGE 4 VEINLETS, >98% OF THE ORIGINAL ACTINOLITE HAS BEEN CHLORITIZED (± MINOR LEUCOXENE); IN STAGE 3 VNLTS., BTE. IS BLEACHED LT.—MED. GREEN W/ ONLY VESTIGES OF ORIGINAL BROWN COLOR.

Fluid Inclusions

ABUND. VAP.-RICH INCLUSIONS IN STAGE 4 QTZ; <3~ DIA., IRREG. TO ROUNDED-APPEARING; RARE LIQ-RICH INCLUSIONS W/ L:V ≈ 3/1; FRANCISCAN QTZ. HOSTS MYRIAD <1~ VAPOR-RICH 2ND INCLUSIONS.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDCF 15D-28, SMPL. D	JEFF HULEN JAN. 16, 1991

Rock Type HIGHLY UNSORTED, V. FINE- TO (RARELY) COARSE-GRAINED, ARGILLACEOUS LITHIC METAGRAYWACKE, V. TOURMALINE-RICH

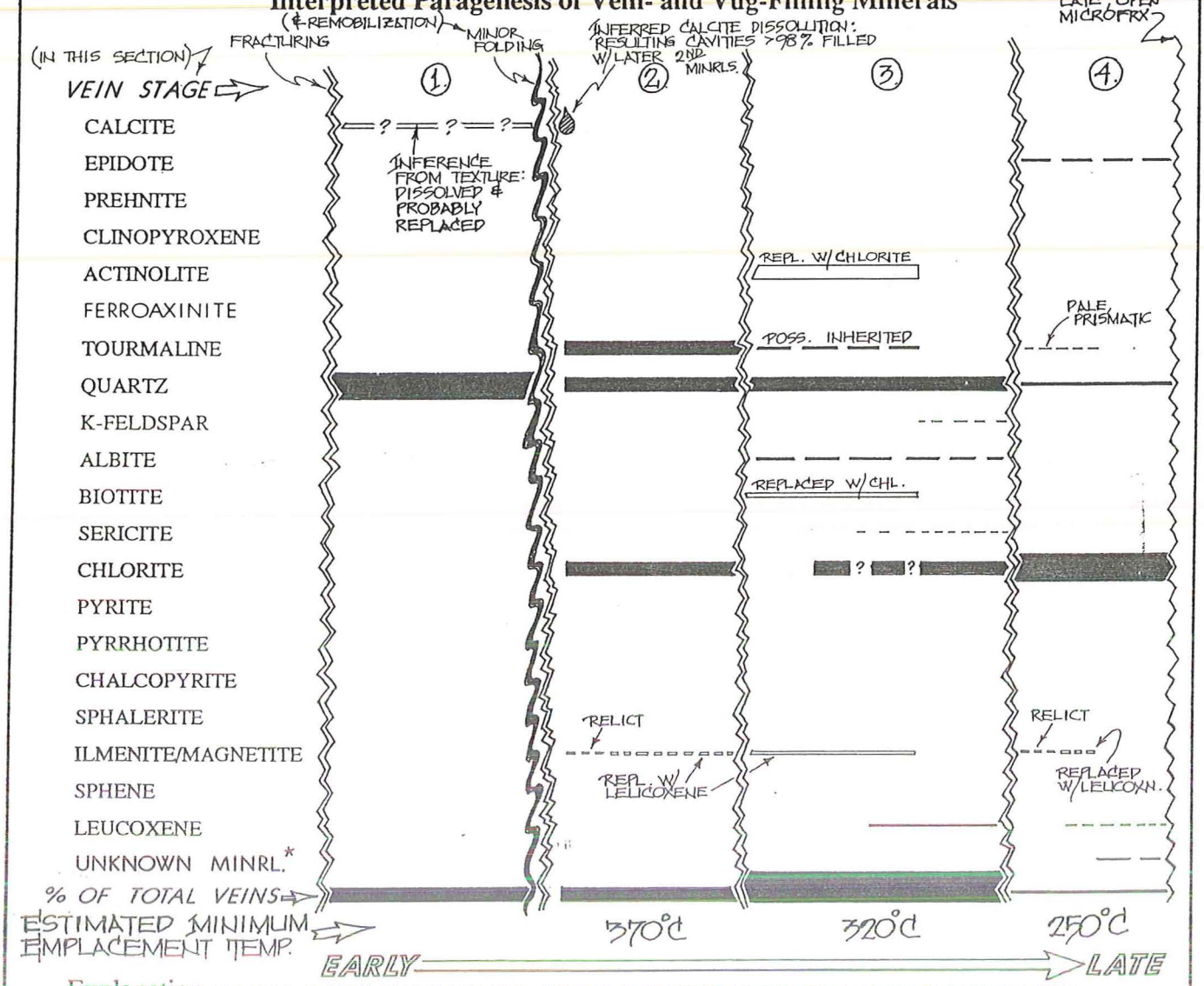
Fracturing/Brecciation/Veining and Vug-Filling 6-7% TOTAL VNS, STRONG PREFERRED ORIENTATION; EARLY FRANCISCAN (?) VNLTS. CONTORTED, GAUZY-APPEARING IN TRANSMITTED LIGHT; ORIGIN OF VEIN-CONTROLLING FRACTURES UNCLEAR.

Porosity Summary <0.5%; MOSTLY AS LATE, OPEN MICROFRACTURES FOLLOWING VEINLETS

Alteration/Metamorphism
APPARENTLY, MATRIX OF ENTIRE ROCK HAS BEEN REPLACED W/ μXLN. CHLORITE ± QTZ., PROBABLY RELATED TO EMPLACEMENT OF STAGE 3 VNLTS.; VEIN BIOTITE & ACTINOLITE REPLACED W/ CHL ± LEUCOXENE, PHENGITE; ABUND. DISS. TOURMALINE; TR. DISS., μXLN. HIGH-RELIEF, LOW-BIREF., UNKNOWN MINRL. (FeAX?) (NEED TO PROBE).

Fluid Inclusions (RECONN.)
ABUND., <2μ-DIA., VAP.-RICH INCLUSIONS IN STAGE 2 & 3 QUARTZ; IRREG. TO ROUNDED; RARE, ASSOCIATED, VAP-RICH INCL'S. W/ L:V ≈ 3/1
STAGE 1 QTZ HOSTS MYRIAD <1μ VAP.-RICH 2ND INCL'S., MAKING THE MINRL. GAUZY-APPEARING IN TRANSMITTED LIGHT.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace
– – – – – – – – < 1% (vol.)
– – – – – > 1-5%
——— > 5-15%
▬▬▬ > 15-50%
▬▬▬ > 50%

* HIGH RELIEF, LOW BIREFRINGENCE

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL GDCF 15D-28, SMPL. E	JEFF HULEN JAN. 21, 1991

Rock Type INTENSELY ALTERED & VEINED, V. FINE- TO COARSE-GRAINED LITHIC METAGRAYWACKE

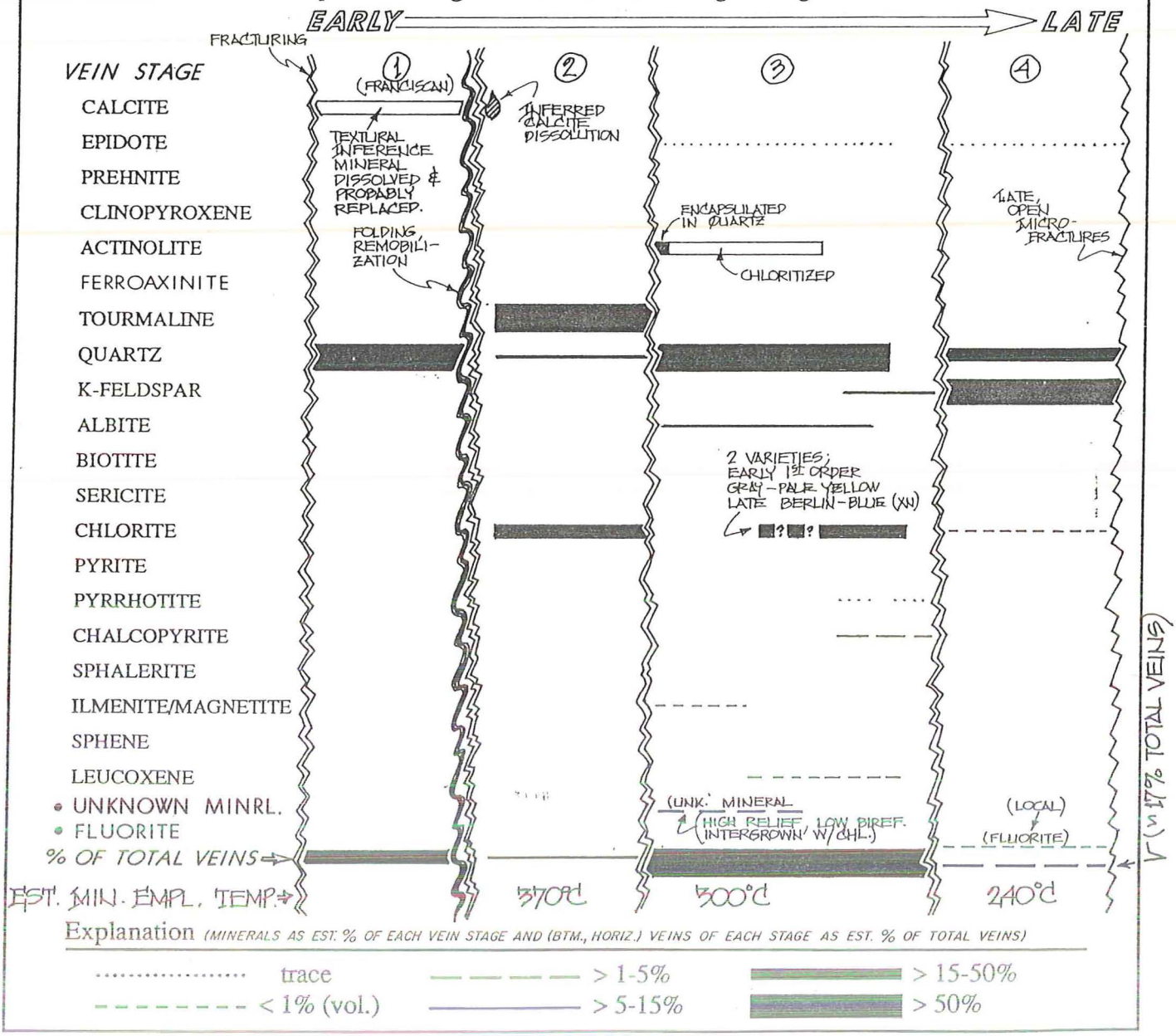
Fracturing/Brecciation/Veining and Vug-Filling ~17% TOTAL VEINS, INCLUDING ABUNDANT FRANCISCAN QTZ(-CAL) VEINS WHICH HAVE BEEN EXTENSIVELY REFRACTURED & REBRECCIATED → ALSO CALCITE IN THESE DISSOLVED, & RESULTING OPEN SPACES FILLED W/YOUNGER MINERALS

Porosity Summary ONLY ~1/2% A FEW OPEN ≠ SPACE IN ST. 3 VNLTS; ST. 4 VNLT LOCALLY ABUND. OPEN SPACE

Alteration/Metamorphism MATRIX OF ENTIRE ROCK APPEARS TO HAVE BEEN PERVASIVELY CHLTZD, SILICIFIED, PROB W/ MINOR ACCOMPANYING KFSP.; ROCK IS VERY "DIRTY"-APPEARING IN TRANSMITTED LIGHT, APPEARS TO HAVE BEEN REXLZD. EVEN BEFORE HYDROTH. ALTN. (PROB. HORNFELSIC REXLZN); NOTE THAT DISS. TOURMALINE HAS NOT BEEN DISSOLVED; VEIN ACTINOLITE ALT. TO CHL. & LEUCOXN.

Fluid Inclusions
ABUND., <3μ-DIA., IRREG. TO ROUNDED VAPOR-RICH INCL. IN ST. 3 QTZ.; RARE, ASSOC. LIQ-RICH INCL. HAVE L/V ≈ 2.5-3/1; MYRIAD, <1μ-DIA. 2ND V-RICH INCLUSIONS IMPART GAUZY APPEARANCE TO FRANCISCAN QTZ.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL TH-7, DEPTH ~1000'	JEFF HULEN JAN. 30, 1991

Rock Type COMPLEX HYDROTHERMAL BRECCIA VEIN SEPARATING UNSORTED V. FINE- TO CRS.-GRAINED, ARGILLACEOUS LITHIC METAGRAYWACKE FROM INTERBEDDED, SILTY- TO SANDY ARGILLITE & SCHISTOSE, ARGILLACEOUS V.F.- CRS.-GR LITHIC MGW

Fracturing/Brecciation/Veining and Vug-Filling HYDROTH. BX VEIN, UP TO 15 MM. WIDE, W/ LOCAL "JIGSAW-PUZZLE" TEXTURES; A FEW ROUNDED CLASTS; VEIN & SUBSIDIARY VEINLETS ACCOUNT FOR 20% OF THE ROCK; V. COMPLEX HISTORY OF MINERALIZATION & DISSOLUTION

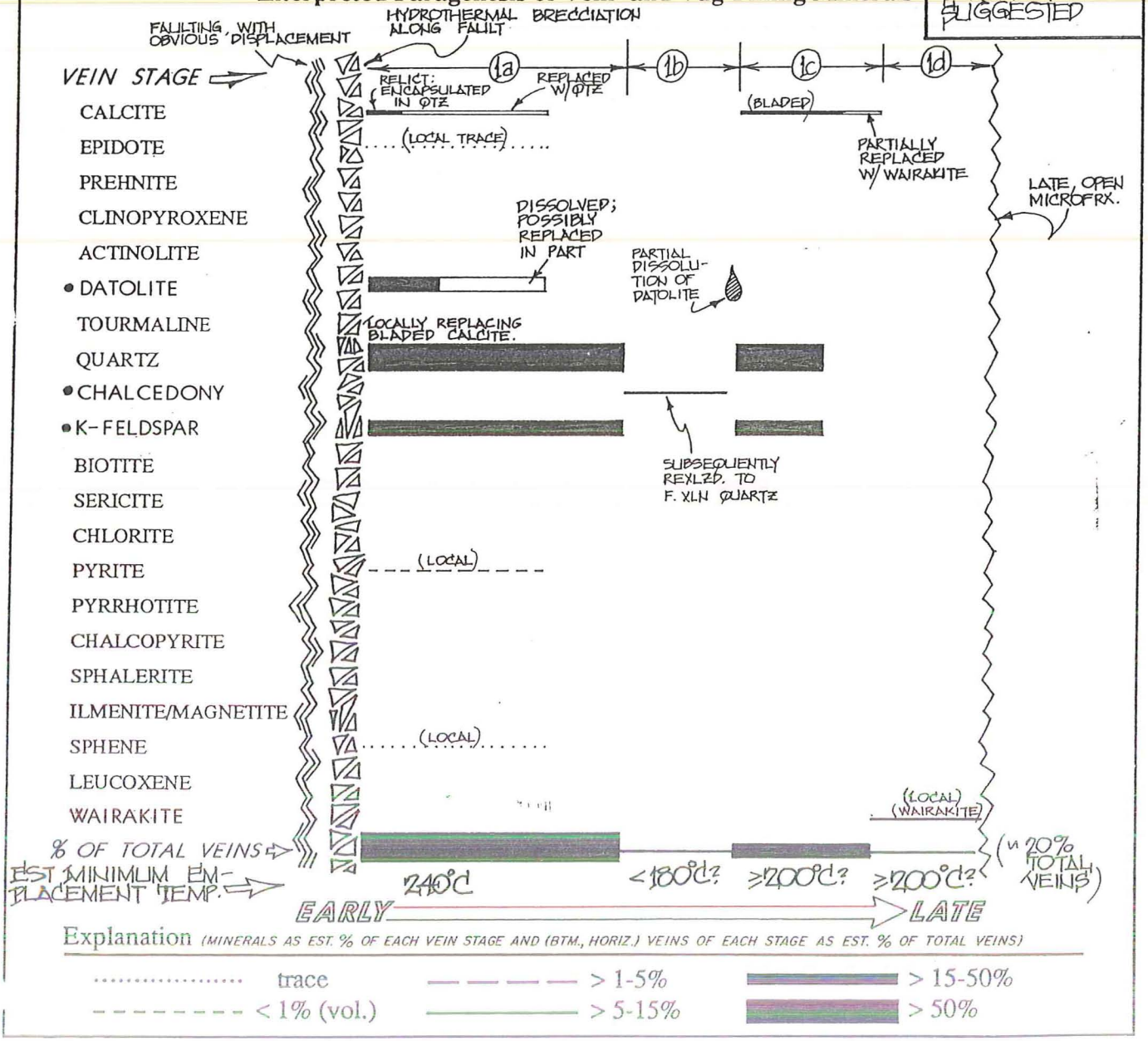
Porosity Summary EST. ~5% 3 INTERXLN. VUGS IN VEINS; ALSO DISSOL. Φ IN DATOLITE; ~0 IN LAYER SILICATE AGGREGATES

Alteration/Metamorphism
WEAK K-SPAR "FLOODING" IMMEDIATELY ADJACENT TO VEINLETS;
IN THE VEINLETS & BRECCIA CEMENTS THEMSELVES: EXTENSIVE DISSOLUTION & PROB. REPLACEMENT OF EARLY DATOLITE; ALSO REPLACEMENT OF EARLY CALCITE W/ QTZ & KFSP; INTERMEDIATE-STAGE CHALCEDONY REXLZD. TO F. XLN. QTZ.; LATEST-STAGE WAIRAKITE PTLY. REPL. LATE, BLADED CALCITE.

Fluid Inclusions ABUND., PRIMARY VAP. & LIQ-RICH INCL. IN VEIN QTZ & KFSP; IRREG. IN QTZ. BLOCKY TO PRISMATIC IN KFSP; UP TO 25μ DIA.; LIQ-RICH VAR. HAVE LIQ/VAP ~ 3.5-4.5/1; EST T_h: 190-240°C
NOTE "EXPLOSION" TEXTURE IN VEIN QUARTZ.

BOILING STRONGLY SUGGESTED

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



SUMMARY

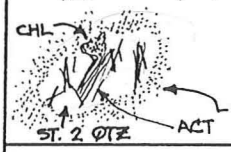
Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL DV-1, SMPL. A	JEFF HULEN JAN. 28, 1991

Rock Type HORNFELSIC, ARGILLACEOUS, V.F.-CRS. GRAINED (POORLY SORTED) LITHIC GRAYWACKE SEMI-SCHIST

Fracturing/Brecciation/Veining and Vug-Filling ~20% TOTAL VNLTS, INCL. CONTORTED FRANCISCAN VNLTS, FROM WHICH ORIGINAL CALCITE WAS DISSOLVED → RESULTING CAVITIES INFILLED WITH LATER 2ND PHASES (SEE DRAWING BELOW)

Porosity Summary ~1.5%, MOSTLY ∔ INTERXLN. VOIDS IN ST. 2 MASSES SOME LATE, OPEN, ~FRX.

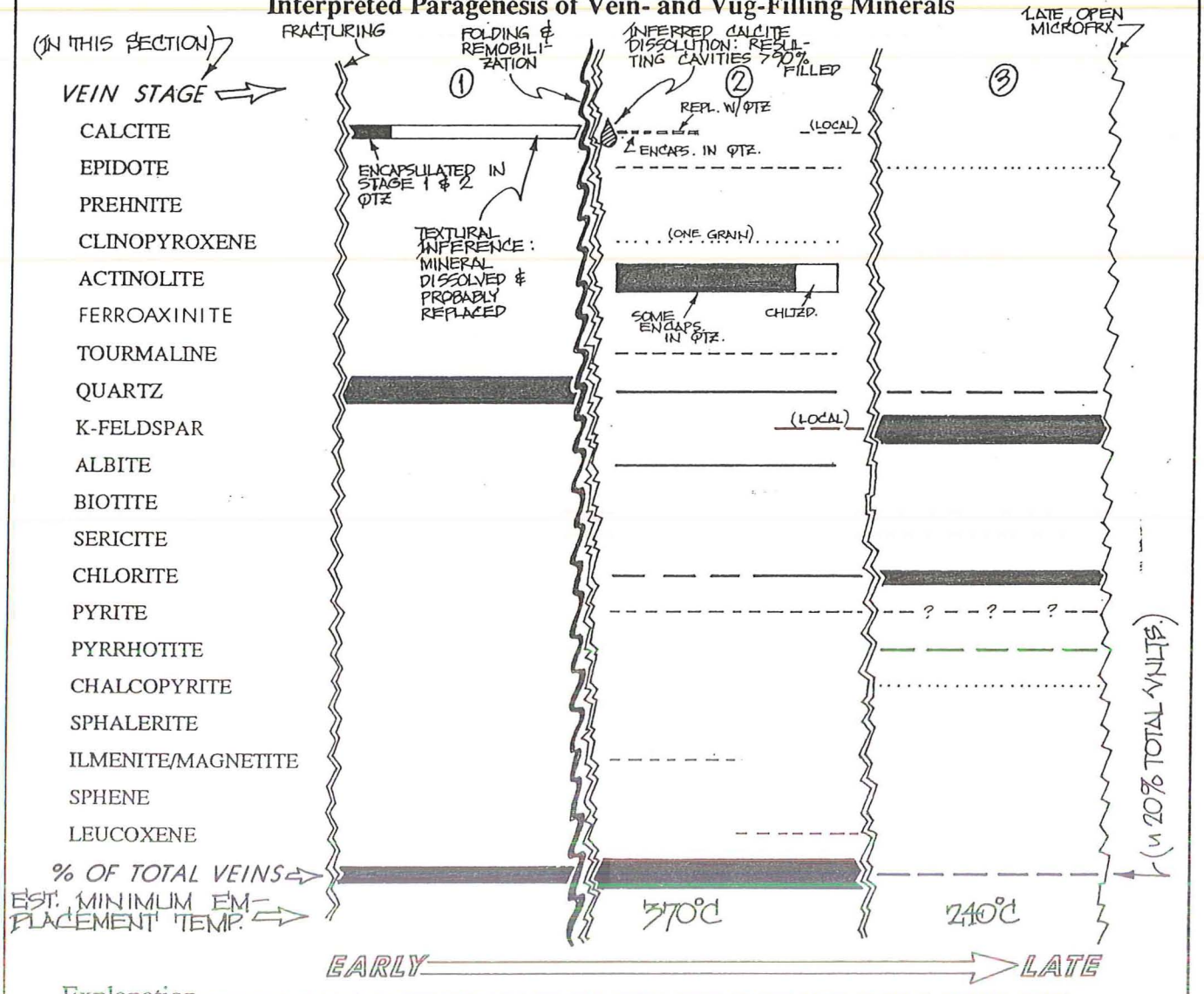
Alteration/Metamorphism METAMORPHIC REXLZN. OF ORIGINAL IL/CH-RICH MATRIX TO BTE. & BROWNISH PHENGITE, THEN EXTENSIVE HYDROTH. ALTN. OF THIS MATRIX TO CHL ± QTZ, ALBITE, & TR. EP., MINOR ACT. & LEUCOXENE ADJACENT TO & BETWEEN ST. 2 VNLTS. (~50% OF THE ROCK IS SO ALTERED).



STAGE 1 QTZ. ⇐ STAGE 2 QTZ-CH-ACT. DEPOSITED IN 0.8 MM.-LONG CAVITY IN ST 1 QTZ.

Fluid Inclusions ABUND. IN ST. 2 QTZ, DEPOSITED IN FORMER ST. 1 CALCITE SITES; <1-10~ DIA, COMMONLY ROUNDED; RARE, ASSOCIATED LIQ-RICH INCL. W/L:V ~ 3/1; MYRIAD 2ND VAPOR-RICH INCLUSIONS IN ST. 1 QTZ, AVG. <0.5~ DIA., IMPART A GAUZY APPEARANCE IN PPL.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL DV-1, SMPL. B	JEFF HULEN, DECEMBER 2, 1990

Rock Type HORNFELSIC, ARGILLACEOUS GRAYWACKE SEMI-SCHIST, CONSPICUOUSLY BANDED, MODERATELY VEINED

Fracturing/Brecciation/Veining and Vug-Filling ≈5% OF THE ROCK IS ACCOUNTED FOR BY 2ND OPEN-SPACE-FILLING PHASES; THESE DEPOSITED IN 3 GENERATIONS - SOME EARLY DISSOLUTION POROSITY FILLED WITH YOUNGER SECONDARY MINERALS.

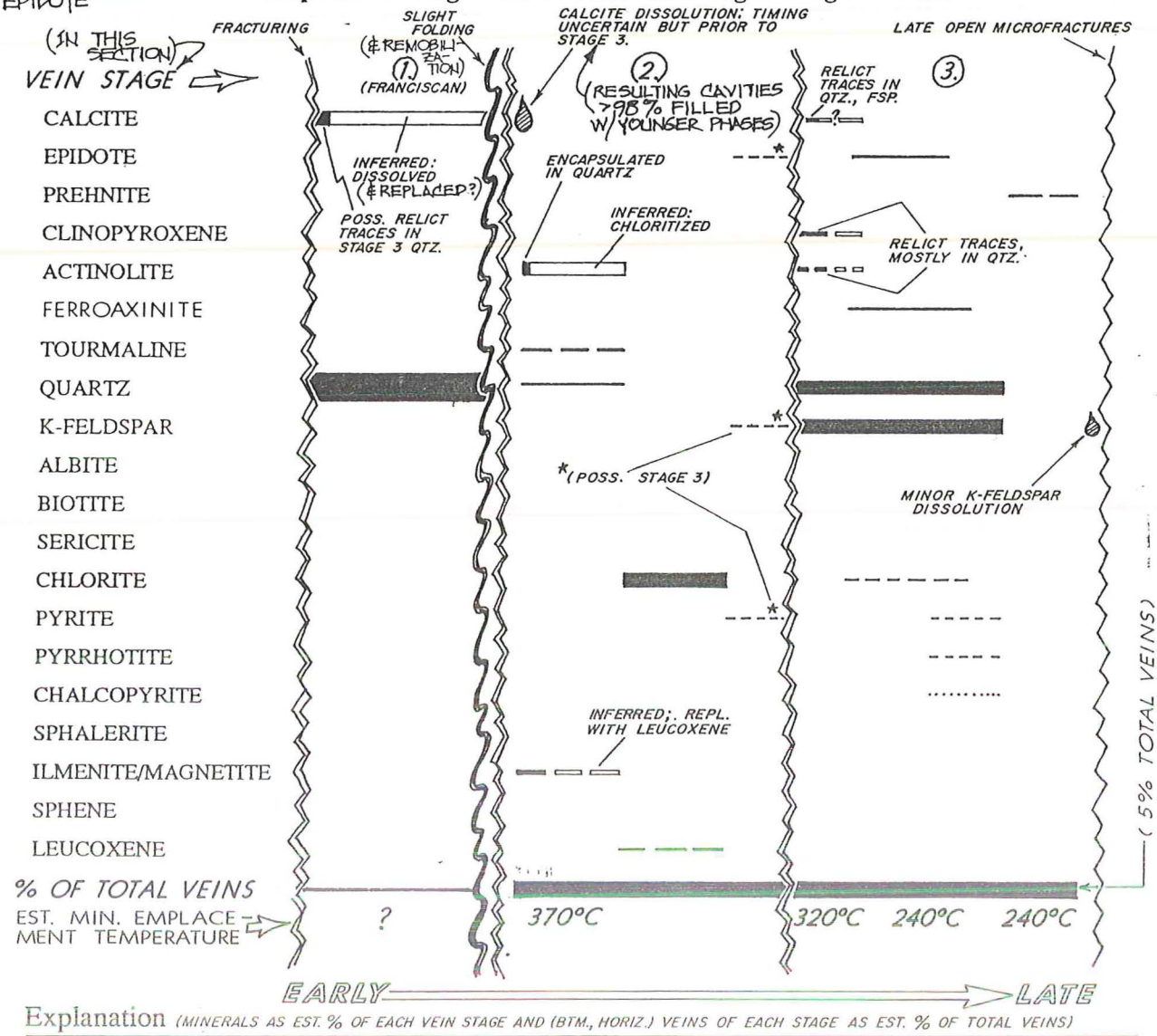
Porosity Summary <0.5%; ≪, PRIMARY INTERCRYSTALLINE VOIDS IN STAGE 3 SECONDARY MINERAL AGGR.; ALSO RARE, LATE, OPEN MICROFRACTURES

Alteration/Metamorphism PRIOR TO HORNFELSING: RECRYSTALLIZATION OF MORE SANDY BEDS TO MICRO-XLN QTZ. AGGREGATES & WISPY, FILAMENTOUS BROWN CHLORITE & ILLITE/PHENGITE; HORNFELS EVENT CONVERTED SOME ARGILLACEOUS PORTIONS OF THE ROCK TO PHENGITE/BIOTITE/QTZ/TOURMALINE HORNFELS (TOURMALINE PORPHYROBLASTS PRESENT); MINOR SILICIFICATION ADJACENT TO STAGE 3 VEINLETS/VUG-FILLINGS LOCALLY, FeAx REPL. EPIDOTE.

Fluid Inclusions (RECONN.) ABUNDANT IN STAGE 3 QUARTZ & K-FELDSPAR; <1-8μ IN DIA., COMMONLY ROUNDED, MOSTLY VAPOR-RICH, SOME LIQ-RICH W/L/V ≈ 3/1; INCLUSIONS IN FERROAXINITE, EPIDOTE & PREHNITE <2μ, VAPOR-RICH; NO UNAMBIGUOUS PRIMARY INCLUSIONS FOUND.

ALSO: PREHNITE LOCALLY REPL. EPIDOTE

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace — — — — > 1-5% > 15-50%

- - - - - - - - - < 1% (vol.) ——— > 5-15% > 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL HVS 94-25, 8243.8–8244.0'	JEFF HULEN DECEMBER 14, 1990

Rock Type ½ OF SLIDE IS ARGILLITE/METASHALE; REMAINDER IS V. FINE- TO MEDIUM-GRAINED LITHIC METAGRAYWACKE

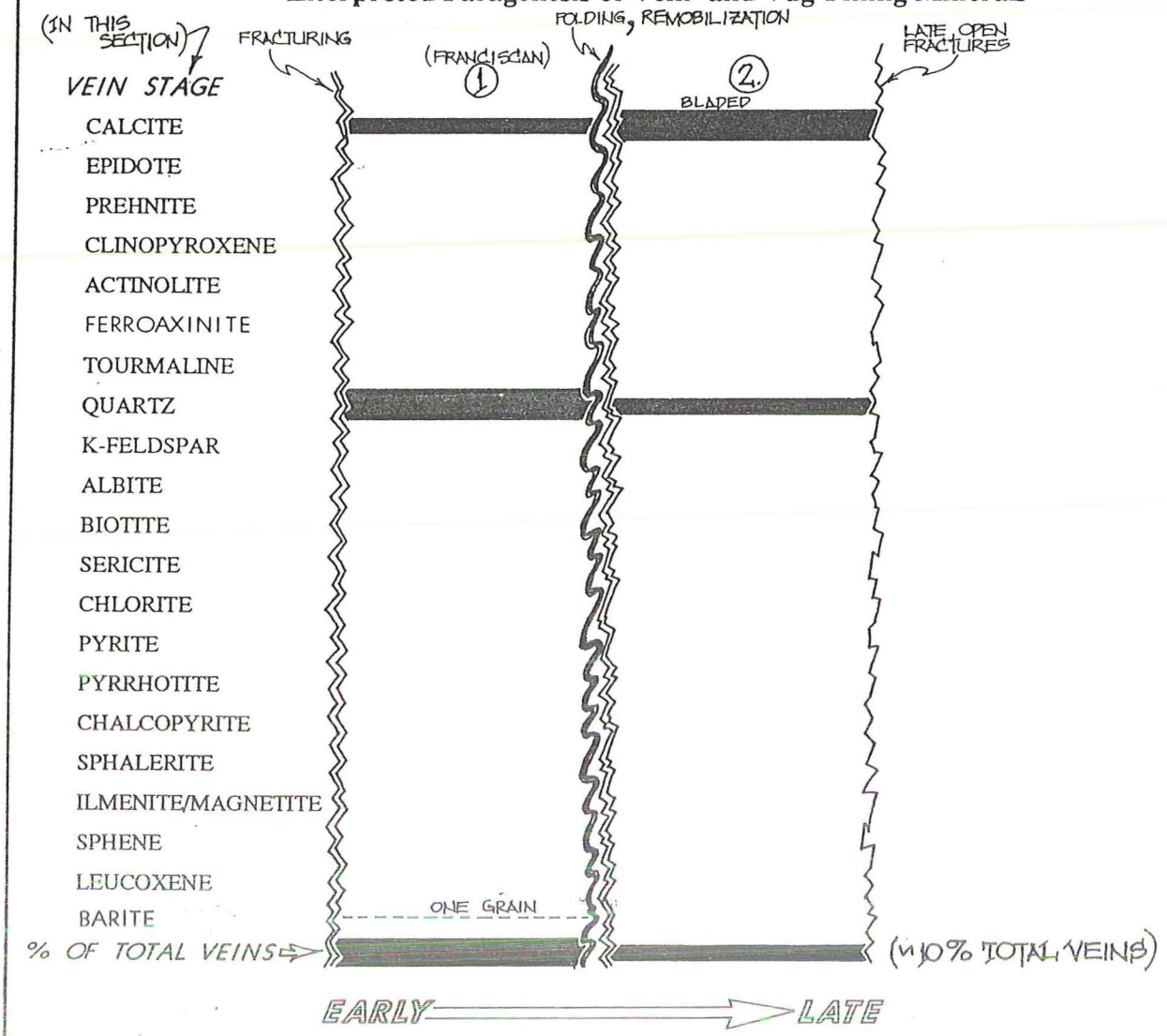
Fracturing/Brecciation/Veining and Vug-Filling ∿ 10% TOTAL VNS.; ORIENTATION OF VEINS ROCK-TYPE DEPENDENT (BEDDING PARALLEL IN ARGILLITE; ⊥ IN METAGRAYWACKE); 2 STAGES QTZ-CALCITE VEINING, YOUNGER W/ BLADED CALCITE.

Porosity Summary SLIDE NOT INJECTED W/ COLORED EPOXY — RELIABLE Φ ESTIMATE NOT POSSIBLE

Alteration/Metamorphism METAMORPHISM OF ORIGINAL ARGILLACEOUS MATRIX OF GRW & OF SHALE TO ILLITE-CHLORITE-QTZ-ALBITE; ∿ 0.5% DISSEMINATED, PROBABLE METAMORPHIC EPIDOTE; ∿ 1% DISS. PYRITE IN ARGILLITE.

Fluid Inclusions ABUNDANT IN STAGE 2 QTZ. & CALCITE; BOTH PRIMARY & SECONDARY; MOST VAPOR-RICH; LIQ.-RICH W/ LIQ/VAP. RATIO 3-3.5/1 (THOSE THAT HAV LEAKED); ST. 1 QTZ & CAL <1% VAPOR-RICH INCL'S.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation *(MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)*

..... trace	— — — — > 1-5%	> 15-50%	
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%	

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL HVS 94-25, SMPL. C	JEFF HULEN, NOV. 2, 1990

Rock Type MASSIVE, V. FINE-MED. GR. LITHIC METAGRAYWACKE

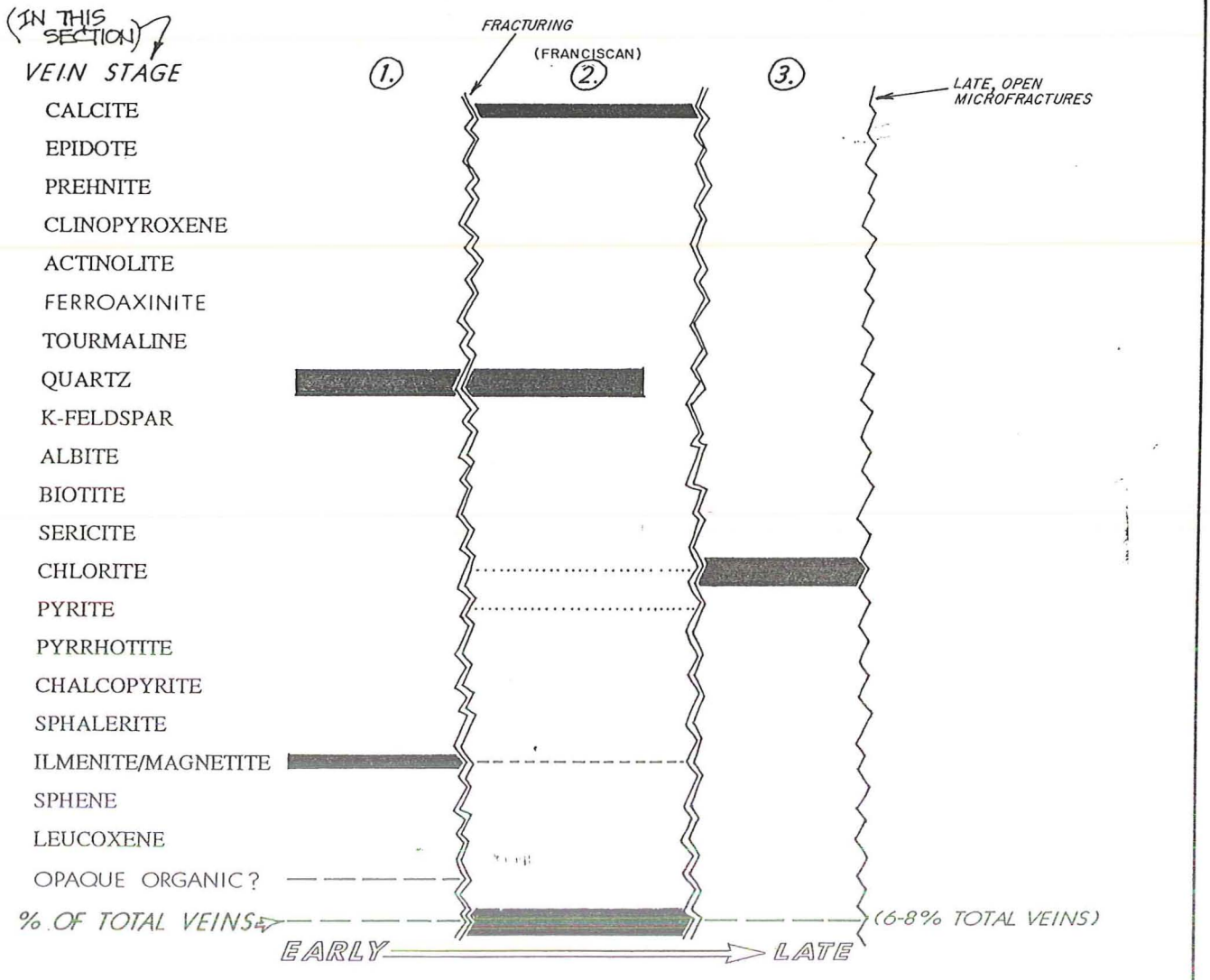
Fracturing/Brecciation/Veining and Vug-Filling 6-8% VEINLETS, 3 STAGES (SEE BELOW); EARLIEST ARE QTZ-ILM/MAG. & QTZ-ORGANIC(?); DOMINANT VEINS ARE UNDULOSE-BORDERED, FOLDED-APPEARING QTZ-CALCITE; LATEST ARE RARE HAIRLINE CHLORITE VEINLETS; LATEST OPEN MICROFRX.

Porosity Summary ~1% MOSTLY AS OPEN MICROFRACTURES & PARTIALLY OPEN CHL. VEINLETS; MINOR MICROPOROSITY IN QTZ & LAYER SILICATE AGGREGATES

Alteration/Metamorphism GREENSCHIST-GRADE METAMORPHISM → ORIGINAL ARGILLACEOUS MATRIX TO ILLITE, CHLORITE, QTZ, ALBITE, LEUCOXENE; POSSIBLE MIXED-LAYER CHL/SMECTITE AFTER DETRITAL BIOTITE.

Fluid Inclusions NO USABLE INCLUSIONS FOUND; MOST VAP.-RICH & <10 DIA.; POSS. CO_2 IN ONE 3° INCLUSION

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE (VERTICAL) AND VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS (BTM., HORIZ.)

.....	trace	— — — —	> 1-5%
- - - - - - - -	< 1% (vol.)	———	> 5-15%
			> 15-50%
			> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL KCF 82-15, SMPL. M	JEFF HULEN 02/04/91

Rock Type LAWSONITE- & PUMPELLYITE-BEARING, V.F.- TO CRS.-GRND. ARGILLACEOUS GRAYWACKE SEMI-SCHIST

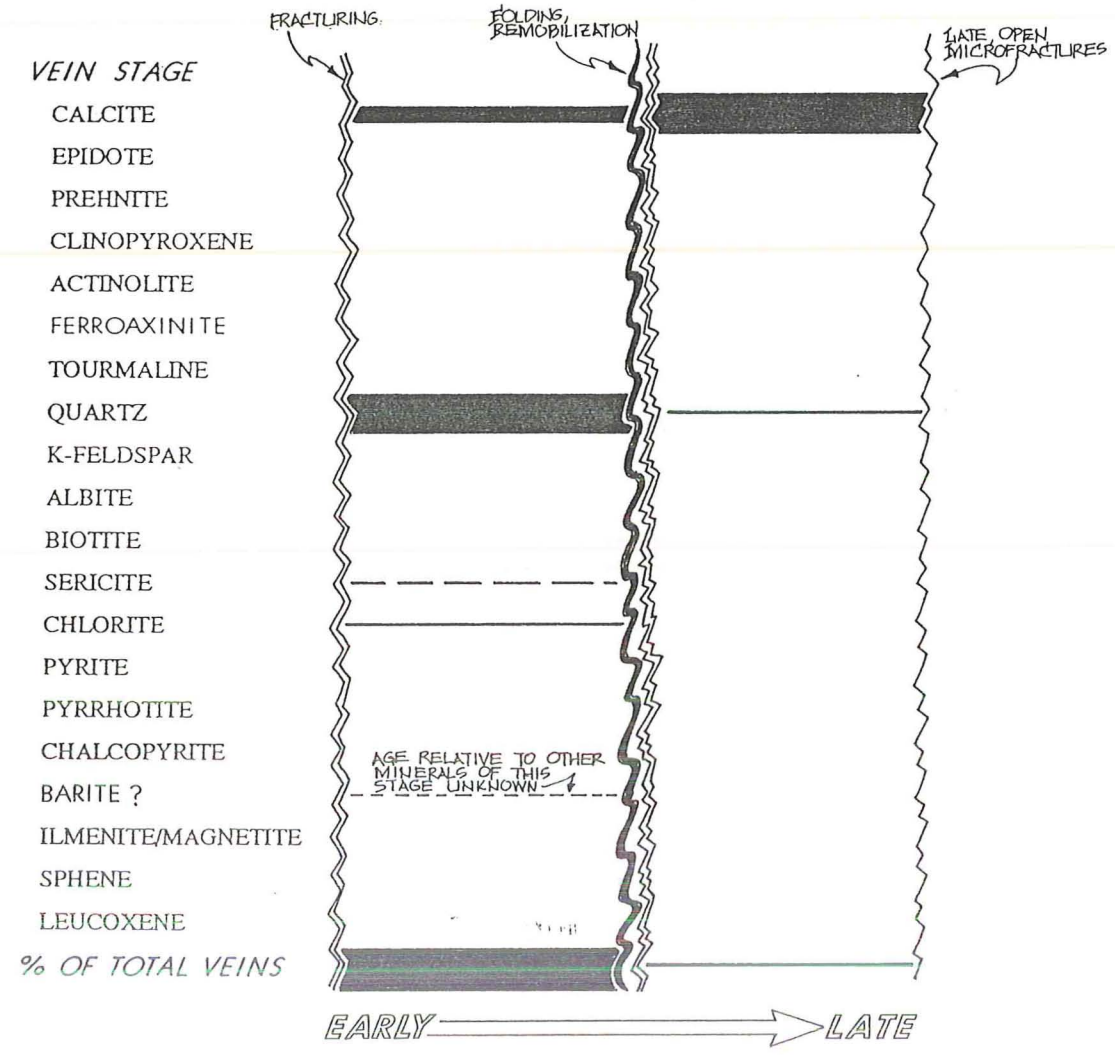
Fracturing/Brecciation/Veining and Vug-Filling ~7% VNLTS., MOSTLY DEFORMED FRANCISCAN(?)-AGE QTZ-CAL. VNLTS.; MINOR, YOUNGER, LESS DEFORMED CAL. VNLTS. — ALSO SCATTERED, DISCONTINUOUS, SIDERITE STRINGERS // TO SCHISTOSITY & OF UNCERTAIN AGE

Porosity Summary <0.2%, MOSTLY LATE, OPEN MICROFRACTURES

Alteration/Metamorphism ABUNDANT LAWSONITE AS STUBBY, SUBHEDRAL-EUHEDRAL PRISMS MOST COMMONLY INTERGROWN WITH SERICITE & LOCALLY FORMING CURVED "SKELETAL FINGERS"; ALSO COMMON GREEN TO BROWN, PUMPELLYITE REPLACING MATRIX & PLAG. & VRF'S; TR. RED-BROWN, BROKEN GARNETS(?) ENCAPSULATED IN SERICITE, CHL.

Fluid Inclusions ABUND. IN VEIN MINRLS. BUT NOT USABLE; <10 AVG. DIA., DOM. VAP.-RICH; ALMOST CERTAINLY MAJOR POST-ENTRAPMENT MODIFICATIONS.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

.....	trace	— — — —	> 1-5%
- - - - - - - -	< 1% (vol.)	———	> 5-15%
▬▬▬	> 15-50%	▬▬▬	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL KCF 82-15, SMPL. N	JEFF HULEN, DECEMBER 20, 1990

Rock Type LAWSONITE-BEARING LITHIC GRAYWACKE SEMI-SCHIST

Fracturing/Brecciation/Veining and Vug-Filling 20-22% VEINLETS & 2ND MINERAL MASSES; STAGE 1—FOLDED, CONTORTED QTZ-CALCITE (-chlorite); STAGE 2—NON-CONTORTED, COARSER-XLN. CALCITE ± QTZ (5% OF ROCK)

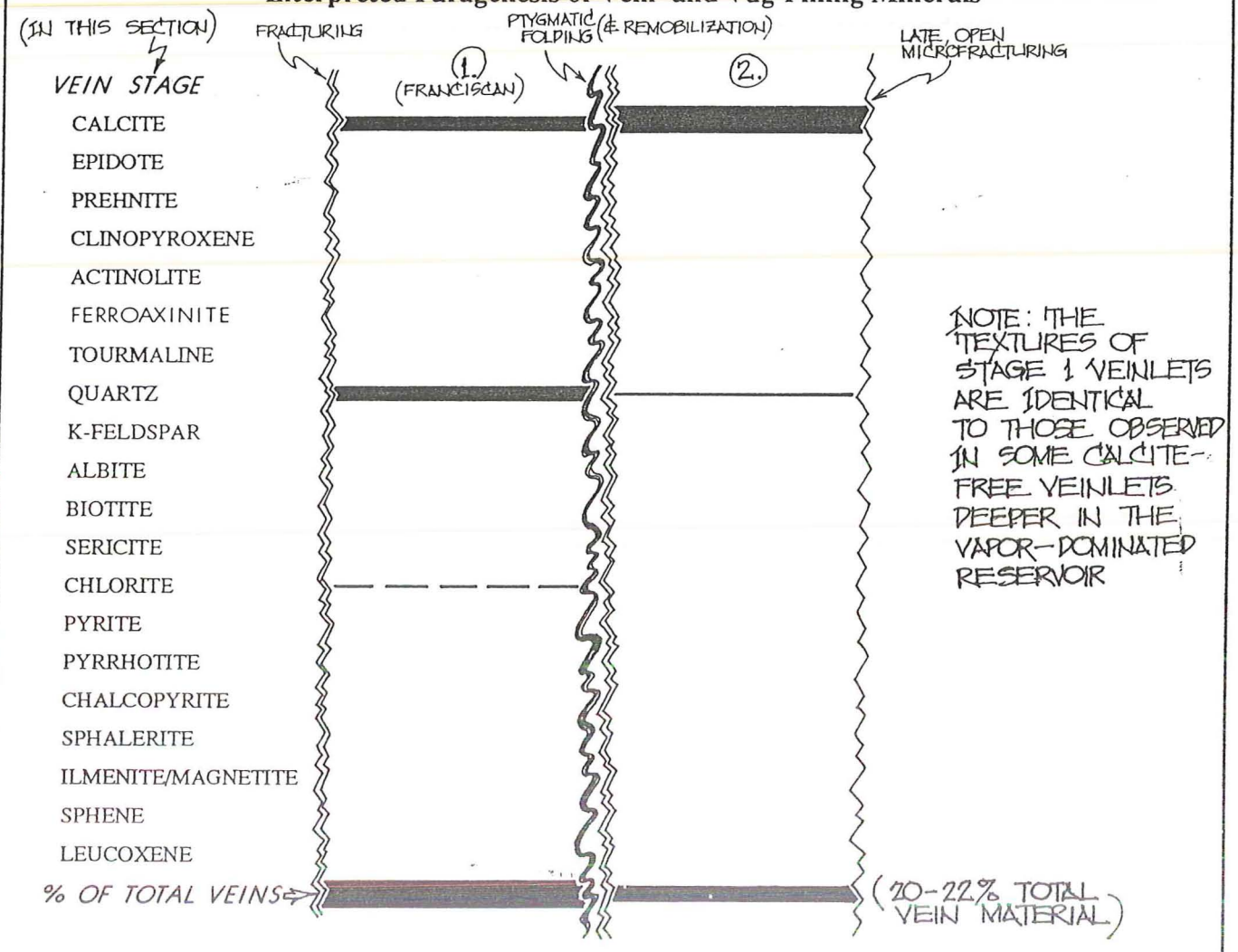
Porosity Summary EST. ≈ 0.7%, ALMOST ALL AS LATE, OPEN MICROFRACTURES.

Alteration/Metamorphism

ORIGINAL GRAYWACKE HAS BEEN METAMORPHOSED TO MICROCRYSTALLINE, WELL-FOLIATED AGGREGATE OF ILLITE, CHLORITE, QTZ, ALBITE & LEUCOXENE, IN WHICH LAWSONITE PORPHYROBLASTS ARE EMBEDDED; ALSO PORPHYROCLASTS FROM ORIGINAL FRAMEWORK GRAINS.

Fluid Inclusions ABUNDANT IN BOTH STAGE 1 & 2 CALCITE; VAPOR-RICH & LIQUID-RICH; GEN. <2μ DIA., COMMON BLOCKY NEGATIVE XL. SHAPES; IN LIQ-RICH, L/V ≈ 3/1 (WHERE NO LEAKAGE)

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



NOTE: THE TEXTURES OF STAGE 1 VEINLETS ARE IDENTICAL TO THOSE OBSERVED IN SOME CALCITE-FREE VEINLETS DEEPER IN THE VAPOR-DOMINATED RESERVOIR

Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	— — — — > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	——— > 5-15%	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL DX-49, c3791'	JEFF HULEN 02/02/91

Rock Type SHEARED, SPARSELY SILTY, ORGANIC-RICH ARGILLITE OR METASHALE; UXLN. AGGREGATE OF QTZ, ILLITE, CHL, ALBITE(?), LEUCOXN., ORG. DEBRIS, MINOR LAWSONITE.

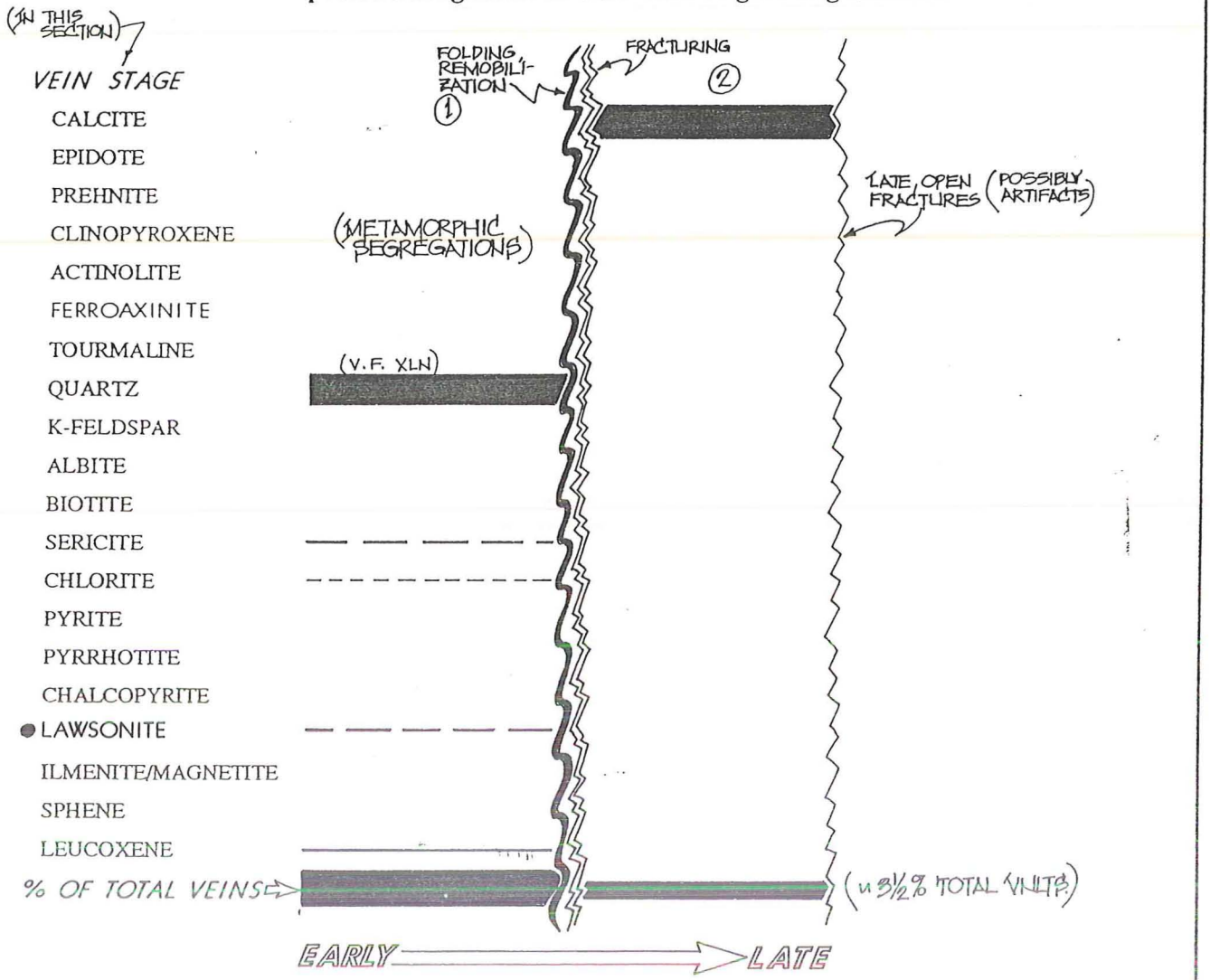
Fracturing/Brecciation/Veining and Vug-Filling
EARLY, WISPY, FOLDED METAMORPHIC SEGREGATIONS OF UXLN. QTZ; MINOR SER, CHL, LEUCOXN. LOCAL LAWSONITE; LATER CALCITE VNLTS. CLEARLY EMPLACED ALONG SHEARED TECTONIC FRACTURES

Porosity Summary LOOKS LIKE 4-5%, BUT MOST OF THAT AS TEXTURALLY SUSPICIOUS LATE FRX—POSSIBLY ARTIFICIAL

Alteration/Metamorphism
SEE IMMEDIATELY ABOVE

Fluid Inclusions (RECONNAISSANCE)
ABUND., <1/10-DIA., VAPOR-RICH INCLS. IN ST. 2 CALCITE (PROB. FRANCISCAN VINTAGE) NONE FOUND DURING RECONNAISSANCE ARE USABLE.

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



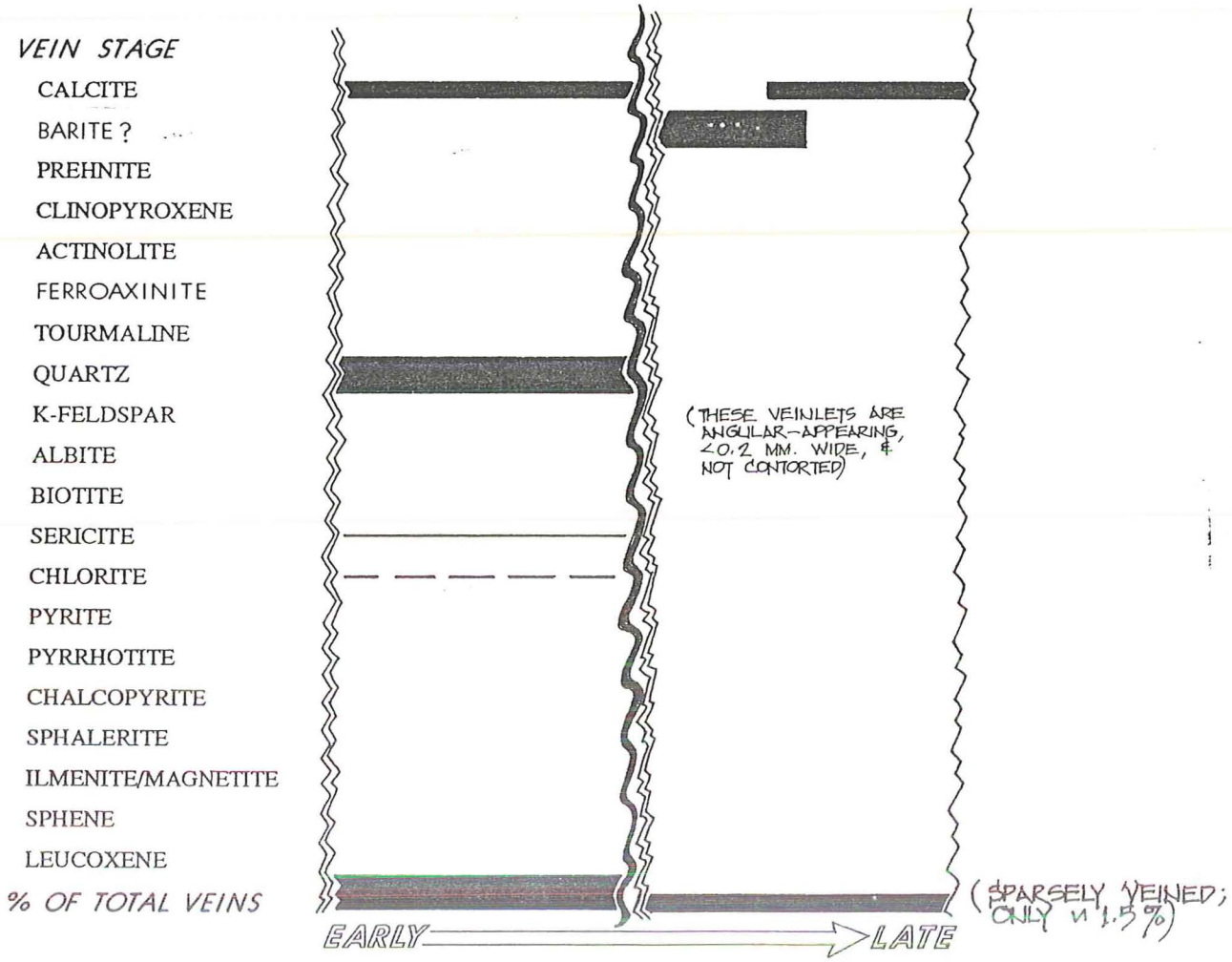
Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

trace; < 1% (vol.); > 1-5%; > 5-15%; > 15-50%; > 50%

SUMMARY

Sample Identification THE GEYSERS WELL DX-57F 3960	Petrographer/Date of Examination JEFF HULEN FEB. 3, 1991
Rock Type SCHISTOSE, ARGILLACEOUS, V. POORLY SORTED, V.F.-CRS.-GR. LITHIC METAGRAYWACKE	
Fracturing/Brecciation/Veining and Vug-Filling SPARSELY VEINED (≈1.5%); EARLIEST ARE CONTORTED QTZ ± CAL. (FRANCISCAN?); LATEST ARE BARITE(?)-CAL. VNLTS., NON-DEFORMED, FILLING BRITTLE FRACTURES.	Porosity Summary SECTION NOT INJECTED W/ EPOXY → RELIABLE ESTIMATE NOT POSSIBLE.
Alteration/Metamorphism ≈1.5% DISS., ANH. EPIDOTE GRAINS & GRAIN AGGREGATES <0.2 MM. DIA. (HYDROTHERMAL?); MINOR RELICT METAMORPHIC PUMPELLYITE, TR. LAWSONITE; 1.5% DISS., μXLN. SPHENE & LEUCOXENE; PLAG. WEAKLY TO LOCALLY MODERATELY ALT. TO EPIDOTE, SERICITE, & CHLORITE.	Fluid Inclusions (RECONN.) NO USABLE INCLUSIONS FOUND

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

..... trace	———— > 1-5%	> 15-50%
- - - - - - - - < 1% (vol.)	———— > 5-15%	> 50%

SUMMARY

Sample Identification	Petrographer/Date of Examination
THE GEYSERS WELL DX-57rd, WO	JEFF HULEN JAN. 31, 1991

Rock Type BRECCIATED, METAMORPHICALLY & HYDROTHERMALLY VEINED, LITHIC GRAYWACKE SEMI-SCHIST

Fracturing/Brecciation/Veining and Vug-Filling 35% VEIN MINERALS INCLUDING EARLY QUARTZOSE SEGREGATIONS; A FEW FRANCISCAN (?) QTZ. VNS. CUT BY BY CALCITE-DOMINANT VNLTS. IN WHICH MUCH CAL. IS DEFORMED

Porosity Summary ROCK NOT INJECTED W/ COLORED EPOXY - RELIABLE ESTIMATE NOT POSSIBLE.

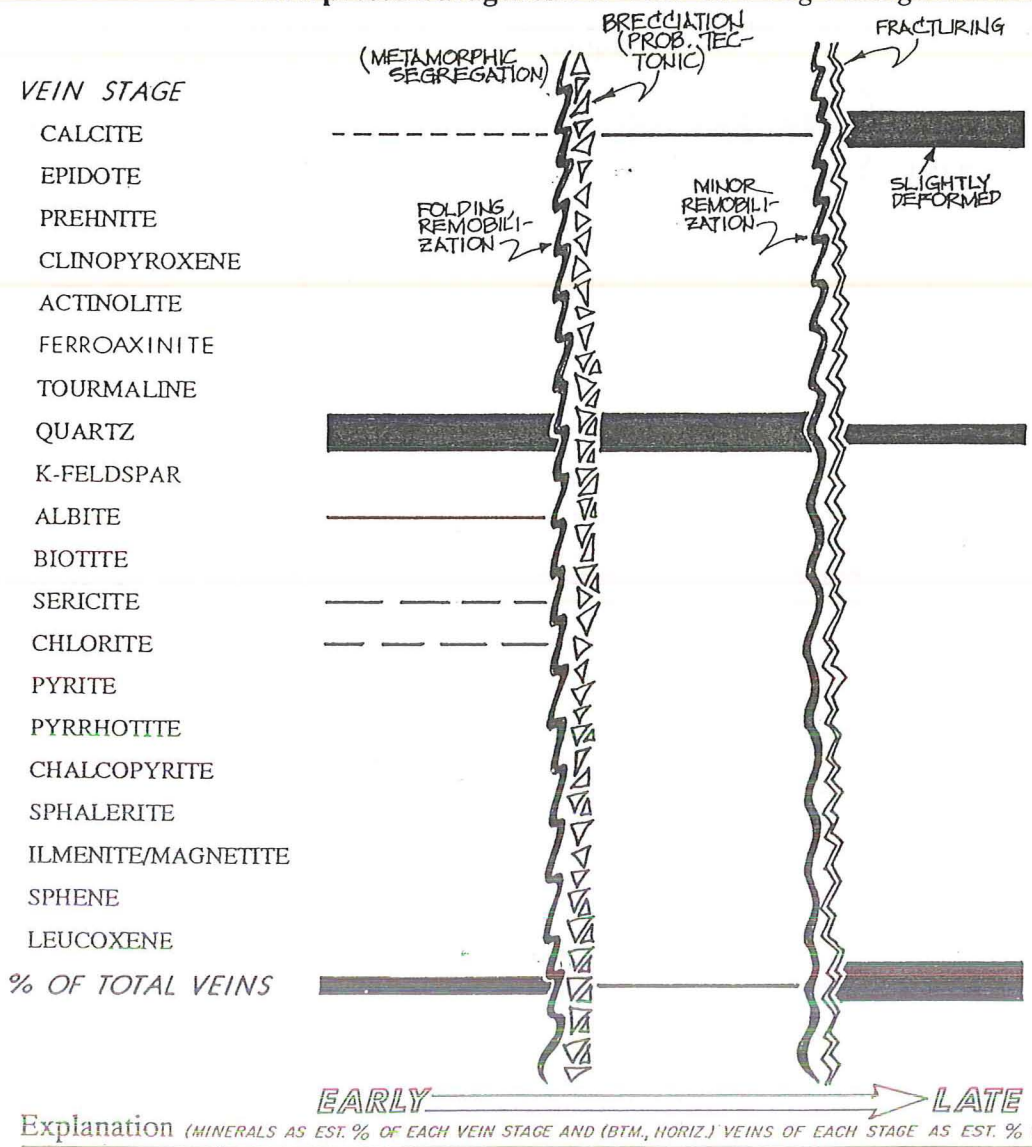
Alteration/Metamorphism

ROCK CONTAINS LAWSONITE & PUMPELLYITE IN ADDITION TO FAIRLY HIGH-GRADE SERICITE; STAGE 1 SEGREGATIONS HIGHLY DEFORMED; STAGE 2 QTZ VNLTS, MODERATELY DEFORMED; STAGE 3 QTZ MOSTLY UNDEFORMED, BUT ST. 3 CALCITE LOCALLY KINKED & OTHERWISE BENT/DEFORMED;

Fluid Inclusions

TRULY ABUNDANT IN ST. 3 CALCITE (UP TO 4% OF THE MINERAL), BUT VERY SUSPICIOUS-LOOKING; <1-15μ DIA., IRREG. TO ROUNDED, >99% VAPOR-RICH; CONSIDERING THE DEFORMATION OF THE HOST CRYSTAL, STRONGLY SUSPECT MOST HAVE LEAKED; THERE ARE A FEW, LOCAL PRISMATIC TO BOXY-APPEARING, LIQ-RICH PRIMARY INCL'S. W/ L:V ≈ 4.5:1

Interpreted Paragenesis of Vein- and Vug-Filling Minerals



Explanation (MINERALS AS EST. % OF EACH VEIN STAGE AND (BTM., HORIZ.) VEINS OF EACH STAGE AS EST. % OF TOTAL VEINS)

trace — > 1-5% — > 15-50%

< 1% (vol.) — > 5-15% — > 50%