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(281) 784-5500
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Anchorage, AK
(907) 561-2465

MUDLOG TVD

COMPANY ExxonMobil Production
WELL FRU 197-28A8
FIELD FREEDOM CREEK UNIT
REGION ROCKIES
COORDINATES LAT: 39.934571000
LON: 108.295879000
ELEVATION GL = 6082'
KB = 6109'
COUNTY, STATE RIO BLANCO, CO
API INDEX 051031163100
SPUD DATE 05/06/2010
CONTRACTOR HELMRICH AND PAYNE
CO. REP. RICKY T OWENS
RIG/TYPE 215 / FLEX 3
LOGGING UNIT MLU 051
GEOLOGISTS GEORGE BAKER
BRENDA MARSH
ADD. PERSONS BILL JOHANNING
DEVIN CLAAR
CO. GEOLOGIST MELAINE A. BIGGS

LOG INTERVAL

CASING DATA

DEPTHS: 3,441' TO 12,275'
DATES: 5/04/2010 TO 5/23/2010
SCALE: 5" = 100'

16.0" AT 119'
10.75" AT 3,441'
AT
AT

MUD TYPES

HOLE SIZE

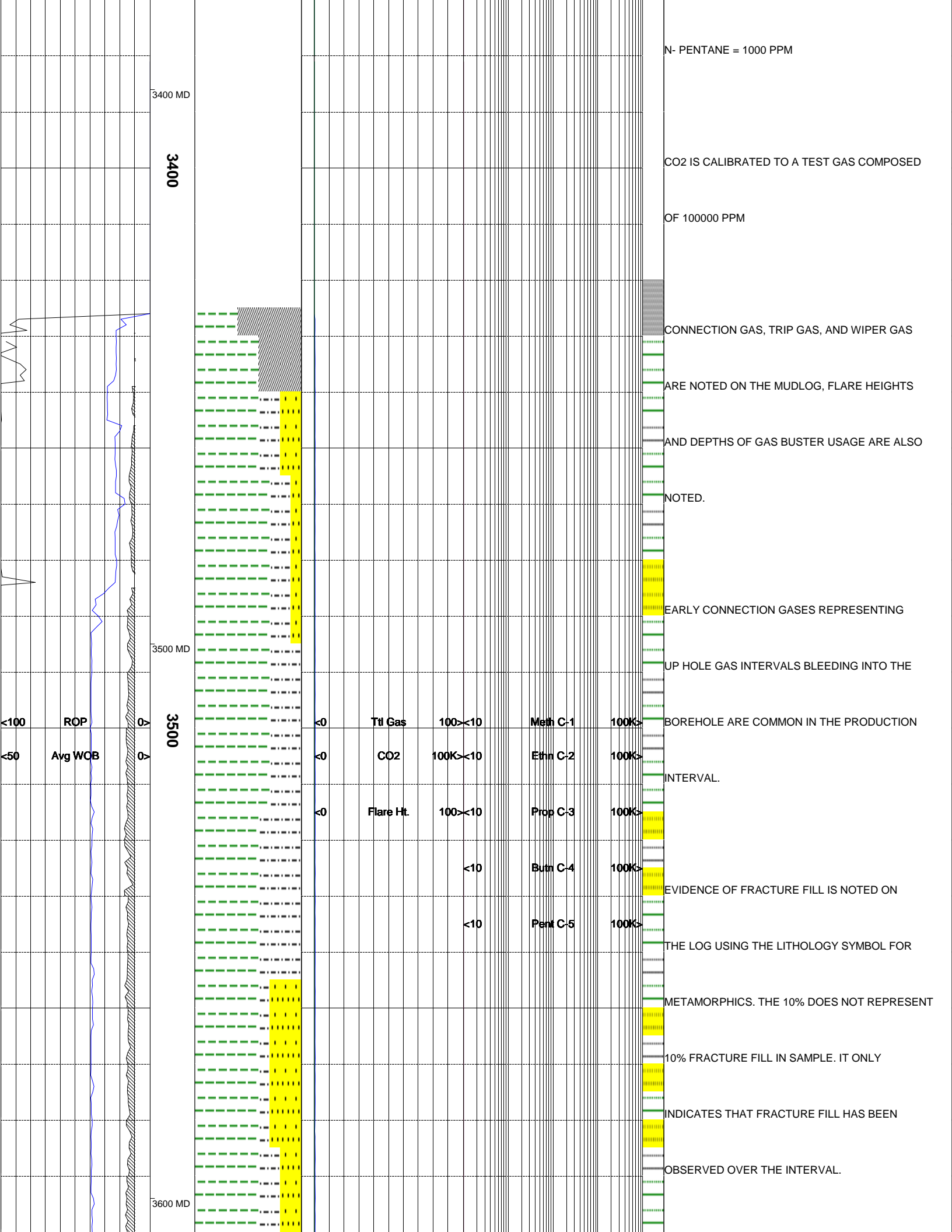
LSND TO 12,275'
TO
TO
TO

14.75" TO 3,441'
8.75" TO 12,275'
TO
TO

ABBREVIATIONS

| | | |
|-----------------------------|---------------------------------|----------------------------|
| <i>NB</i> NEWBIT | <i>PV</i> PLASTIC VISCOSITY | <i>LC</i> LOST CIRCULATION |
| <i>RRB</i> RERUN BIT | <i>YP</i> YIELD POINT | <i>CO</i> CIRCULATE OUT |
| <i>CB</i> CORE BIT | <i>FL</i> FLUID LOSS | <i>NR</i> NO RETURNS |
| <i>WOB</i> WEIGHT ON BIT | <i>CL</i> PPM CLORIDE ION | <i>TG</i> TRIP GAS |
| <i>RPM</i> ROTARY REV/MIN | <i>Rm</i> MUD RESISTIVITY | <i>SG</i> SURVEY GAS |
| <i>PP</i> PUMP PRESSURE | <i>Rmf</i> FILTRATE RESISTIVITY | <i>WG</i> WIPER GAS |
| <i>SPM</i> STROKES/MIN | <i>PR</i> POOR RETURNS | <i>CG</i> CONNECTION GAS |
| <i>MW</i> MUD WEIGHT | <i>LAT</i> LOGGED AFTER TRIP | |
| <i>VIS</i> FUNNEL VISCOSITY | <i>LAS</i> LOGGED AFTER SURVEY | |

| | | | | |
|------------------|----------------------|-------------------|------------------------|----------------------|
| ALTERED ZONE | CHERT - GLASSY | FELSIC SILIC DIKE | MARL - CALC | SANDSTONE |
| ANDESITE | CHERT - PORCEL | FOSSIL | METAMORPHICS | SANDSTONE-TUFFACEOUS |
| ANHYDRITE | CHERT - TIGER STRIPE | GABBRO | MUDSTONE | SERICITIZATION |
| BASALT | CHERT - UNDIFF | GLASSY TUFF | OBSIDIAN | SERPENTINE |
| BENTONITE | CLAY | GRANITE | PALEOSOL | SHALE |
| BIOTITIZATION | CLAY-MUDSTONE | GRANITE WASH | PHOSPHATE | SHALE TUFFACEOUS |
| BRECCIA | CLYST-TUFFACEOUS | GRANODIORITE | PORCELANITE | SHELL FRAGMENTS |
| CALCARENITE | CHLORITIZATION | GYPSUM | PORCELANEOUS CLYST | SIDERITE |
| CALCAREOUS TUFF | COAL | HALITE | PYRITE | SILICIFICATION |
| CALCILUTITE | CONGLOMERATE | HORNBL-QTZ-DIO | PYROCLASTICS | SILTSTONE |
| CARBONATES | CONGL. SAND | IGNEOUS (ACIDIC) | QUARTZ DIORITE | SILTST-TUFFACEOUS |
| CARBONACEOUS MAT | CONGL. SANDSTONE | IGNEOUS (BASIC) | QUARTZ LATITE | TUFF |
| CARBONACEOUS SH | COQUINA | INTRUSIVES | QUARTZ MONZONITE | VOLCANICLASTICS SEDS |
| CEMENT CONTAM. | DACITE | KAOLINIC | RECRYSTALLIZED CALCITE | VOLCANICS |
| CHALK | DIATOMITE | LIMESTONE | RHYOLITE | |
| CRYSTALLINE TUFF | DIORITE | LITHIC TUFF | SALT | |
| CHERT - ARGILL | DOLOSTONE | MARL - DOLO | SAND | |

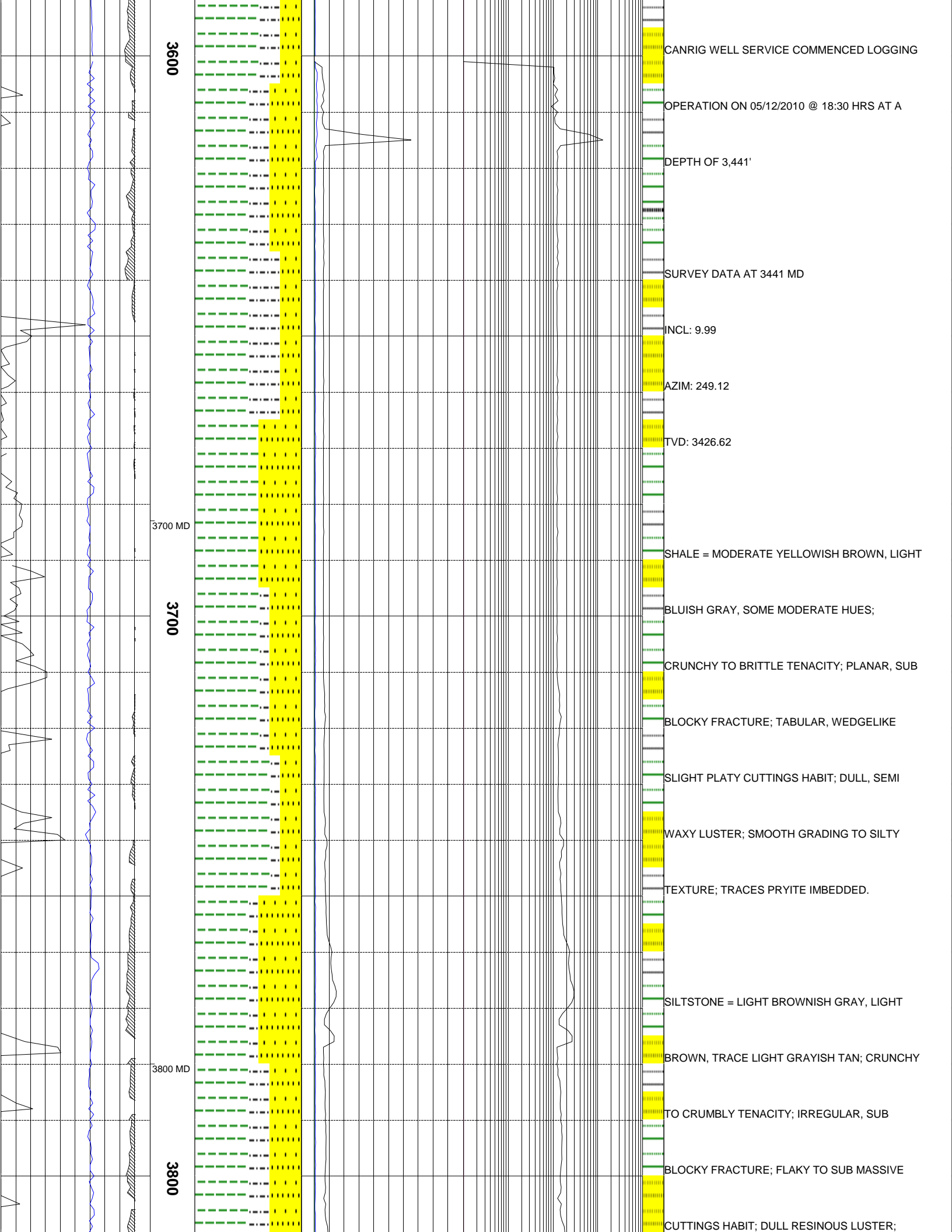


3400 MD
3400
 3500 MD
3500
 3600 MD

<100 ROP
 <50 Avg WOB

| | | | | |
|----|-----------|------------|----------|--------|
| <0 | Ttl Gas | 100 > <10 | Meth C-1 | 100K > |
| <0 | CO2 | 100K > <10 | Ethn C-2 | 100K > |
| <0 | Flare Ht. | 100 > <10 | Prop C-3 | 100K > |
| | | <10 | Butn C-4 | 100K > |
| | | <10 | Pent C-5 | 100K > |

N- PENTANE = 1000 PPM
 CO2 IS CALIBRATED TO A TEST GAS COMPOSED OF 100000 PPM
 CONNECTION GAS, TRIP GAS, AND WIPER GAS ARE NOTED ON THE MUDLOG, FLARE HEIGHTS AND DEPTHS OF GAS BUSTER USAGE ARE ALSO NOTED.
 EARLY CONNECTION GASES REPRESENTING UP HOLE GAS INTERVALS BLEEDING INTO THE BOREHOLE ARE COMMON IN THE PRODUCTION INTERVAL.
 EVIDENCE OF FRACTURE FILL IS NOTED ON THE LOG USING THE LITHOLOGY SYMBOL FOR METAMORPHICS. THE 10% DOES NOT REPRESENT 10% FRACTURE FILL IN SAMPLE. IT ONLY INDICATES THAT FRACTURE FILL HAS BEEN OBSERVED OVER THE INTERVAL.



3600

CANRIG WELL SERVICE COMMENCED LOGGING

OPERATION ON 05/12/2010 @ 18:30 HRS AT A

DEPTH OF 3,441'

SURVEY DATA AT 3441 MD

INCL: 9.99

AZIM: 249.12

TVD: 3426.62

3700 MD

SHALE = MODERATE YELLOWISH BROWN, LIGHT

3700

BLUISH GRAY, SOME MODERATE HUES;

CRUNCHY TO BRITTLE TENACITY; PLANAR, SUB

BLOCKY FRACTURE; TABULAR, WEDGELIKE

SLIGHT PLATY CUTTINGS HABIT; DULL, SEMI

WAXY LUSTER; SMOOTH GRADING TO SILTY

TEXTURE; TRACES PRYITE IMBEDDED.

3800 MD

SILTSTONE = LIGHT BROWNISH GRAY, LIGHT

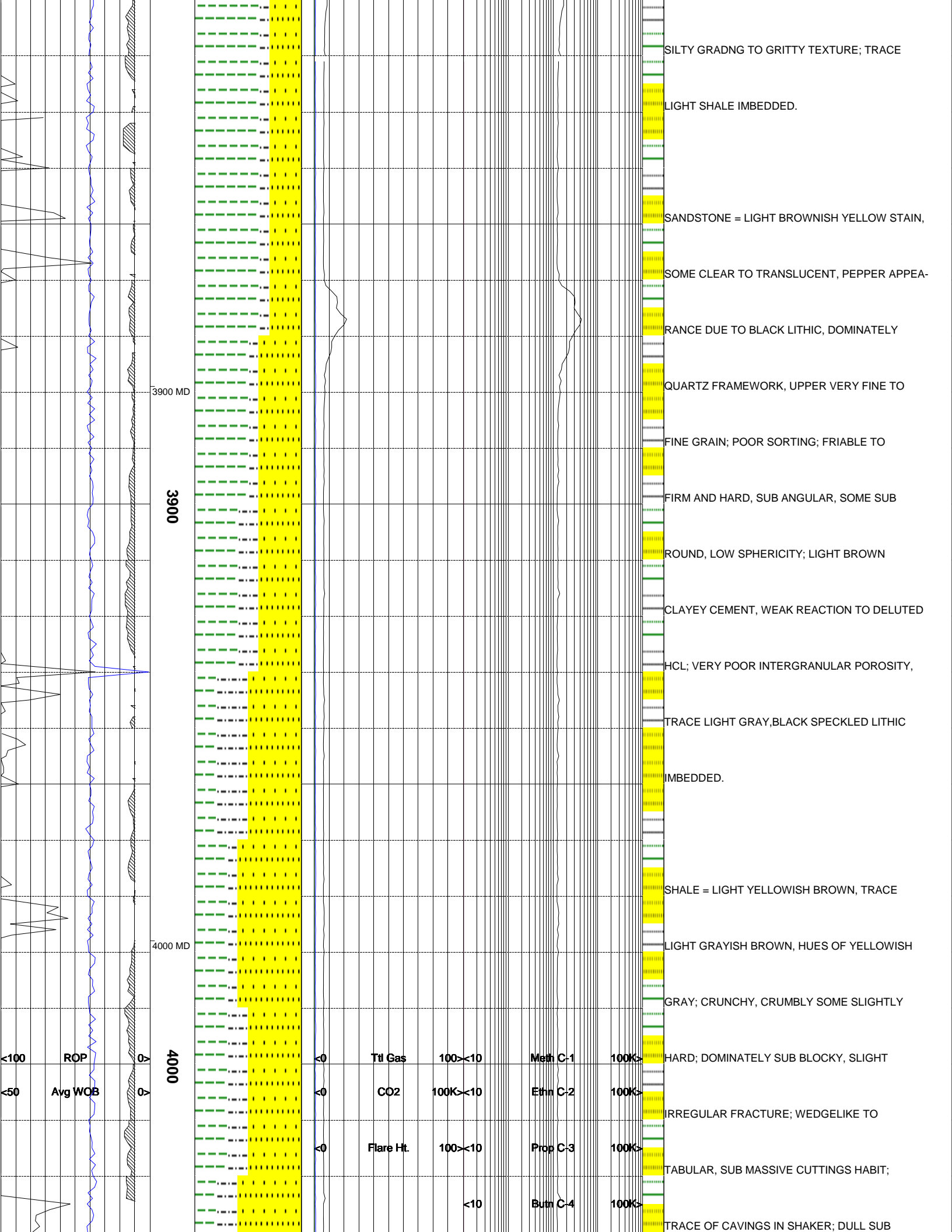
BROWN, TRACE LIGHT GRAYISH TAN; CRUNCHY

TO CRUMBLY TENACITY; IRREGULAR, SUB

3800

BLOCKY FRACTURE; FLAKY TO SUB MASSIVE

CUTTINGS HABIT; DULL RESINOUS LUSTER;



3900 MD
3900

4000 MD
4000

SILTY GRADNG TO GRITTY TEXTURE; TRACE

LIGHT SHALE IMBEDDED.

SANDSTONE = LIGHT BROWNISH YELLOW STAIN,

SOME CLEAR TO TRANSLUCENT, PEPPER APPEA-

RANCE DUE TO BLACK LITHIC, DOMINATELY

QUARTZ FRAMEWORK, UPPER VERY FINE TO

FINE GRAIN; POOR SORTING; FRIABLE TO

FIRM AND HARD, SUB ANGULAR, SOME SUB

ROUND, LOW SPHERICITY; LIGHT BROWN

CLAYEY CEMENT, WEAK REACTION TO DELUTED

HCL; VERY POOR INTERGRANULAR POROSITY,

TRACE LIGHT GRAY, BLACK SPECKLED LITHIC

IMBEDDED.

SHALE = LIGHT YELLOWISH BROWN, TRACE

LIGHT GRAYISH BROWN, HUES OF YELLOWISH

GRAY; CRUNCHY, CRUMBLY SOME SLIGHTLY

HARD; DOMINATELY SUB BLOCKY, SLIGHT

IRREGULAR FRACTURE; WEDGELIKE TO

TABULAR, SUB MASSIVE CUTTINGS HABIT;

TRACE OF CAVINGS IN SHAKER; DULL SUB

<100 ROP

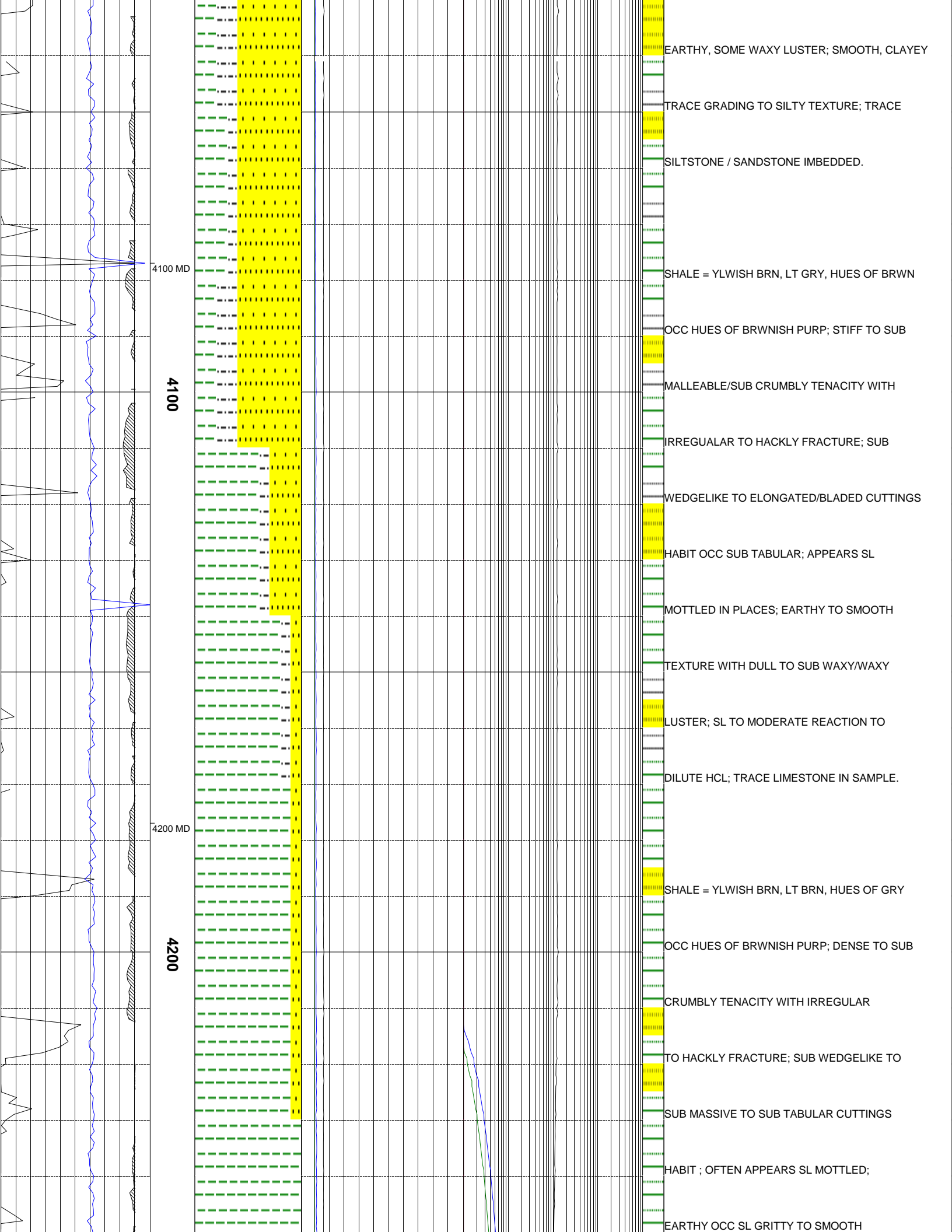
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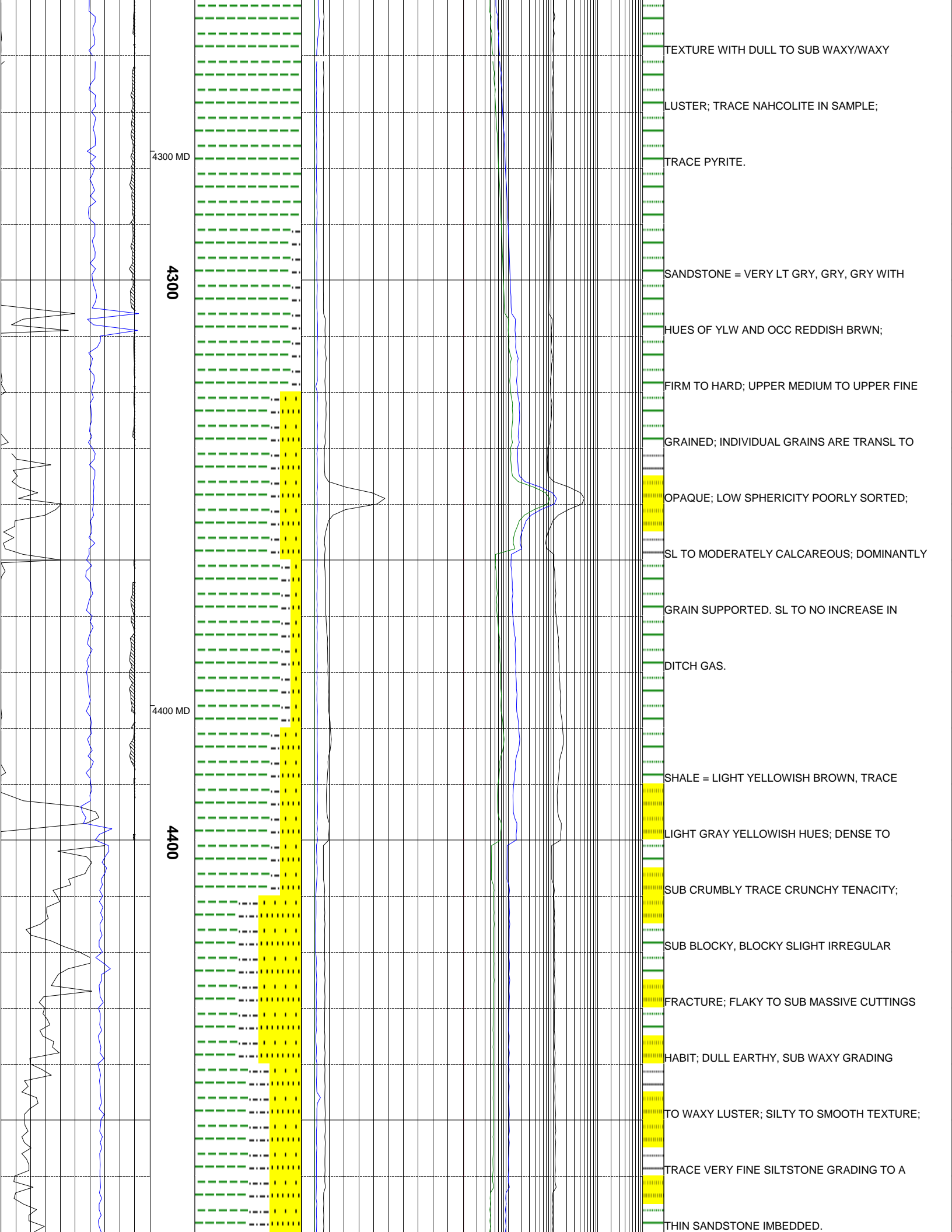
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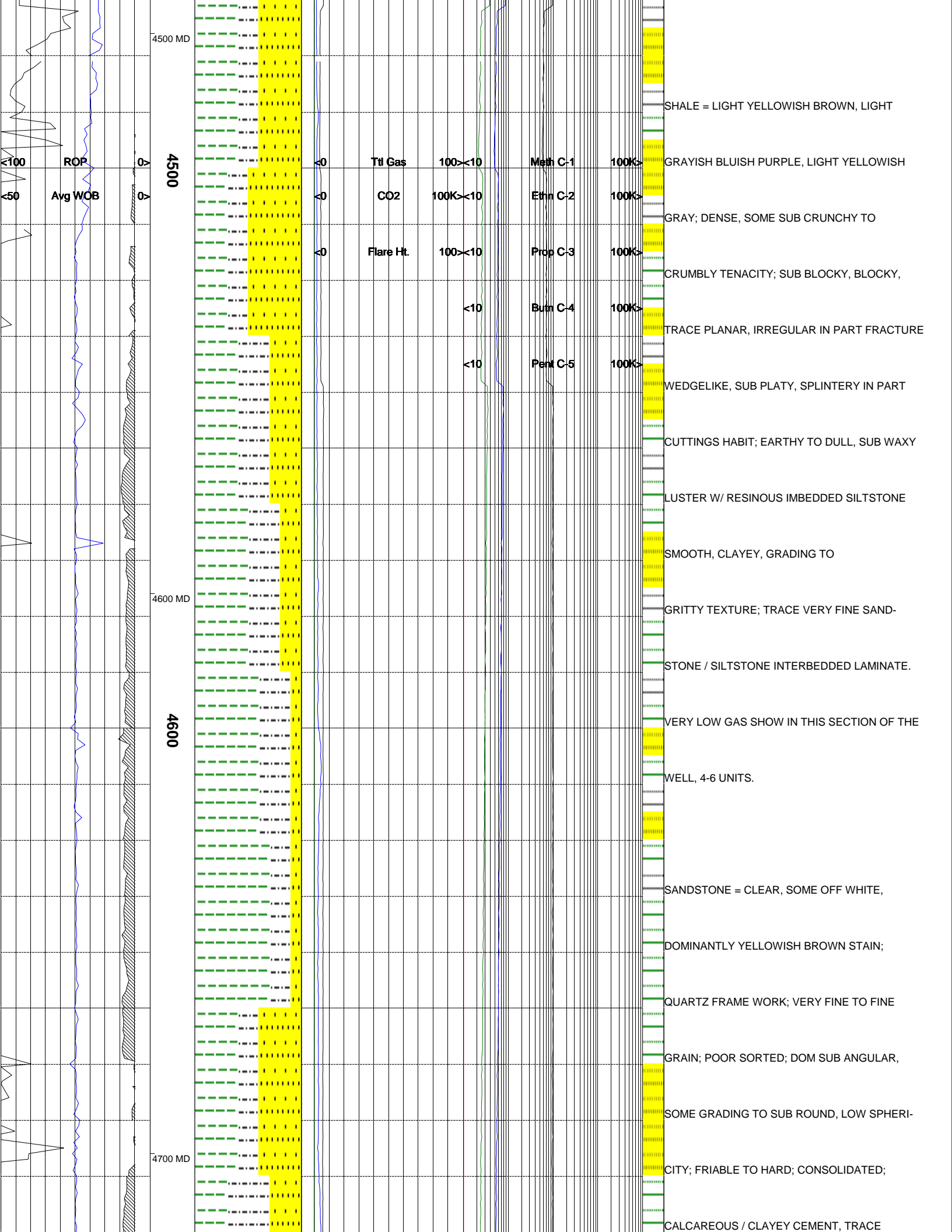
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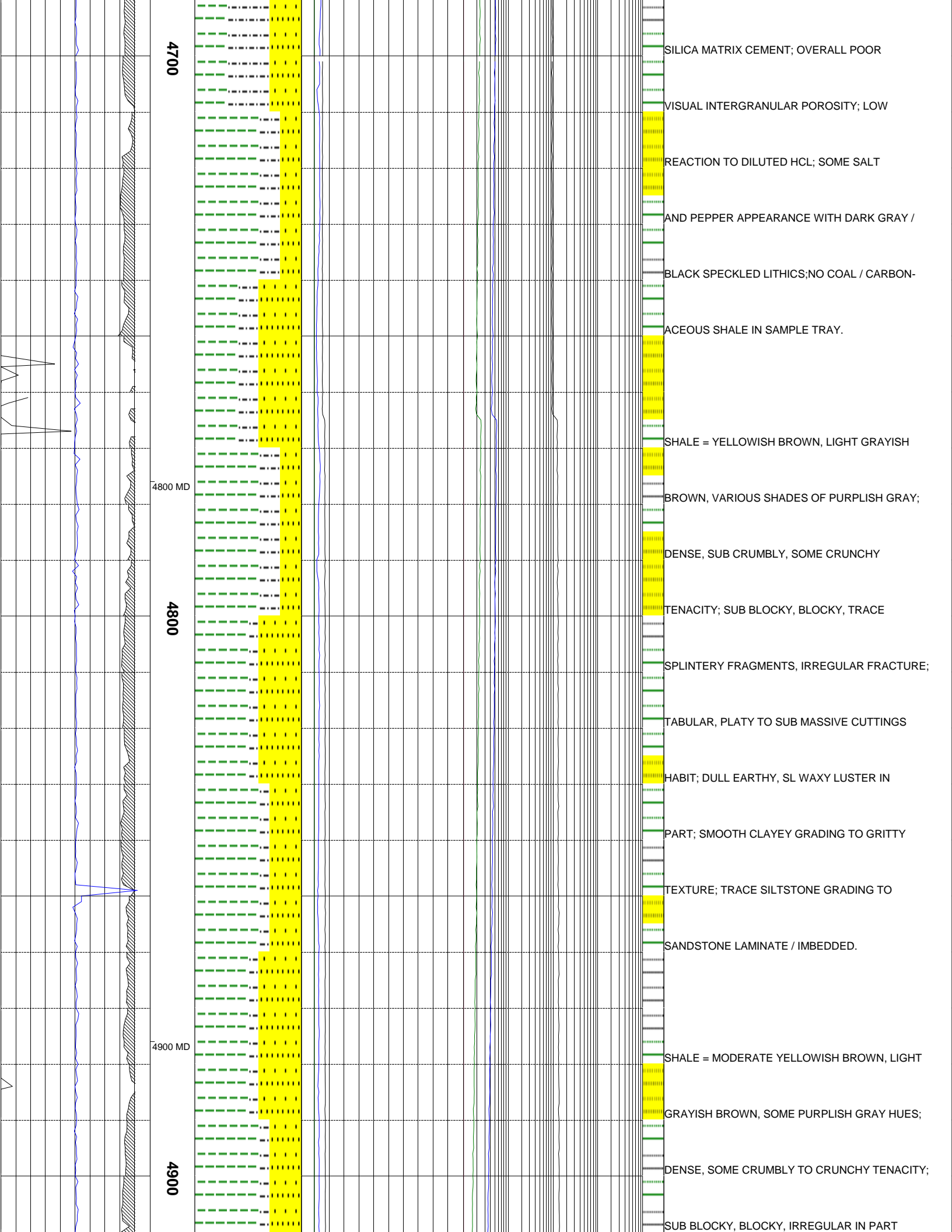
<0 Flare Ht. 100<10 Prop C-3 100K>

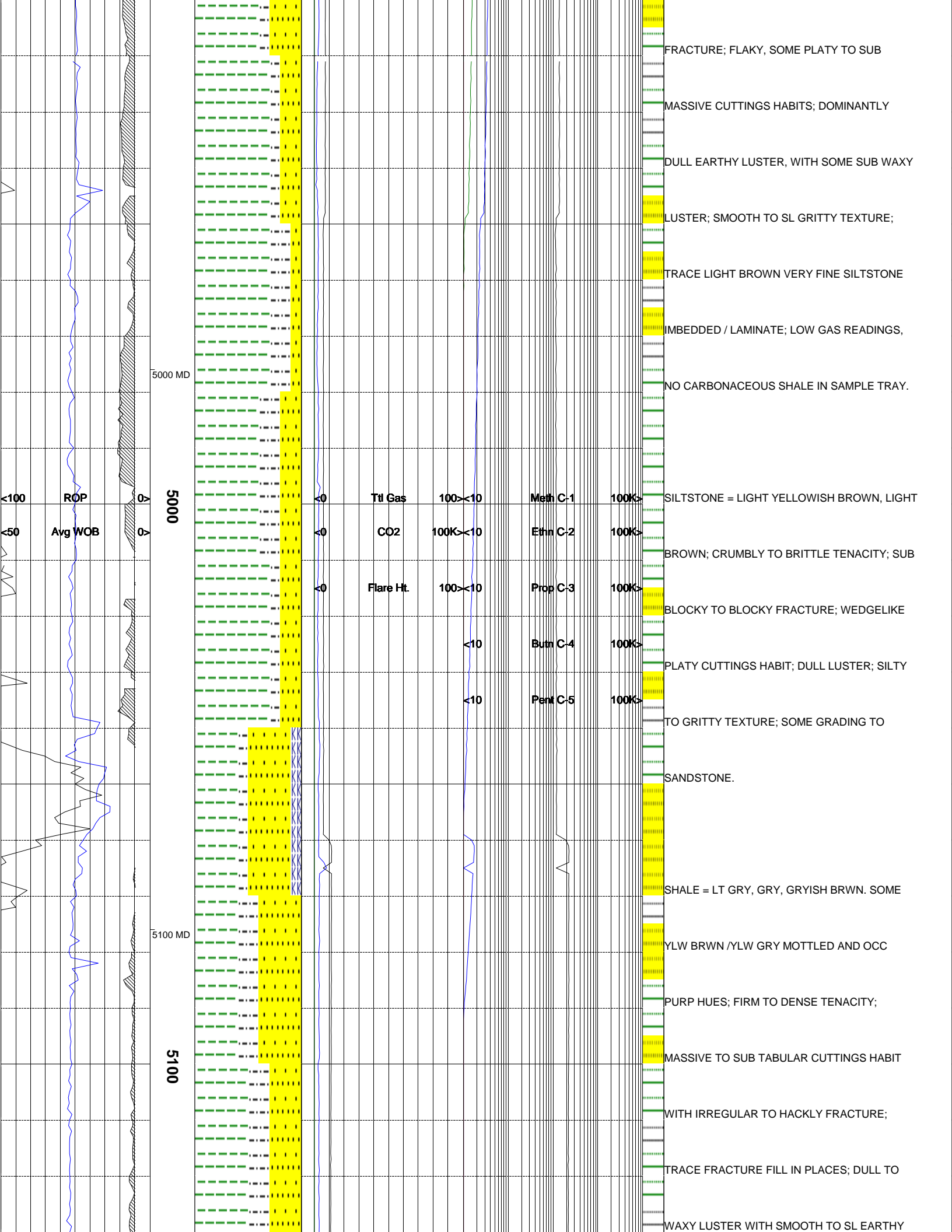
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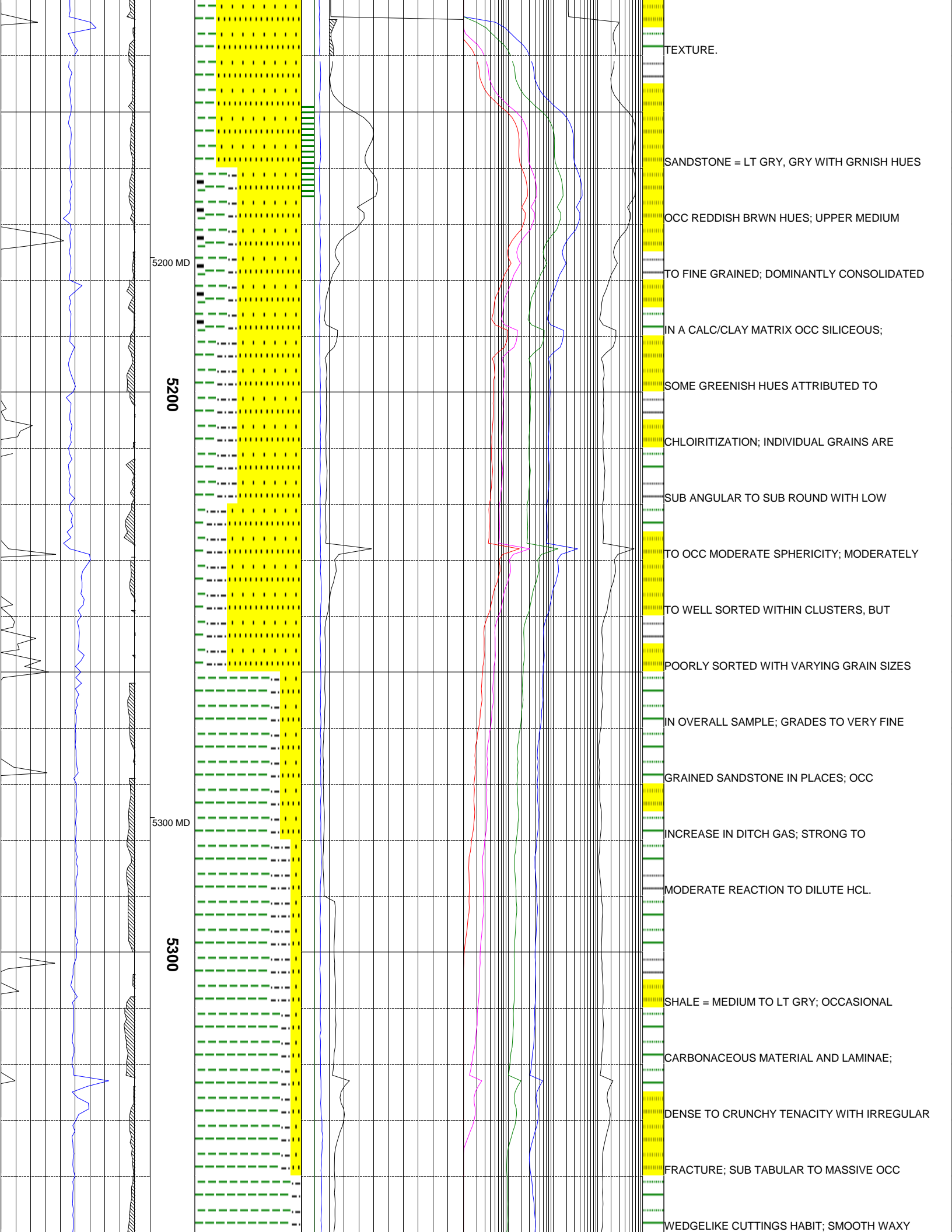


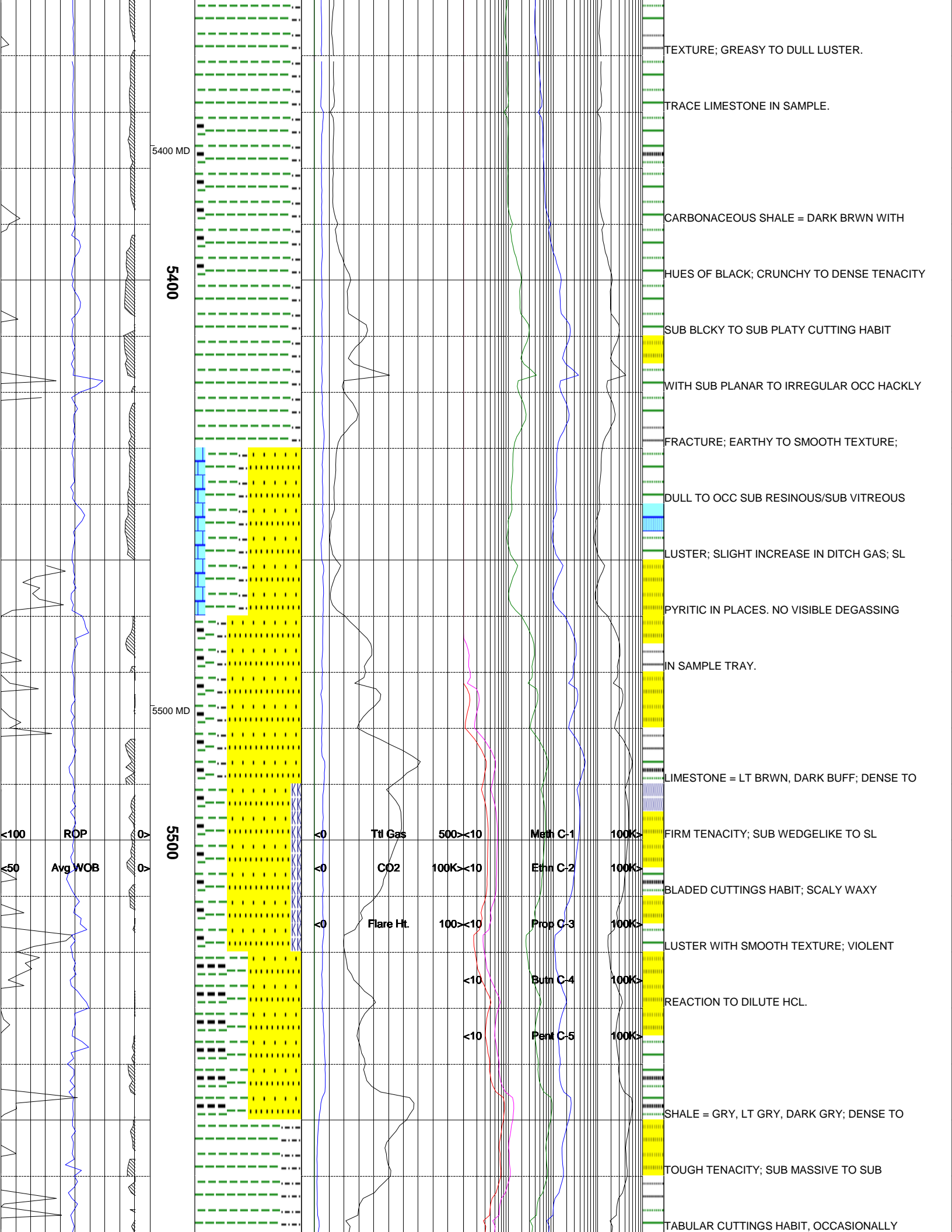


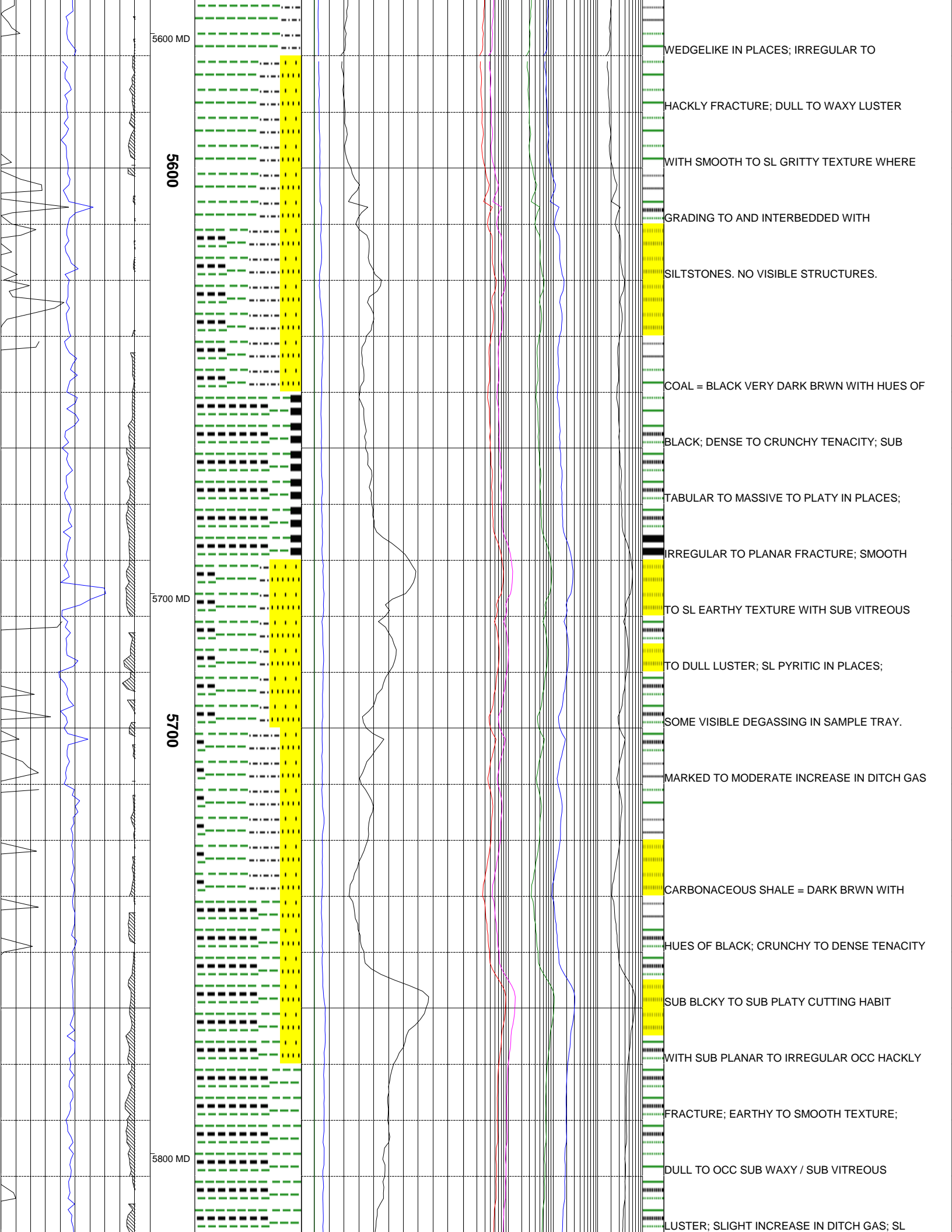


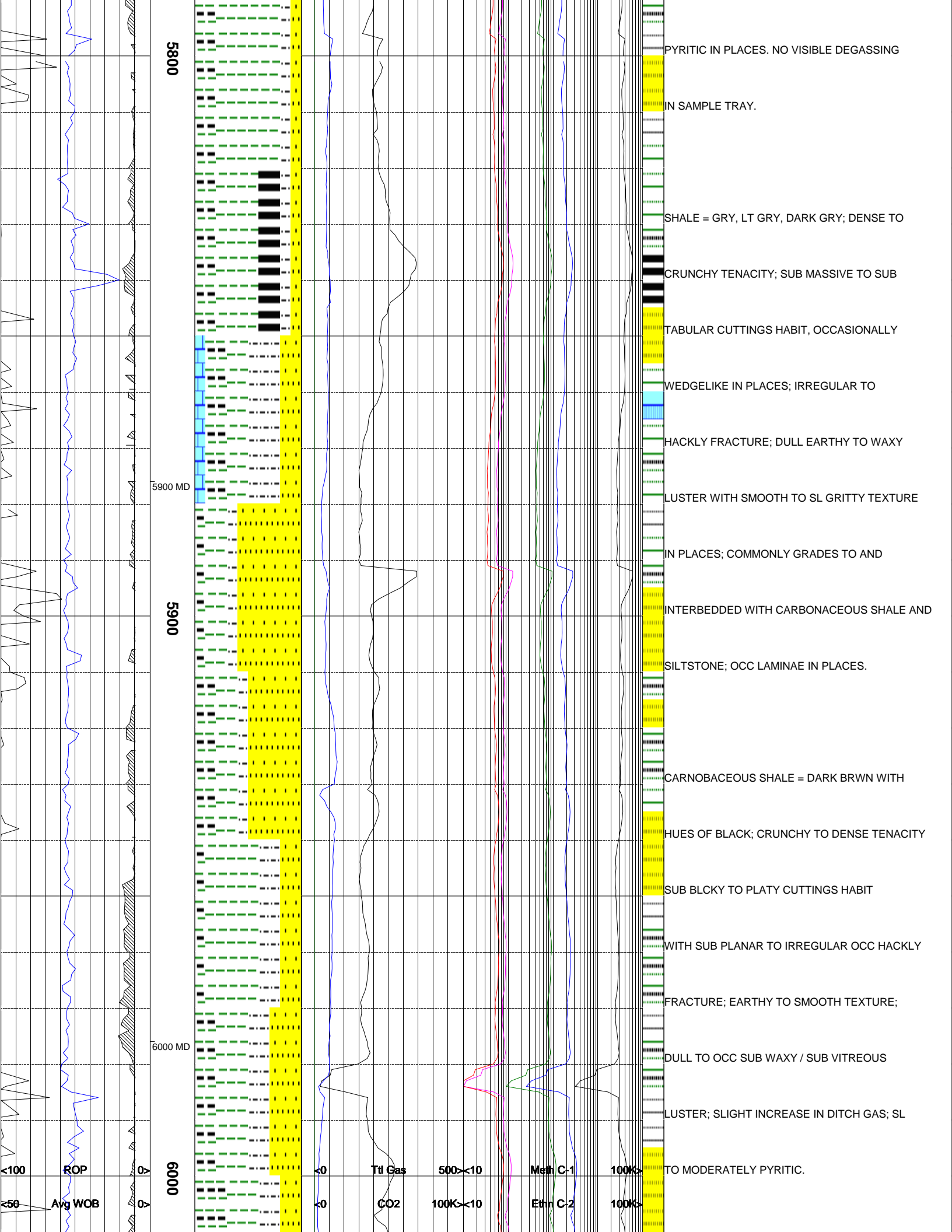


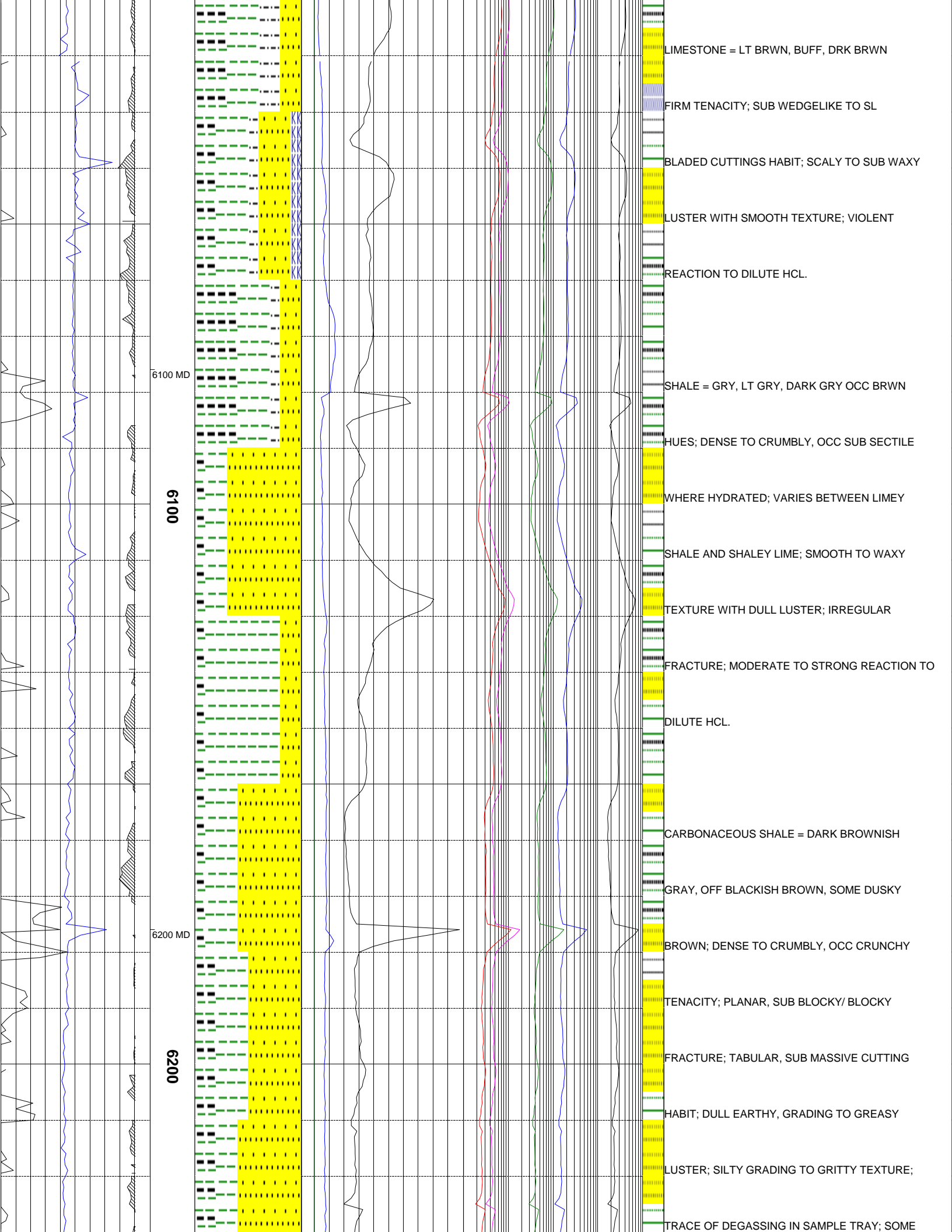


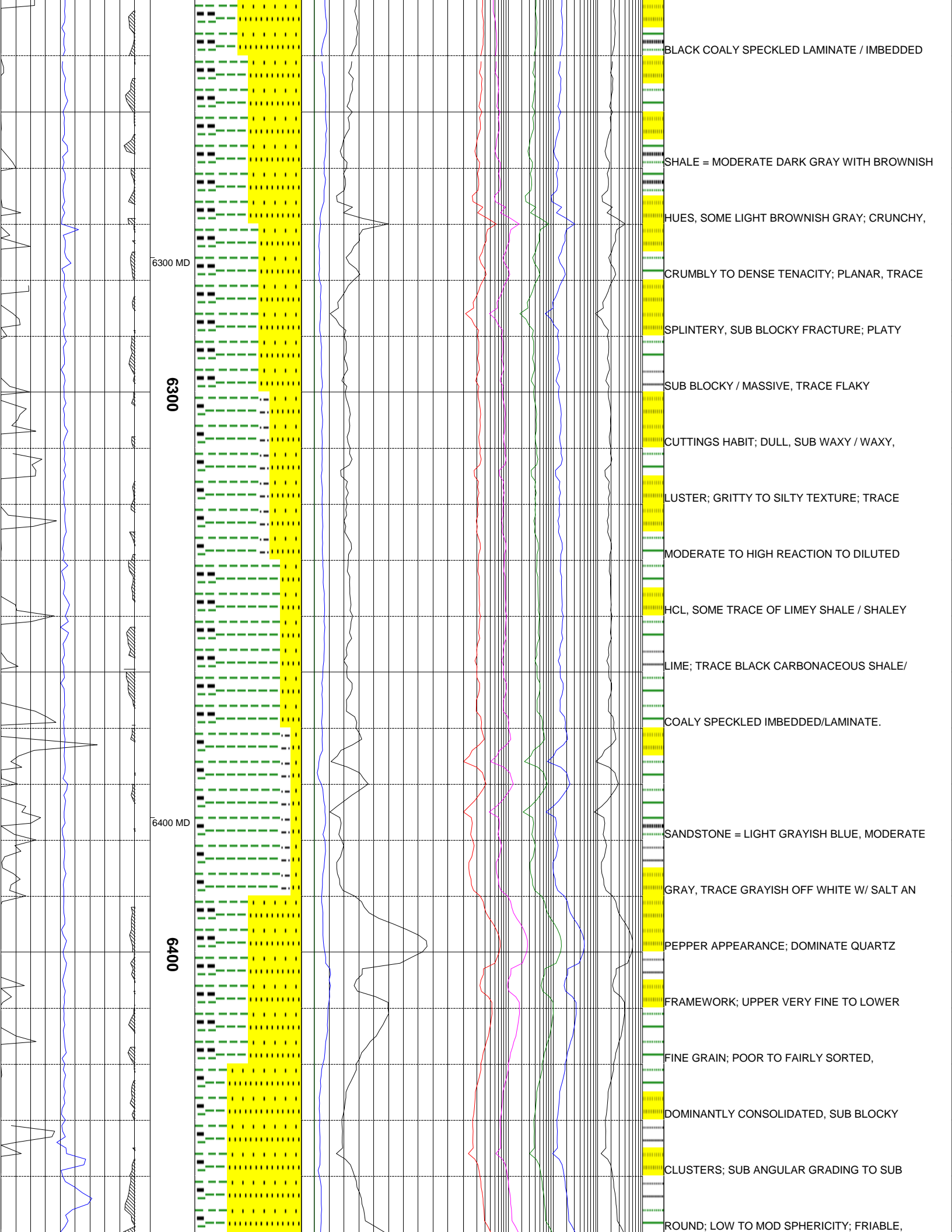


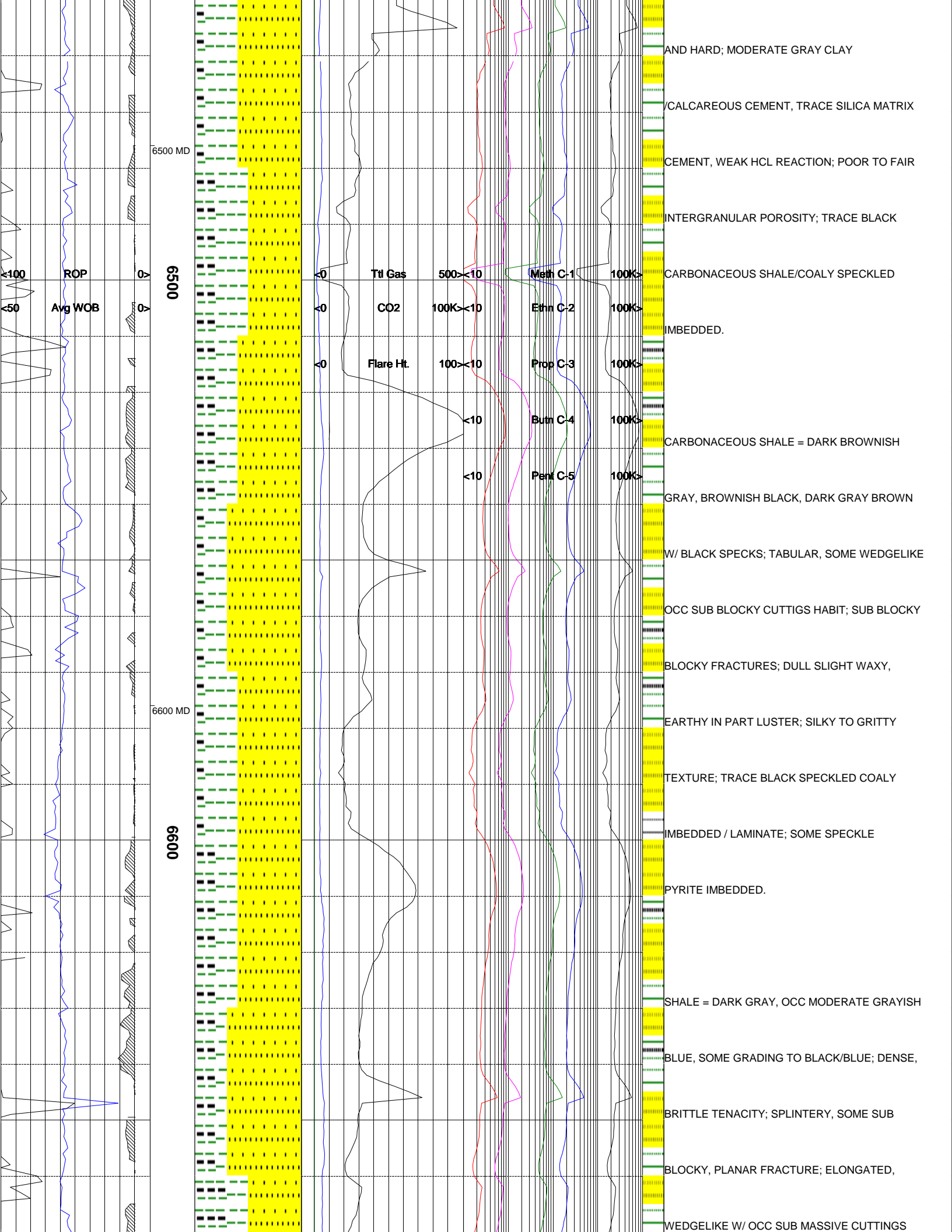


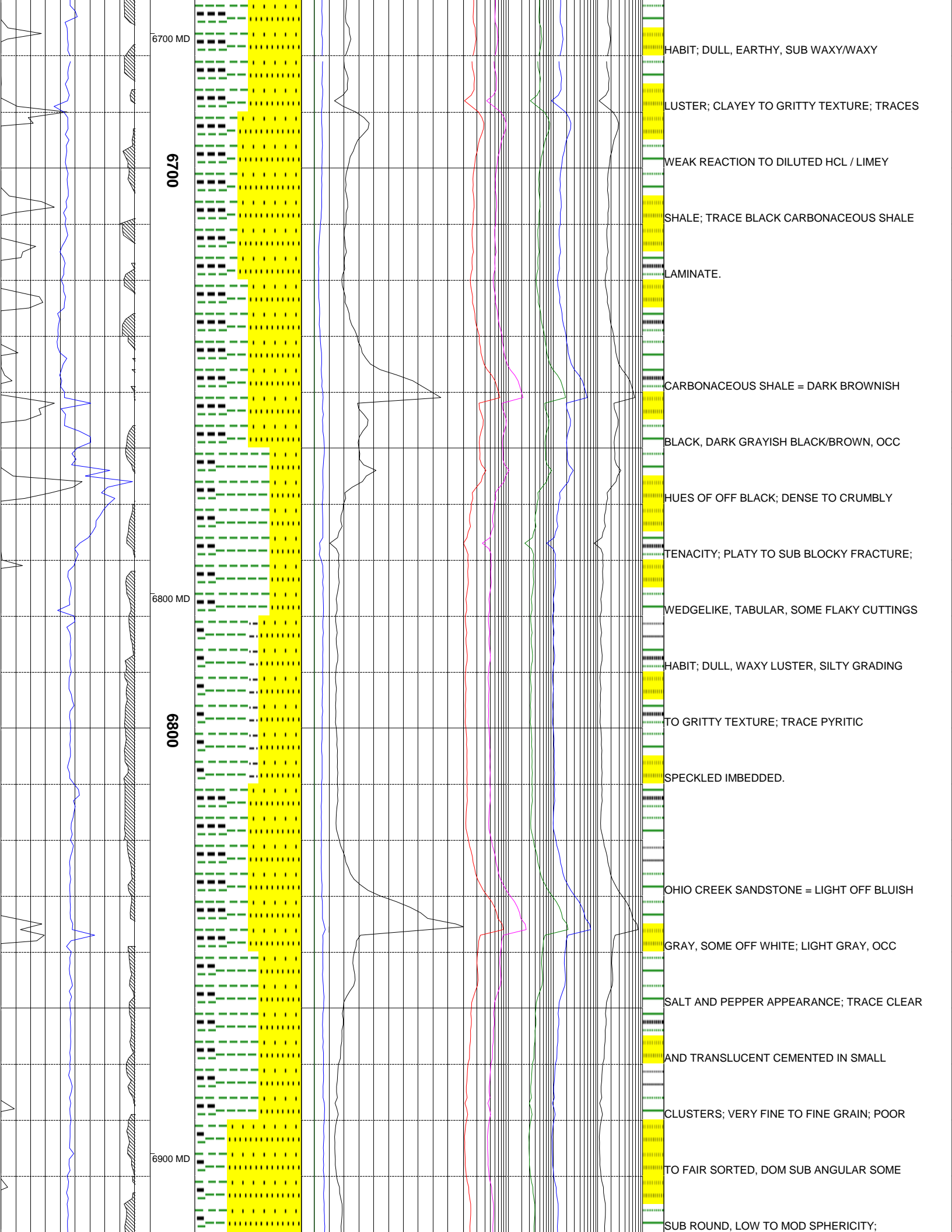












6700 MD

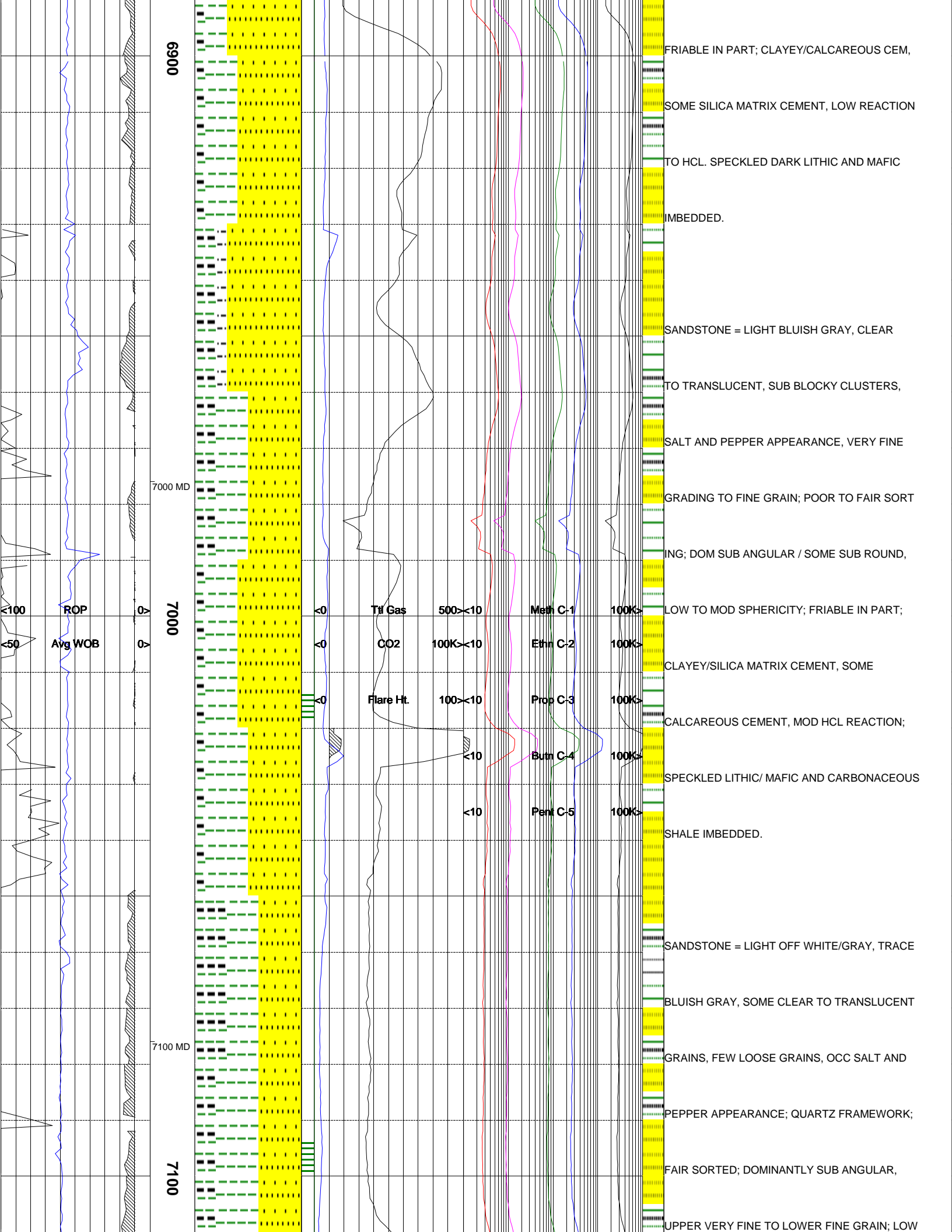
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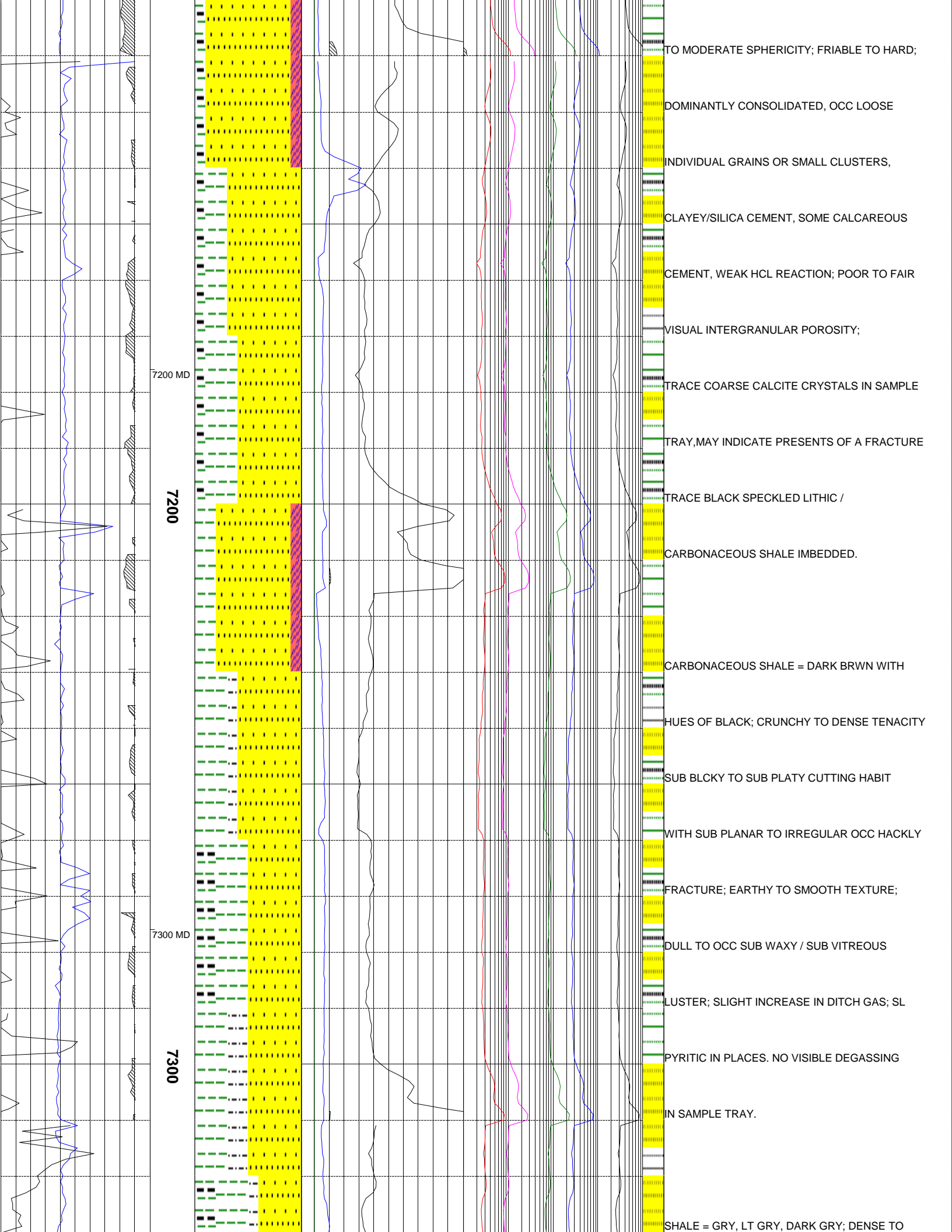
6800 MD

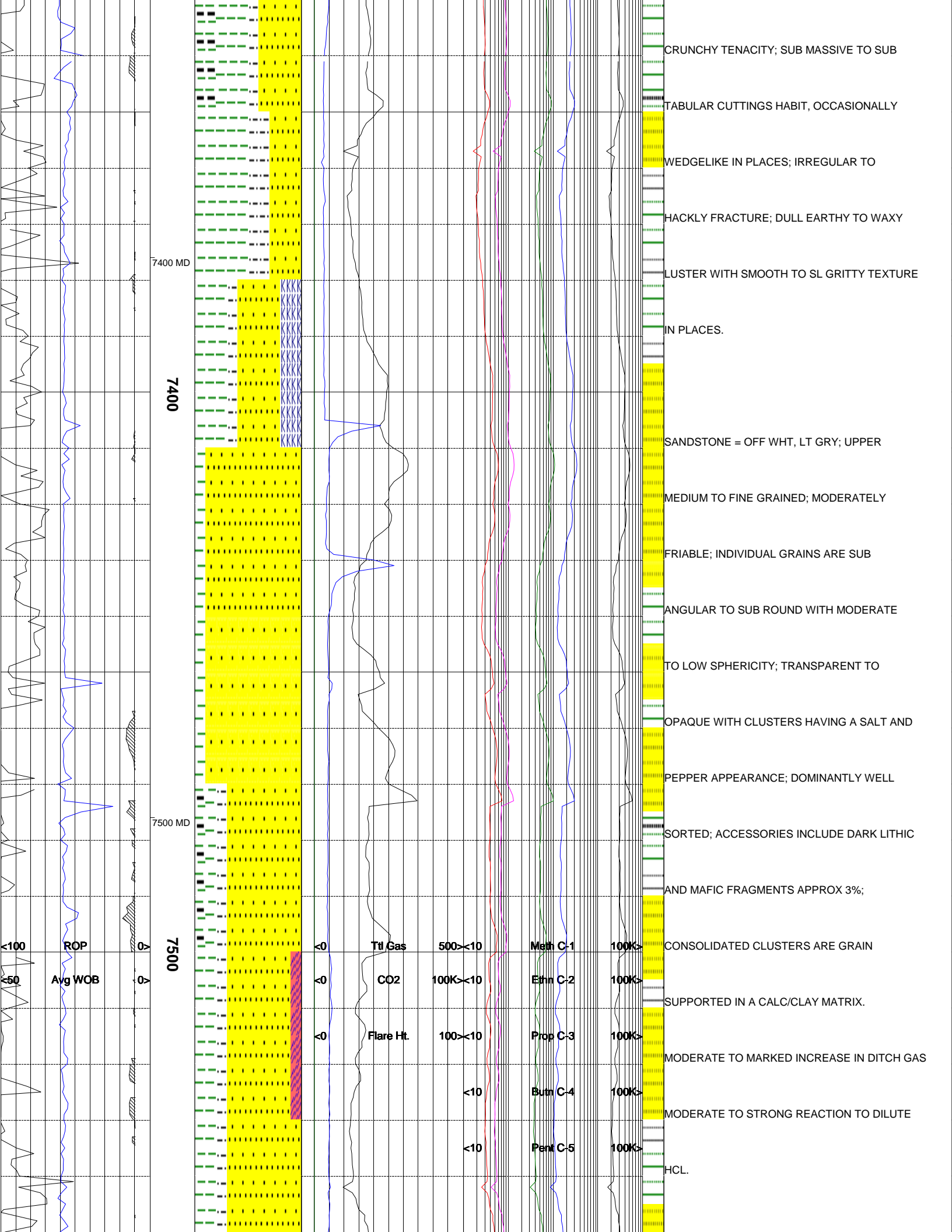
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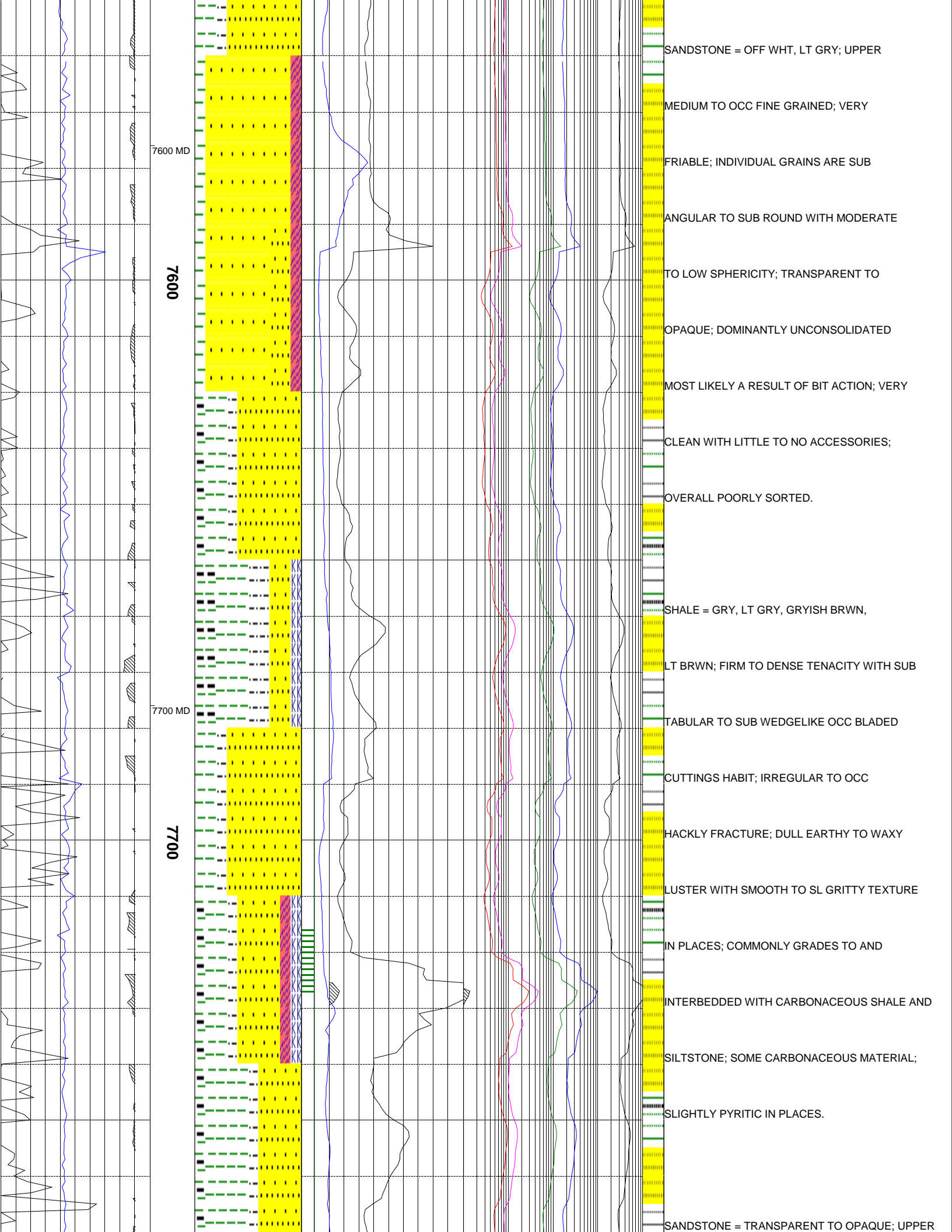
6900 MD

HABIT; DULL, EARTHY, SUB WAXY/WAXY
LUSTER; CLAYEY TO GRITTY TEXTURE; TRACES
WEAK REACTION TO DILUTED HCL / LIMEY
SHALE; TRACE BLACK CARBONACEOUS SHALE
LAMINATE.
CARBONACEOUS SHALE = DARK BROWNISH
BLACK, DARK GRAYISH BLACK/BROWN, OCC
HUES OF OFF BLACK; DENSE TO CRUMBLY
TENACITY; PLATY TO SUB BLOCKY FRACTURE;
WEDGELIKE, TABULAR, SOME FLAKY CUTTINGS
HABIT; DULL, WAXY LUSTER, SILTY GRADING
TO GRITTY TEXTURE; TRACE PYRITIC
SPECKLED IMBEDDED.
OHIO CREEK SANDSTONE = LIGHT OFF BLUISH
GRAY, SOME OFF WHITE; LIGHT GRAY, OCC
SALT AND PEPPER APPEARANCE; TRACE CLEAR
AND TRANSLUCENT CEMENTED IN SMALL
CLUSTERS; VERY FINE TO FINE GRAIN; POOR
TO FAIR SORTED, DOM SUB ANGULAR SOME
SUB ROUND, LOW TO MOD SPHERICITY;









7600 MD

7600

7700 MD

7700

SANDSTONE = OFF WHT, LT GRY; UPPER

MEDIUM TO OCC FINE GRAINED; VERY

FRIABLE; INDIVIDUAL GRAINS ARE SUB

ANGULAR TO SUB ROUND WITH MODERATE

TO LOW SPHERICITY; TRANSPARENT TO

OPAQUE; DOMINANTLY UNCONSOLIDATED

MOST LIKELY A RESULT OF BIT ACTION; VERY

CLEAN WITH LITTLE TO NO ACCESSORIES;

OVERALL POORLY SORTED.

SHALE = GRY, LT GRY, GRYISH BRWN,

LT BRWN; FIRM TO DENSE TENACITY WITH SUB

TABULAR TO SUB WEDGELIKE OCC BLADED

CUTTINGS HABIT; IRREGULAR TO OCC

HACKLY FRACTURE; DULL EARTHY TO WAXY

LUSTER WITH SMOOTH TO SL GRITTY TEXTURE

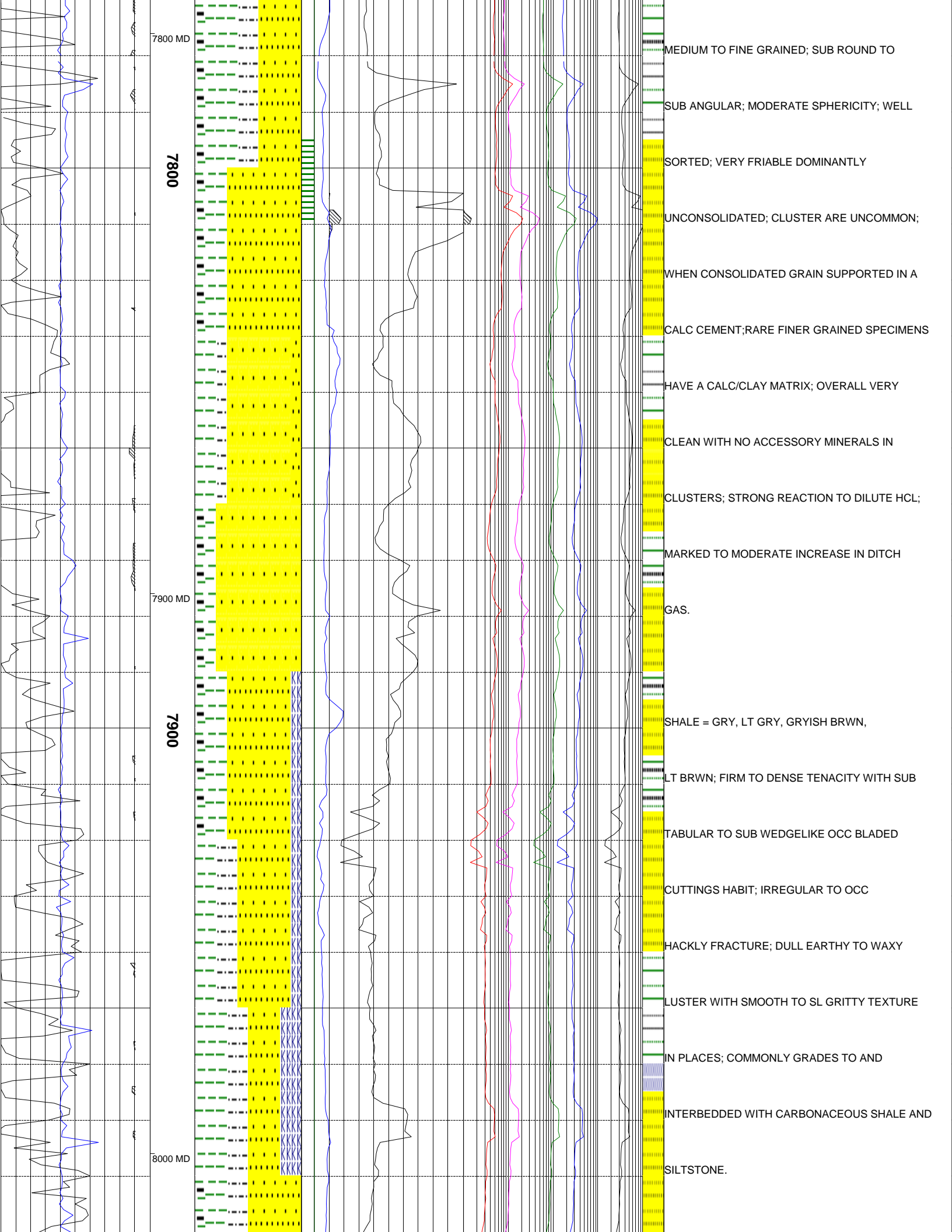
IN PLACES; COMMONLY GRADES TO AND

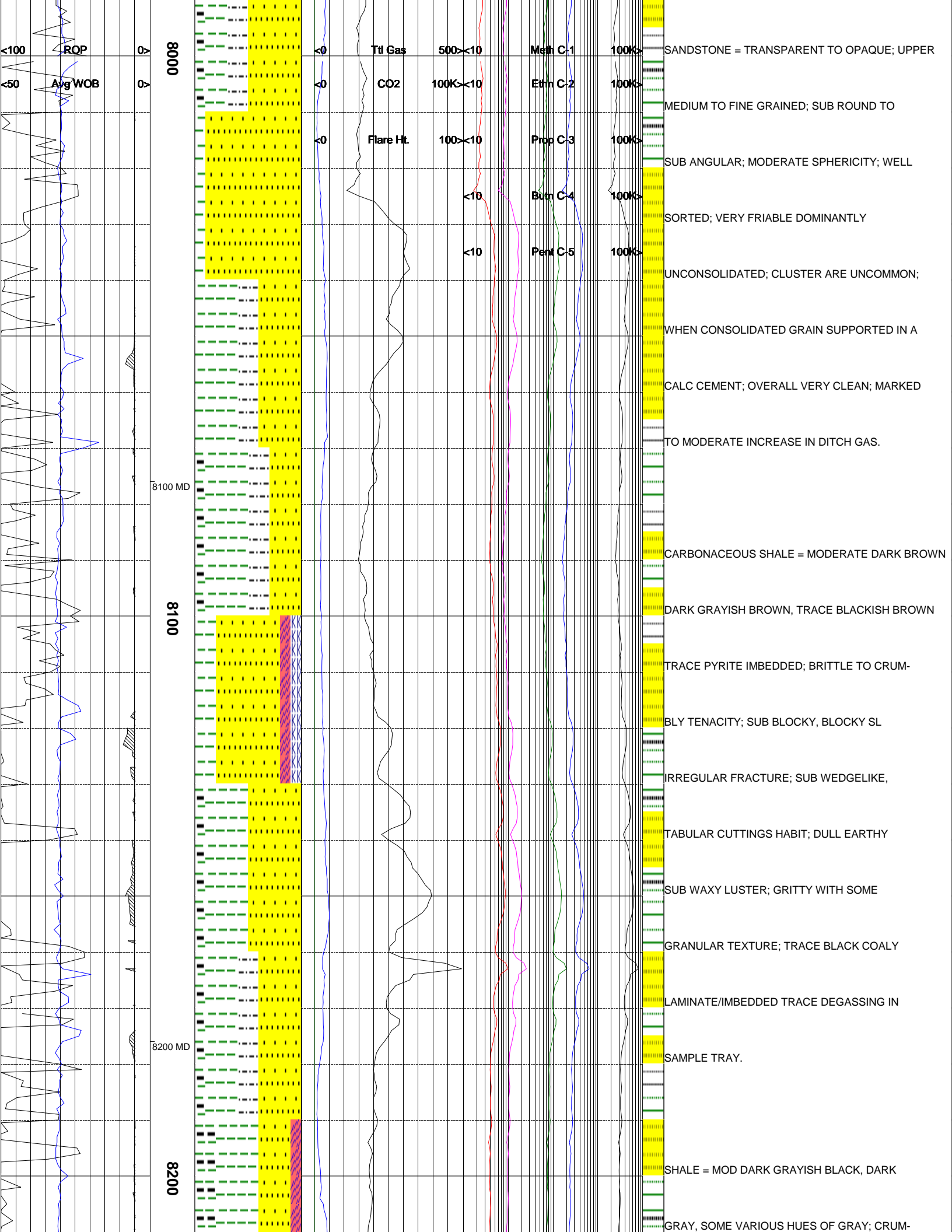
INTERBEDDED WITH CARBONACEOUS SHALE AND

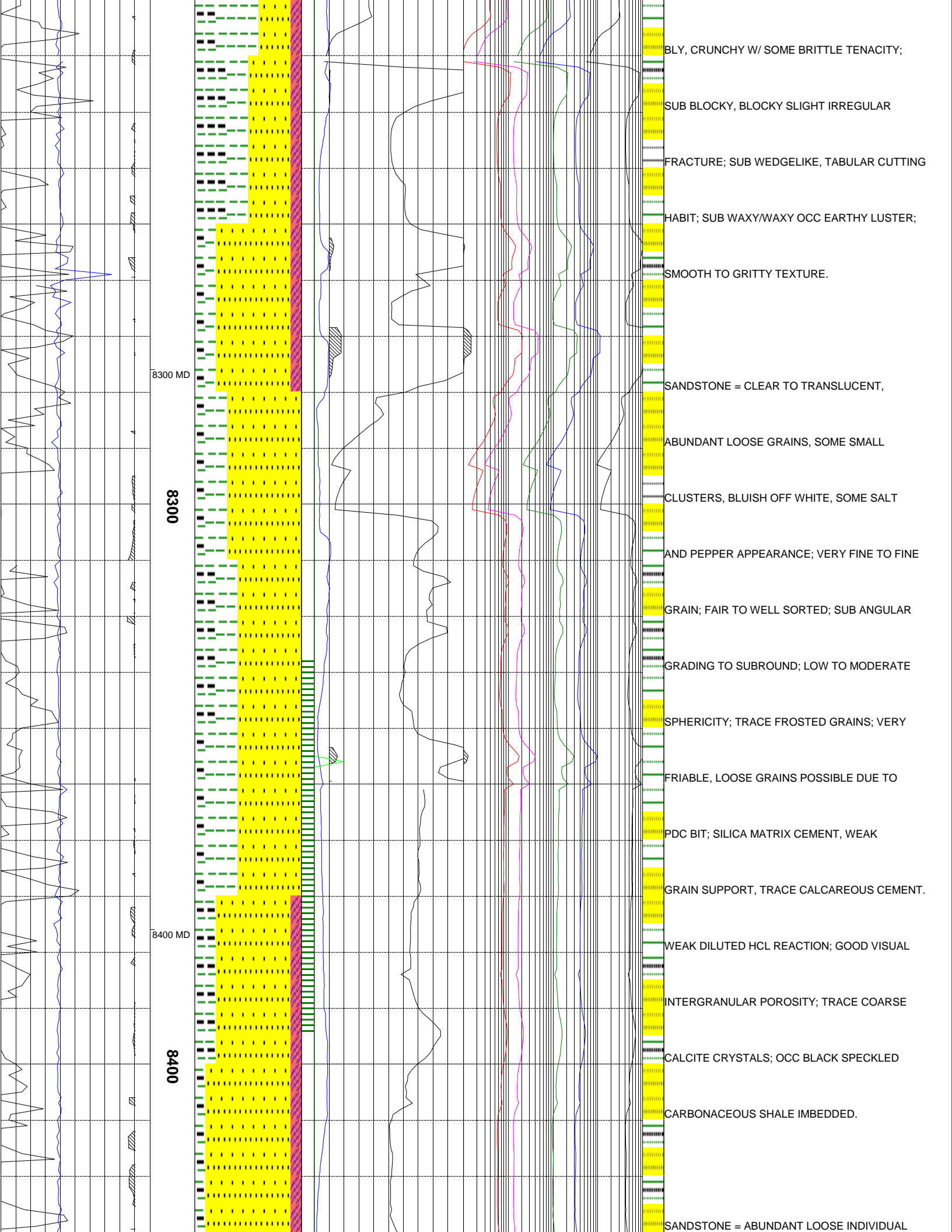
SILTSTONE; SOME CARBONACEOUS MATERIAL;

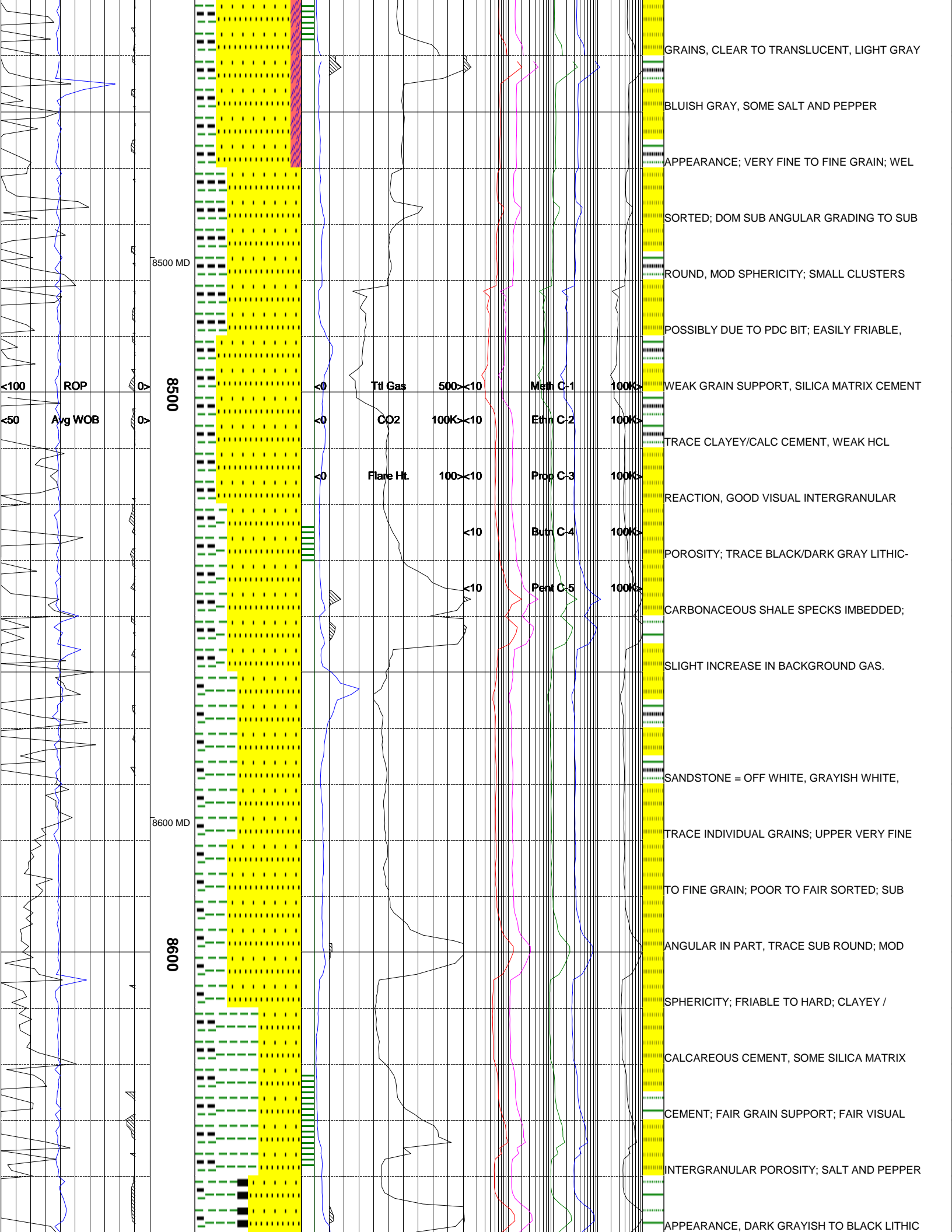
SLIGHTLY PYRITIC IN PLACES.

SANDSTONE = TRANSPARENT TO OPAQUE; UPPER









8500 MD

8500

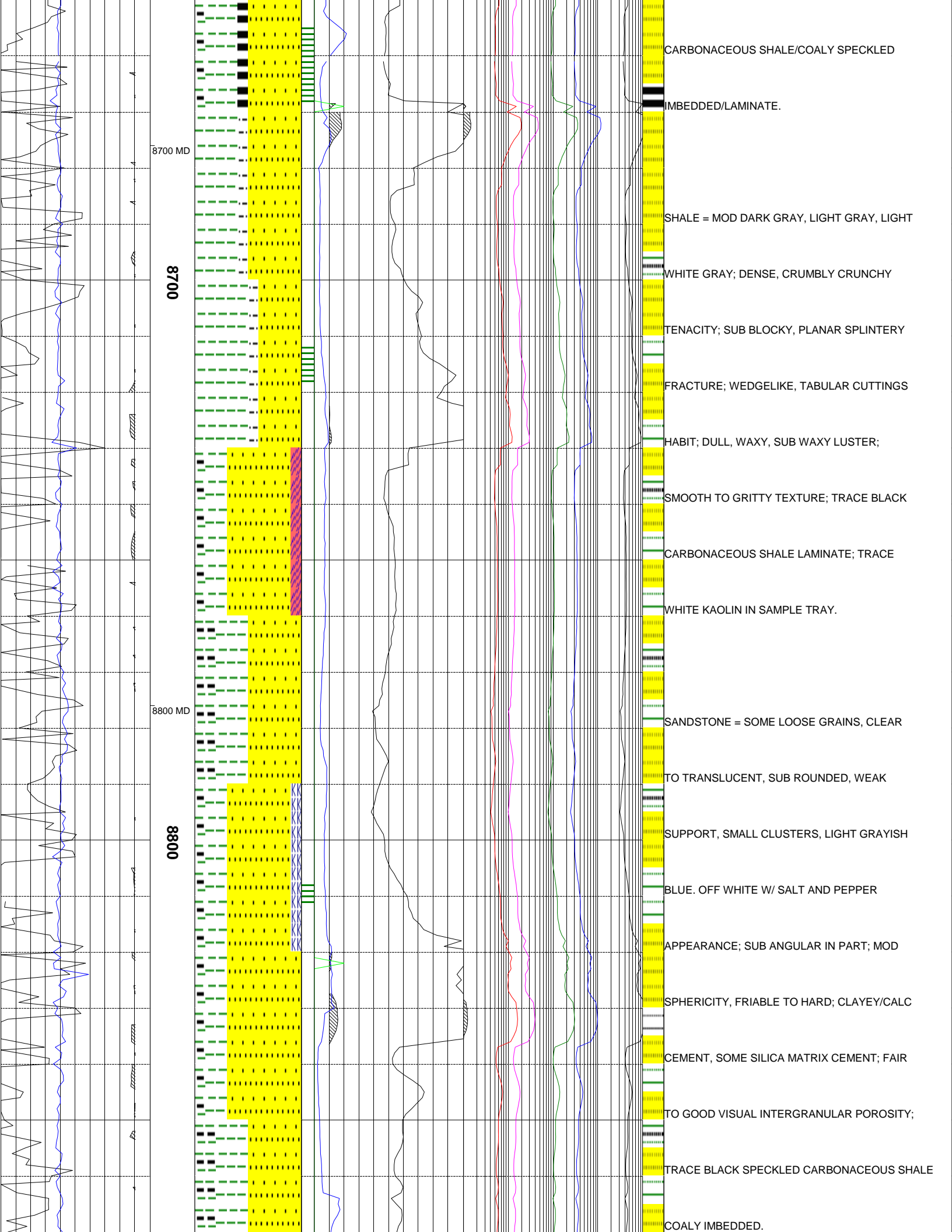
8600 MD

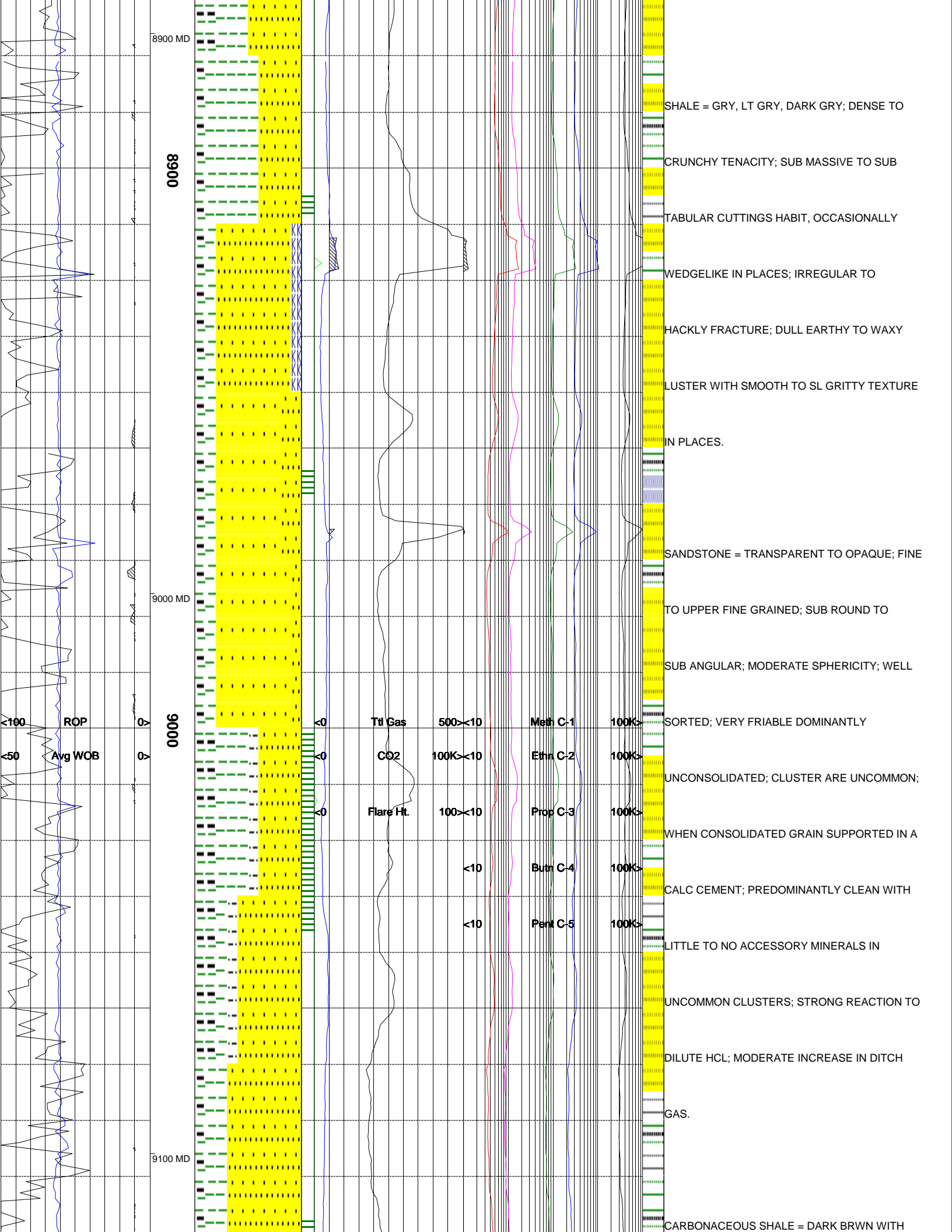
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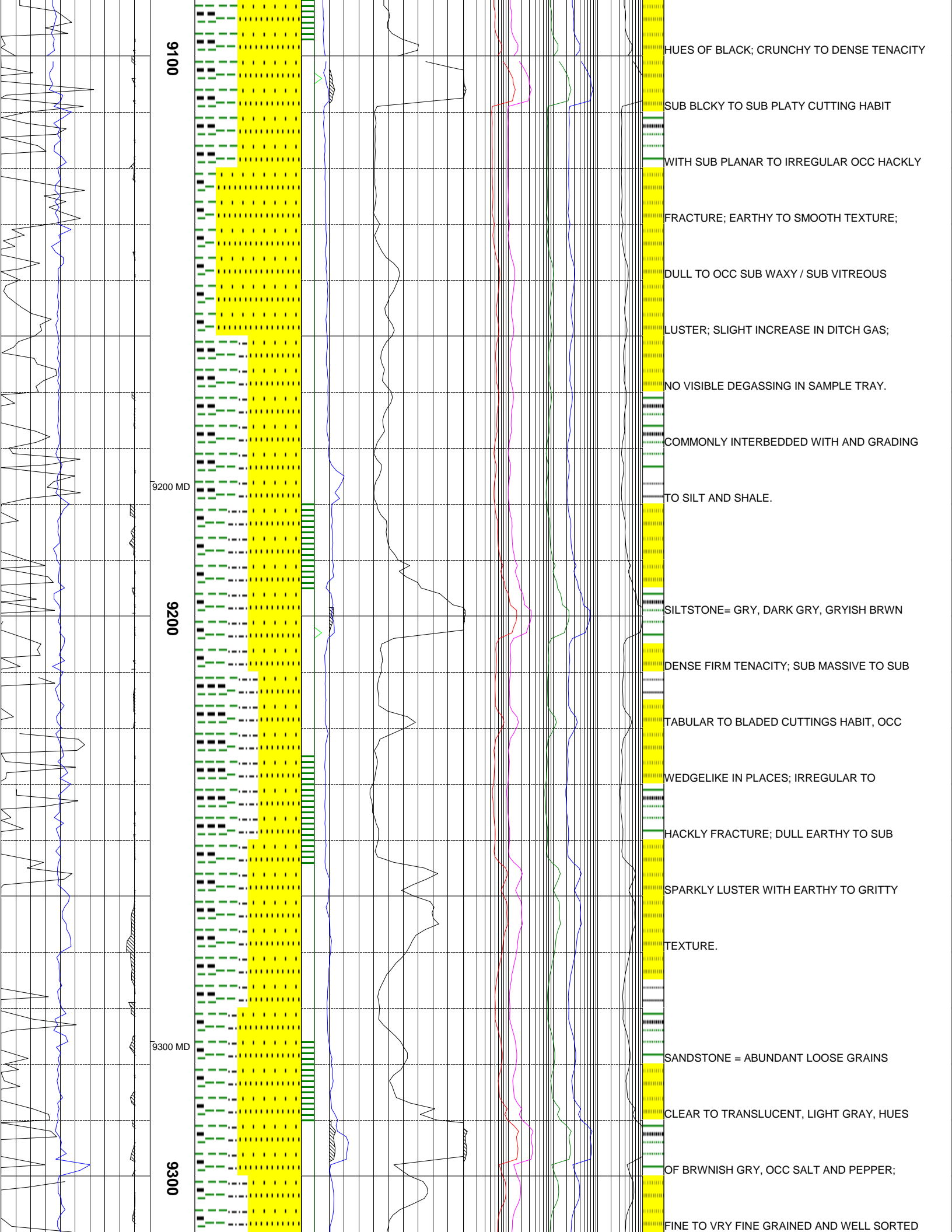
<100 ROP
<50 Avg WOB

Ttl Gas 500 <10 Meth C-1 100K >
 CO2 100K <10 Ethn C-2 100K >
 Flare Ht. 100 <10 Prop C-3 100K >
 <10 Butn C-4 100K >
 <10 Pent C-5 100K >

GRAINS, CLEAR TO TRANSLUCENT, LIGHT GRAY
 BLUISH GRAY, SOME SALT AND PEPPER
 APPEARANCE; VERY FINE TO FINE GRAIN; WEL
 SORTED; DOM SUB ANGULAR GRADING TO SUB
 ROUND, MOD SPHERICITY; SMALL CLUSTERS
 POSSIBLY DUE TO PDC BIT; EASILY FRIABLE,
 WEAK GRAIN SUPPORT, SILICA MATRIX CEMENT
 TRACE CLAYEY/CALC CEMENT, WEAK HCL
 REACTION, GOOD VISUAL INTERGRANULAR
 POROSITY; TRACE BLACK/DARK GRAY LITHIC-
 CARBONACEOUS SHALE SPECKS IMBEDDED;
 SLIGHT INCREASE IN BACKGROUND GAS.
 SANDSTONE = OFF WHITE, GRAYISH WHITE,
 TRACE INDIVIDUAL GRAINS; UPPER VERY FINE
 TO FINE GRAIN; POOR TO FAIR SORTED; SUB
 ANGULAR IN PART, TRACE SUB ROUND; MOD
 SPHERICITY; FRIABLE TO HARD; CLAYEY /
 CALCAREOUS CEMENT, SOME SILICA MATRIX
 CEMENT; FAIR GRAIN SUPPORT; FAIR VISUAL
 INTERGRANULAR POROSITY; SALT AND PEPPER
 APPEARANCE, DARK GRAYISH TO BLACK LITHIC







9100

HUES OF BLACK; CRUNCHY TO DENSE TENACITY

SUB BLCY TO SUB PLATY CUTTING HABIT

WITH SUB PLANAR TO IRREGULAR OCC HACKLY

FRACTURE; EARTHY TO SMOOTH TEXTURE;

DULL TO OCC SUB WAXY / SUB VITREOUS

LUSTER; SLIGHT INCREASE IN DITCH GAS;

NO VISIBLE DEGASSING IN SAMPLE TRAY.

COMMONLY INTERBEDDED WITH AND GRADING

TO SILT AND SHALE.

9200 MD

9200

SILTSTONE= GRY, DARK GRY, GRYISH BRWN

DENSE FIRM TENACITY; SUB MASSIVE TO SUB

TABULAR TO BLADED CUTTINGS HABIT, OCC

WEDGELIKE IN PLACES; IRREGULAR TO

HACKLY FRACTURE; DULL EARTHY TO SUB

SPARKLY LUSTER WITH EARTHY TO GRITTY

TEXTURE.

9300 MD

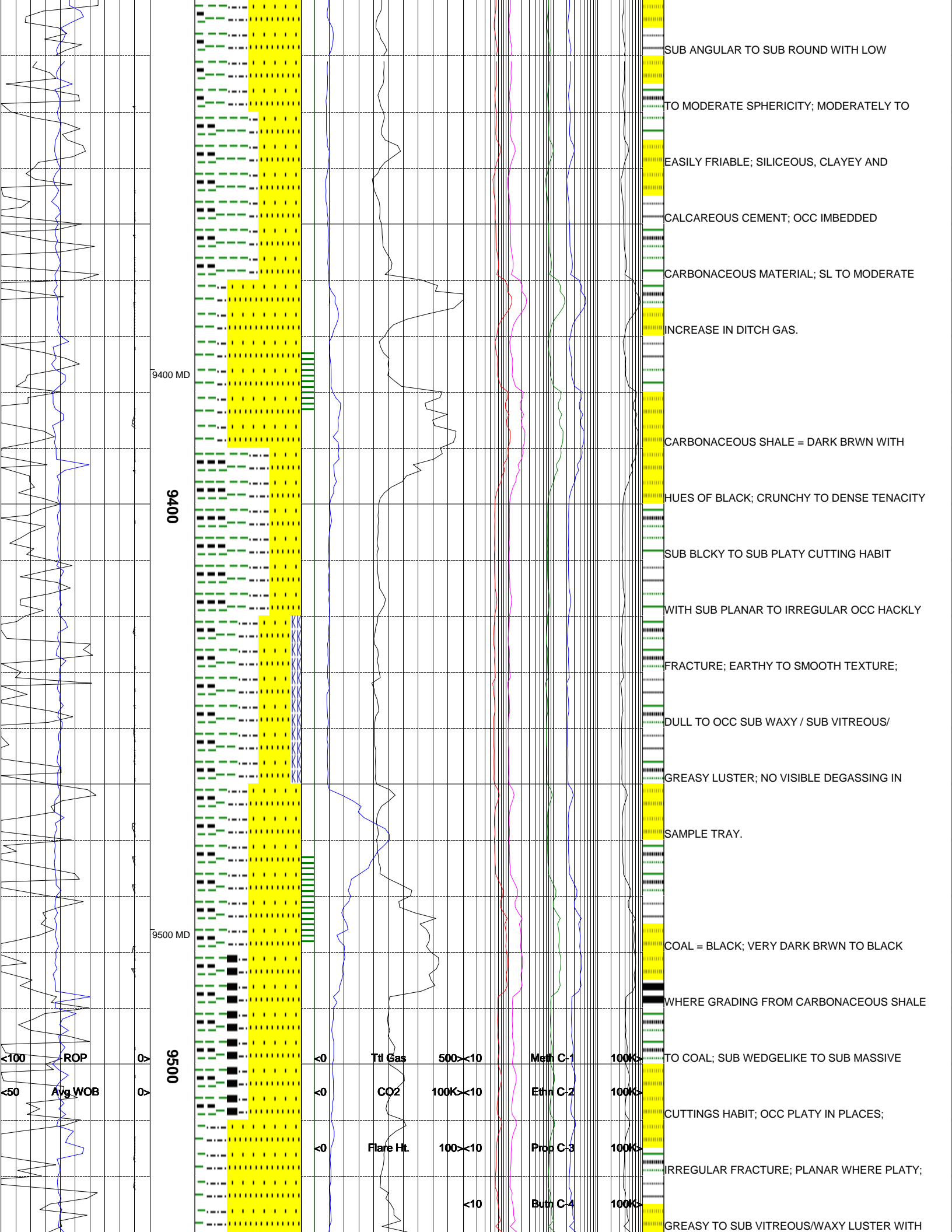
9300

SANDSTONE = ABUNDANT LOOSE GRAINS

CLEAR TO TRANSLUCENT, LIGHT GRAY, HUES

OF BRWNISH GRY, OCC SALT AND PEPPER;

FINE TO VRY FINE GRAINED AND WELL SORTED



9400 MD

9400

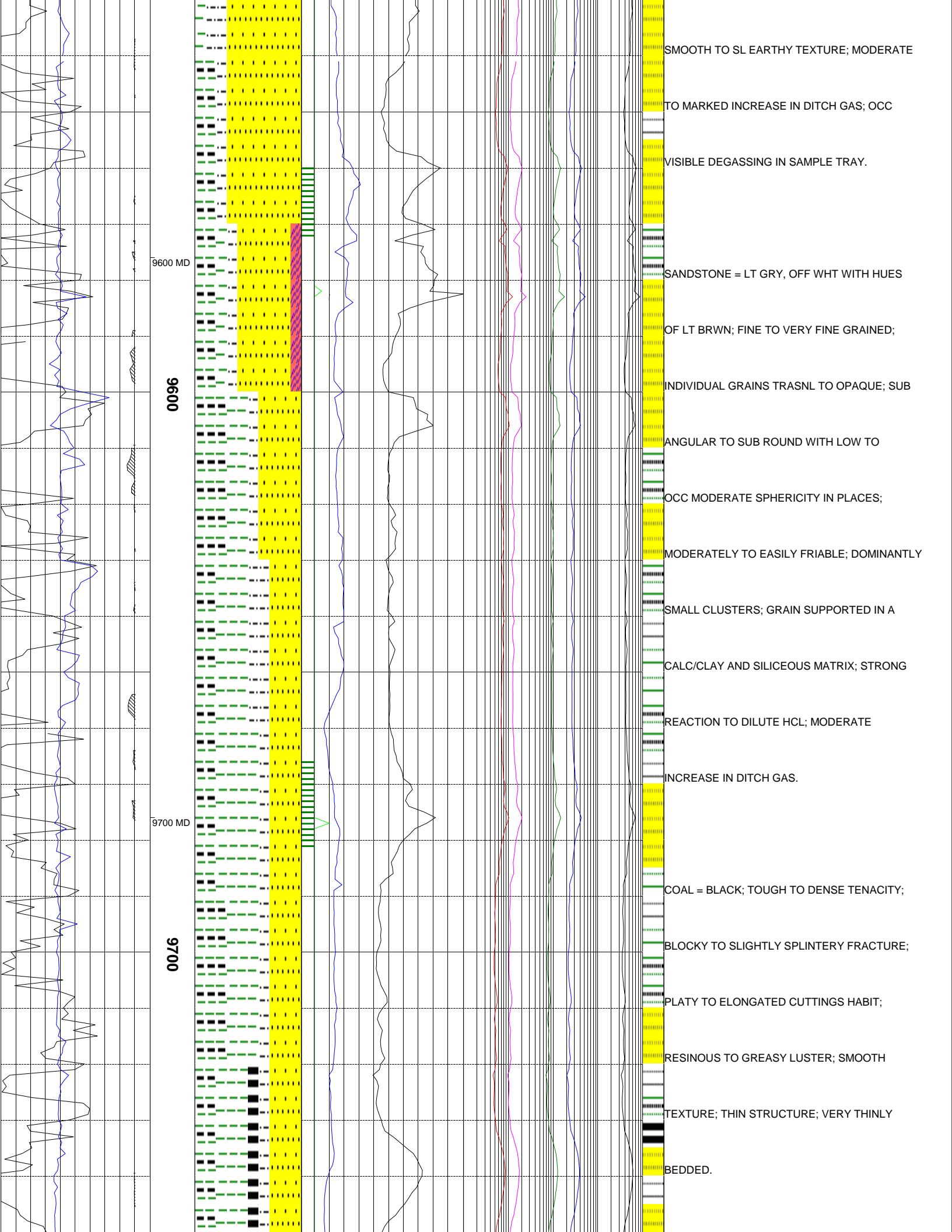
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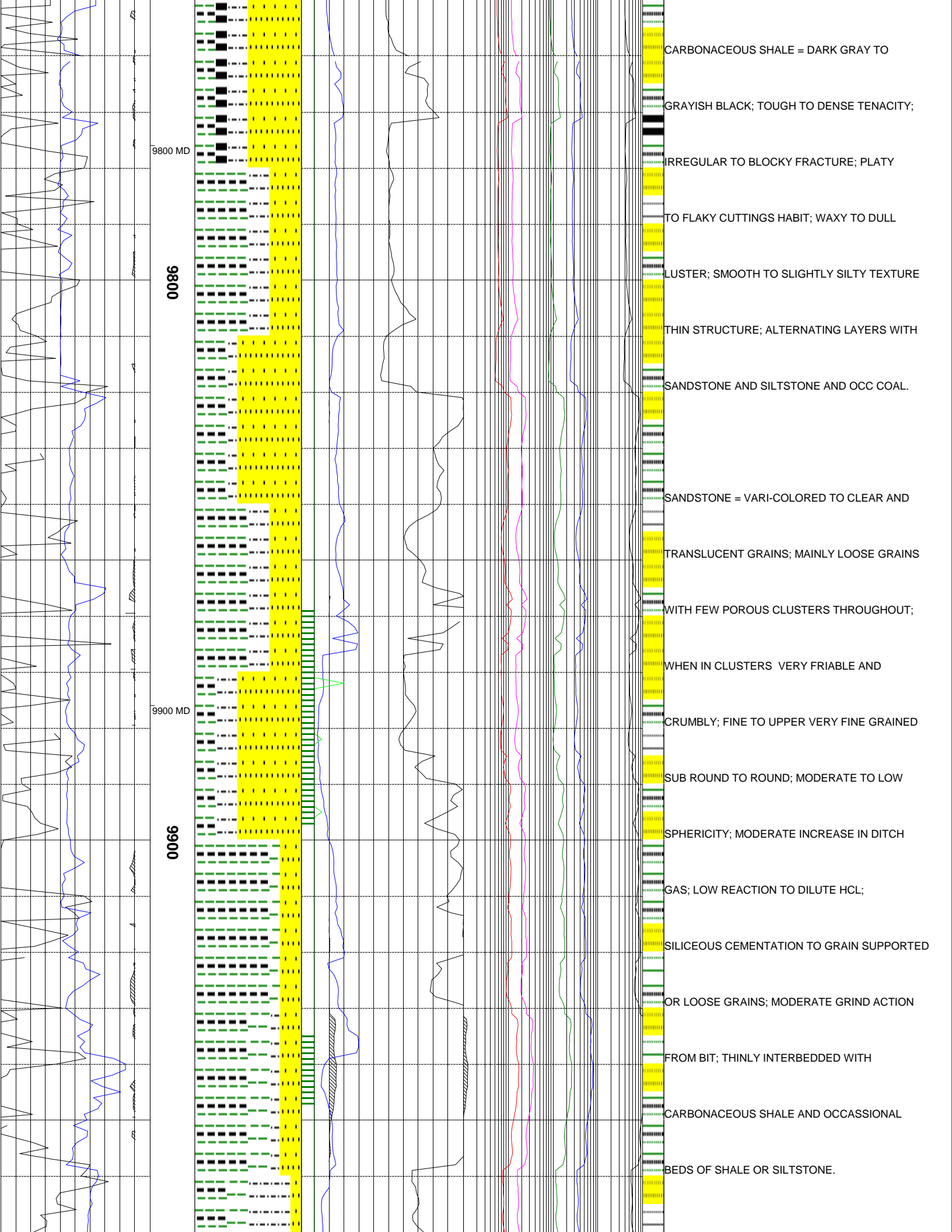
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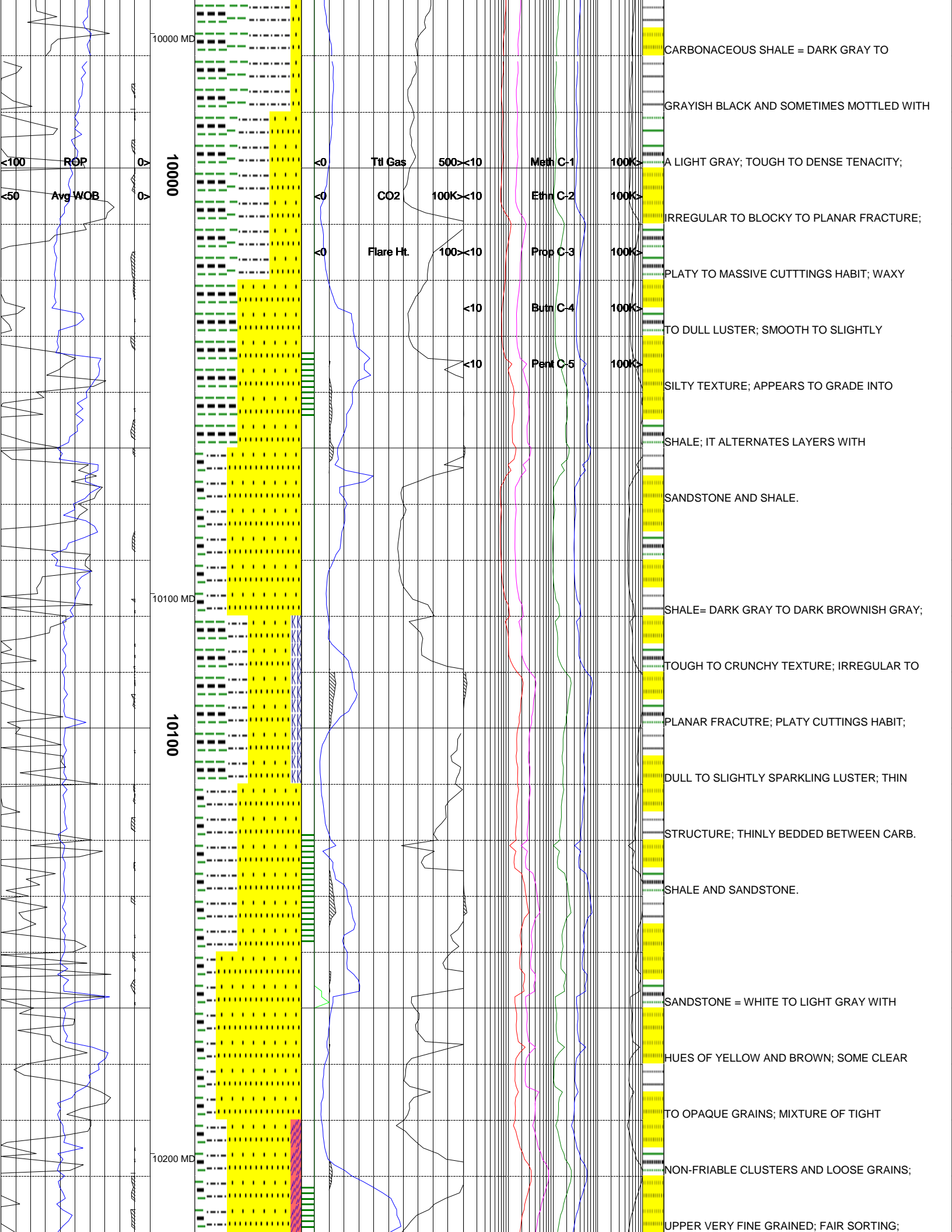
>100 ROP
<50 Avg WOB

| | | | | | |
|----|-----------|------|-----|----------|------|
| <0 | Ttl Gas | 500 | <10 | Meth C-1 | 100K |
| <0 | CO2 | 100K | <10 | Ethn C-2 | 100K |
| <0 | Flare Ht. | 100 | <10 | Prop C-3 | 100K |
| | | | <10 | Butn C-4 | 100K |

SUB ANGULAR TO SUB ROUND WITH LOW TO MODERATE SPHERICITY; MODERATELY TO EASILY FRIABLE; SILICEOUS, CLAYEY AND CALCAREOUS CEMENT; OCC IMBEDDED CARBONACEOUS MATERIAL; SL TO MODERATE INCREASE IN DITCH GAS. CARBONACEOUS SHALE = DARK BRWN WITH HUES OF BLACK; CRUNCHY TO DENSE TENACITY SUB BLCY TO SUB PLATY CUTTING HABIT WITH SUB PLANAR TO IRREGULAR OCC HACKLY FRACTURE; EARTHY TO SMOOTH TEXTURE; DULL TO OCC SUB WAXY / SUB VITREOUS/ GREASY LUSTER; NO VISIBLE DEGASSING IN SAMPLE TRAY. COAL = BLACK; VERY DARK BRWN TO BLACK WHERE GRADING FROM CARBONACEOUS SHALE TO COAL; SUB WEDGELIKE TO SUB MASSIVE CUTTINGS HABIT; OCC PLATY IN PLACES; IRREGULAR FRACTURE; PLANAR WHERE PLATY; GREASY TO SUB VITREOUS/WAXY LUSTER WITH







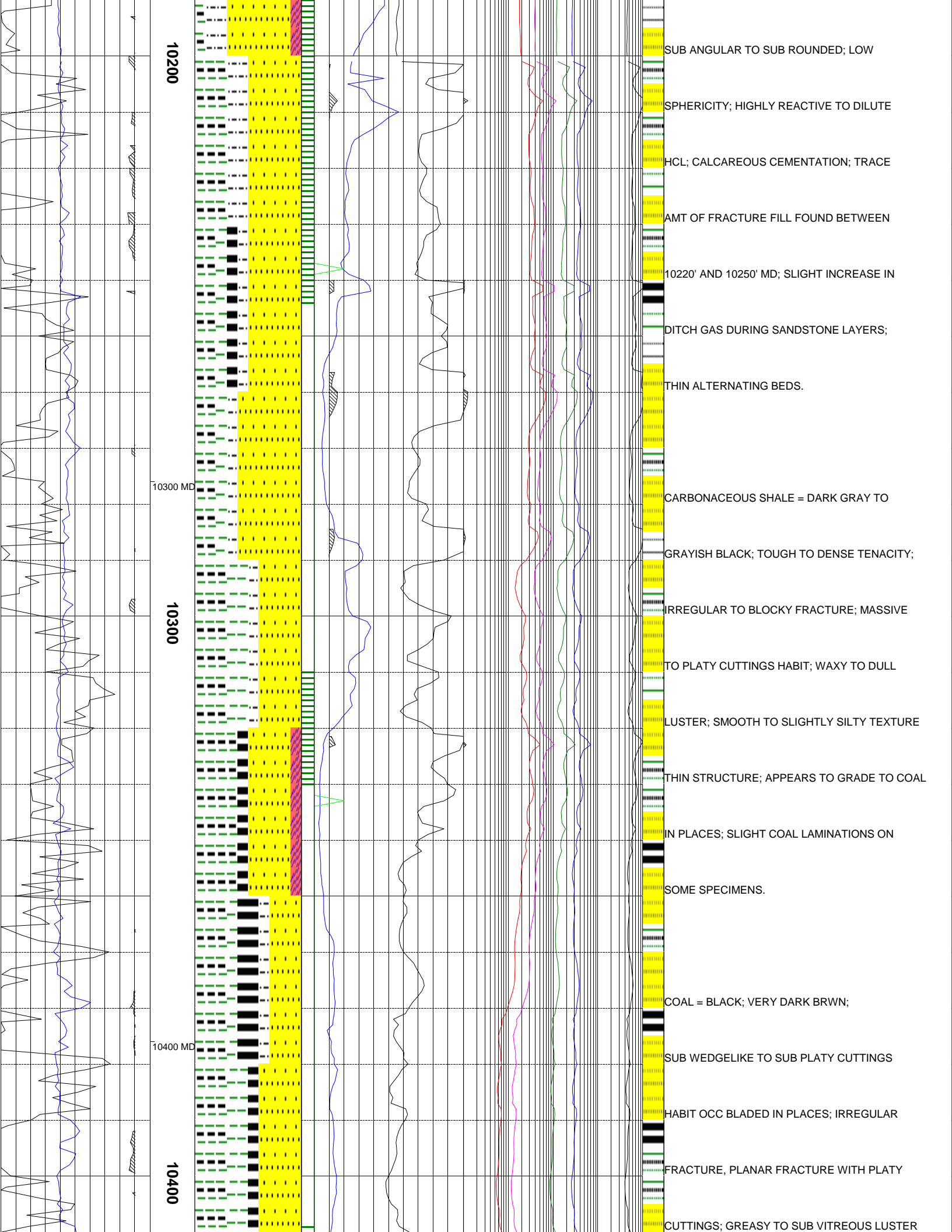
10000 MD
 10100 MD
 10200 MD

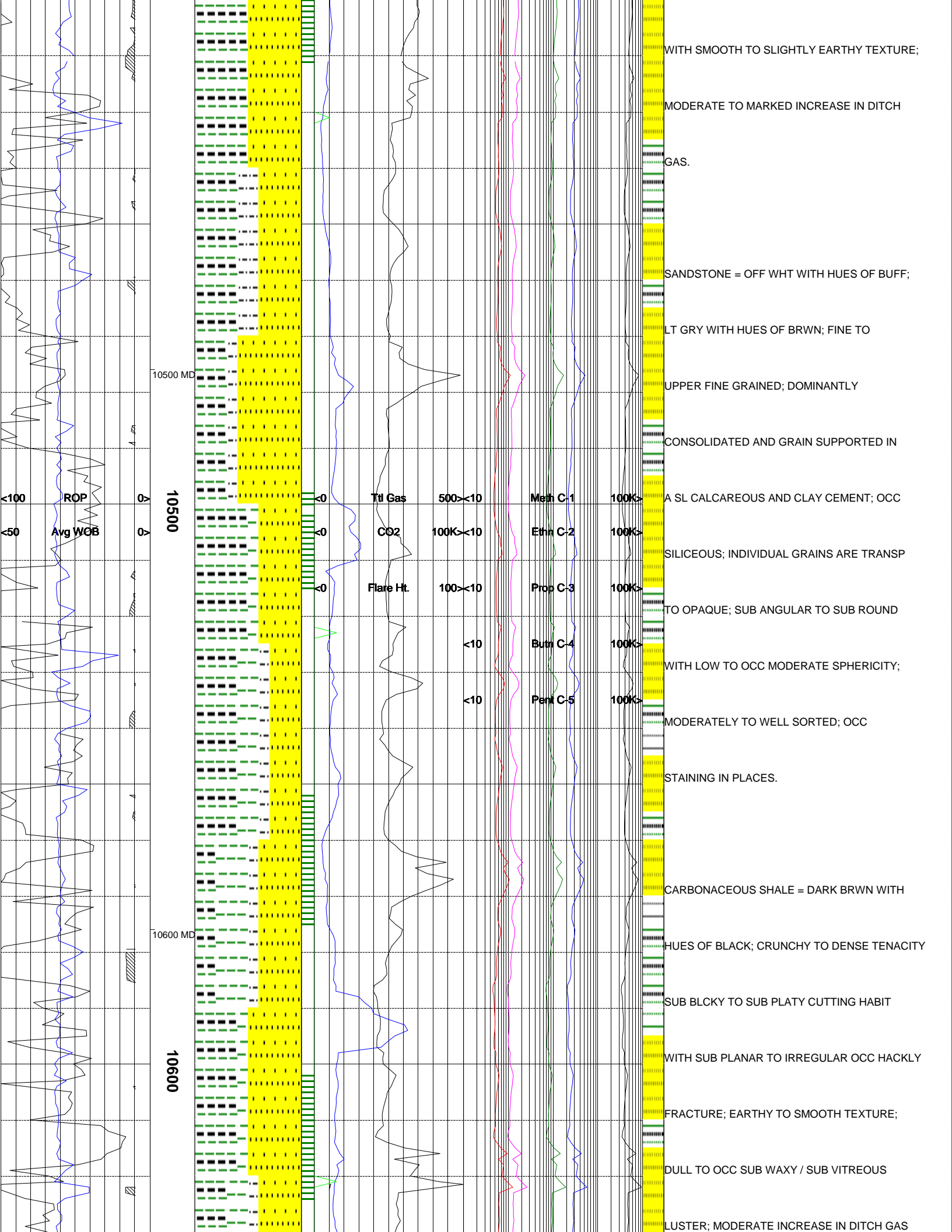
<100 ROP
 <50 Avg WOB

Ttl Gas 500 <10
 CO2 100K <10
 Flare Ht. 100 <10
 Meth C-1 100K <
 Ethn C-2 100K <
 Prop C-3 100K <
 Butn C-4 100K <
 Pent C-5 100K <

CARBONACEOUS SHALE = DARK GRAY TO
 GRAYISH BLACK AND SOMETIMES MOTTLED WITH
 A LIGHT GRAY; TOUGH TO DENSE TENACITY;
 IRREGULAR TO BLOCKY TO PLANAR FRACTURE;
 PLATY TO MASSIVE CUTTINGS HABIT; WAXY
 TO DULL LUSTER; SMOOTH TO SLIGHTLY
 SILTY TEXTURE; APPEARS TO GRADE INTO
 SHALE; IT ALTERNATES LAYERS WITH
 SANDSTONE AND SHALE.
 SHALE= DARK GRAY TO DARK BROWNISH GRAY;
 TOUGH TO CRUNCHY TEXTURE; IRREGULAR TO
 PLANAR FRACUTRE; PLATY CUTTINGS HABIT;
 DULL TO SLIGHTLY SPARKLING LUSTER; THIN
 STRUCTURE; THINLY BEDDED BETWEEN CARB.
 SHALE AND SANDSTONE.
 SANDSTONE = WHITE TO LIGHT GRAY WITH
 HUES OF YELLOW AND BROWN; SOME CLEAR
 TO OPAQUE GRAINS; MIXTURE OF TIGHT
 NON-FRIABLE CLUSTERS AND LOOSE GRAINS;
 UPPER VERY FINE GRAINED; FAIR SORTING;

10000
 10100





10500 MD

10500

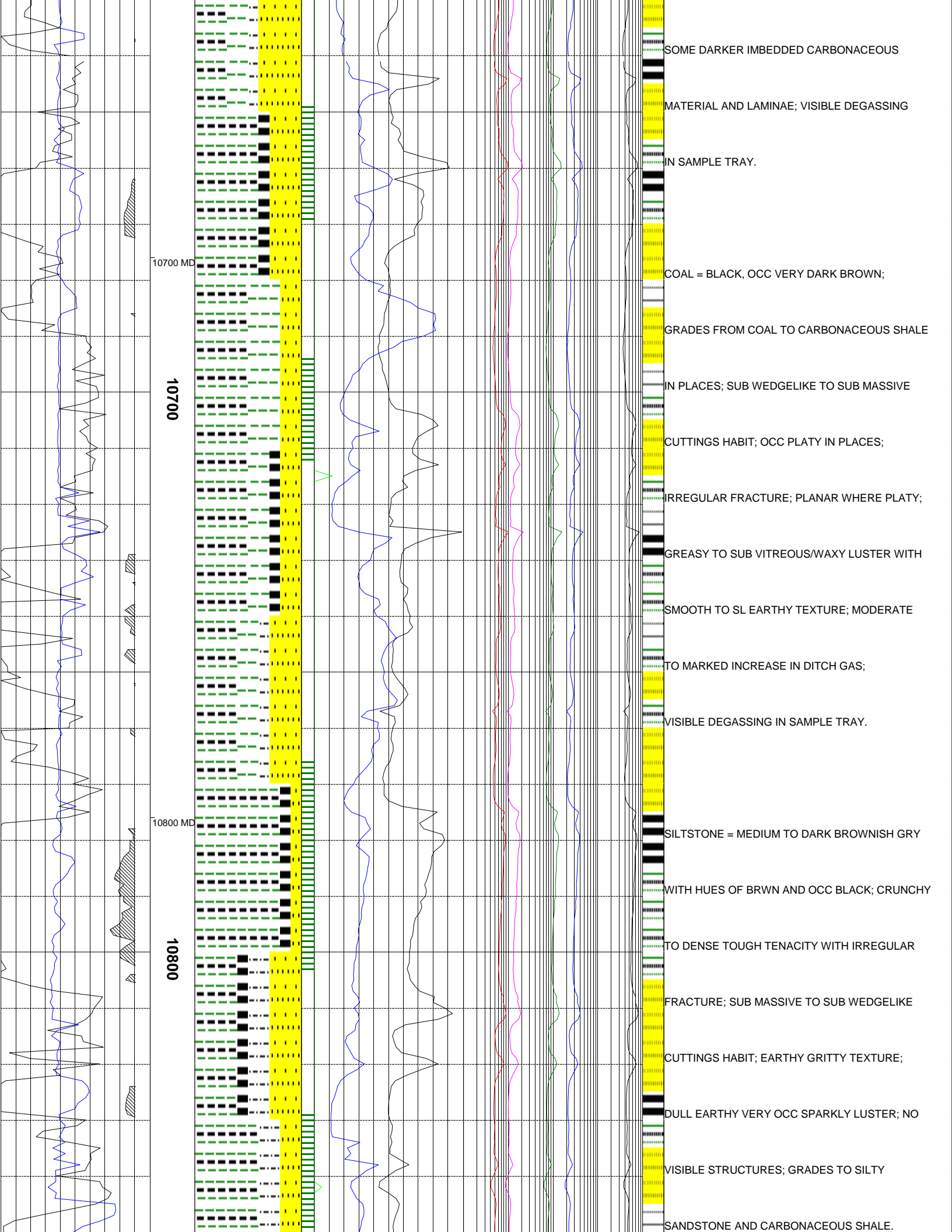
10600 MD

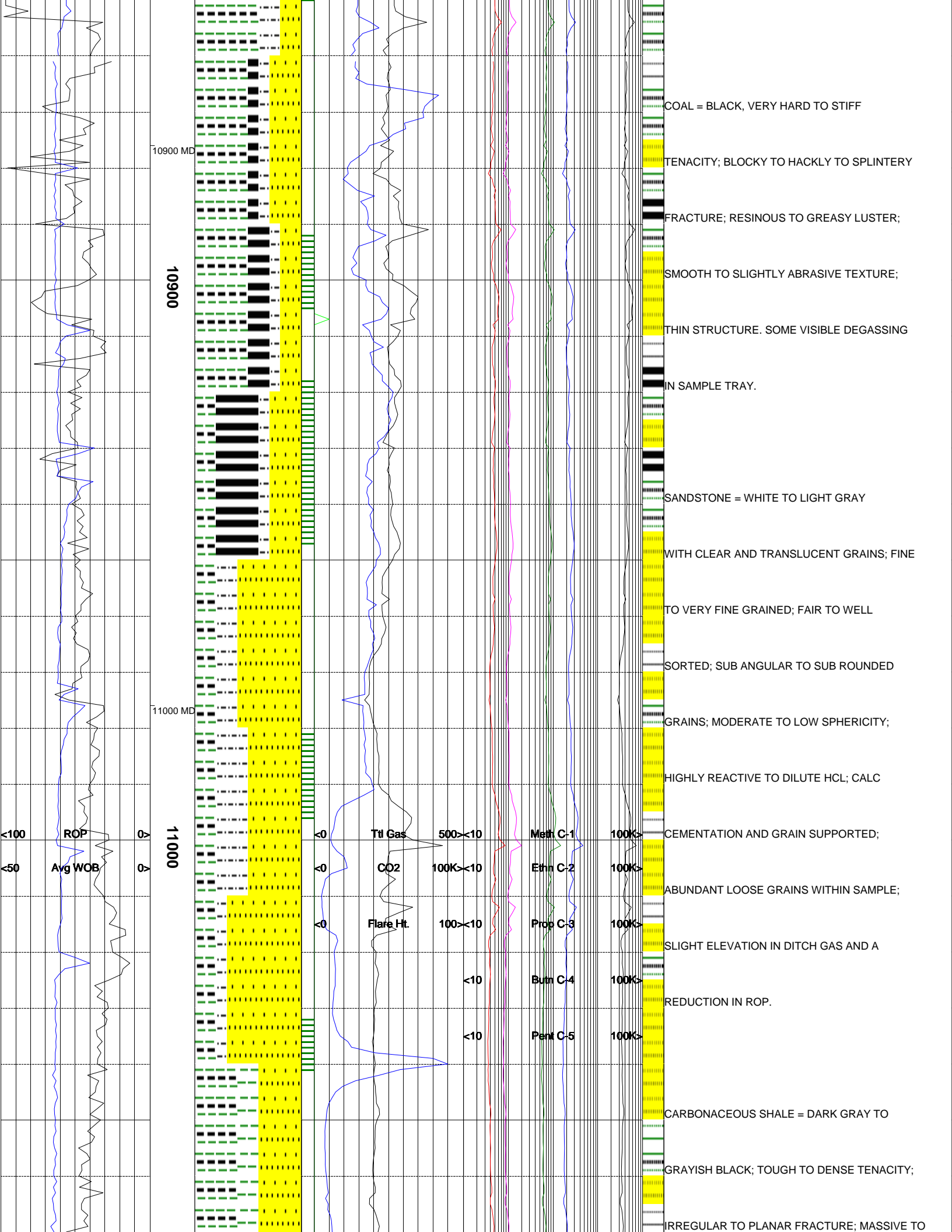
10600

ROP
Avg WOB

Ttl Gas 500 < 10
CO2 100K < 10
Flare Ht. 100 < 10
Meth C-1 100K <
Ethn C-2 100K <
Prop C-3 100K <
Butn C-4 < 10
Pent C-5 < 10

WITH SMOOTH TO SLIGHTLY EARTHY TEXTURE;
MODERATE TO MARKED INCREASE IN DITCH
GAS.
SANDSTONE = OFF WHT WITH HUES OF BUFF;
LT GRY WITH HUES OF BRWN; FINE TO
UPPER FINE GRAINED; DOMINANTLY
CONSOLIDATED AND GRAIN SUPPORTED IN
A SL CALCAREOUS AND CLAY CEMENT; OCC
SILICEOUS; INDIVIDUAL GRAINS ARE TRANSP
TO OPAQUE; SUB ANGULAR TO SUB ROUND
WITH LOW TO OCC MODERATE SPHERICITY;
MODERATELY TO WELL SORTED; OCC
STAINING IN PLACES.
CARBONACEOUS SHALE = DARK BRWN WITH
HUES OF BLACK; CRUNCHY TO DENSE TENACITY
SUB BLCY TO SUB PLATY CUTTING HABIT
WITH SUB PLANAR TO IRREGULAR OCC HACKLY
FRACTURE; EARTHY TO SMOOTH TEXTURE;
DULL TO OCC SUB WAXY / SUB VITREOUS
LUSTER; MODERATE INCREASE IN DITCH GAS





10900 MD

10900

11000 MD

11000

COAL = BLACK, VERY HARD TO STIFF

TENACITY; BLOCKY TO HACKLY TO SPLINTERY

FRACTURE; RESINOUS TO GREASY LUSTER;

SMOOTH TO SLIGHTLY ABRASIVE TEXTURE;

THIN STRUCTURE. SOME VISIBLE DEGASSING

IN SAMPLE TRAY.

SANDSTONE = WHITE TO LIGHT GRAY

WITH CLEAR AND TRANSLUCENT GRAINS; FINE

TO VERY FINE GRAINED; FAIR TO WELL

SORTED; SUB ANGULAR TO SUB ROUNDED

GRAINS; MODERATE TO LOW SPHERICITY;

HIGHLY REACTIVE TO DILUTE HCL; CALC

CEMENTATION AND GRAIN SUPPORTED;

ABUNDANT LOOSE GRAINS WITHIN SAMPLE;

SLIGHT ELEVATION IN DITCH GAS AND A

REDUCTION IN ROP.

CARBONACEOUS SHALE = DARK GRAY TO

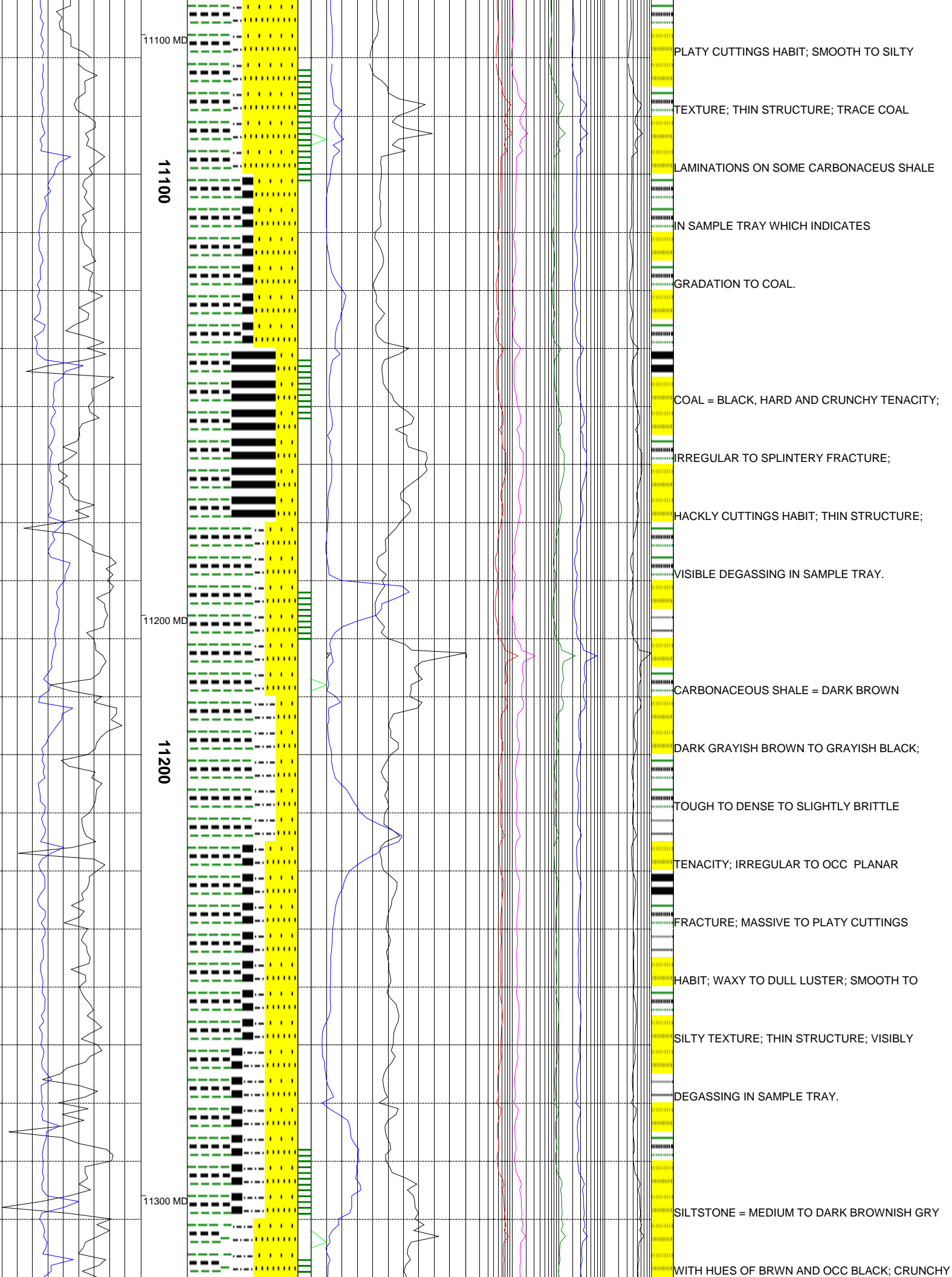
GRAYISH BLACK; TOUGH TO DENSE TENACITY;

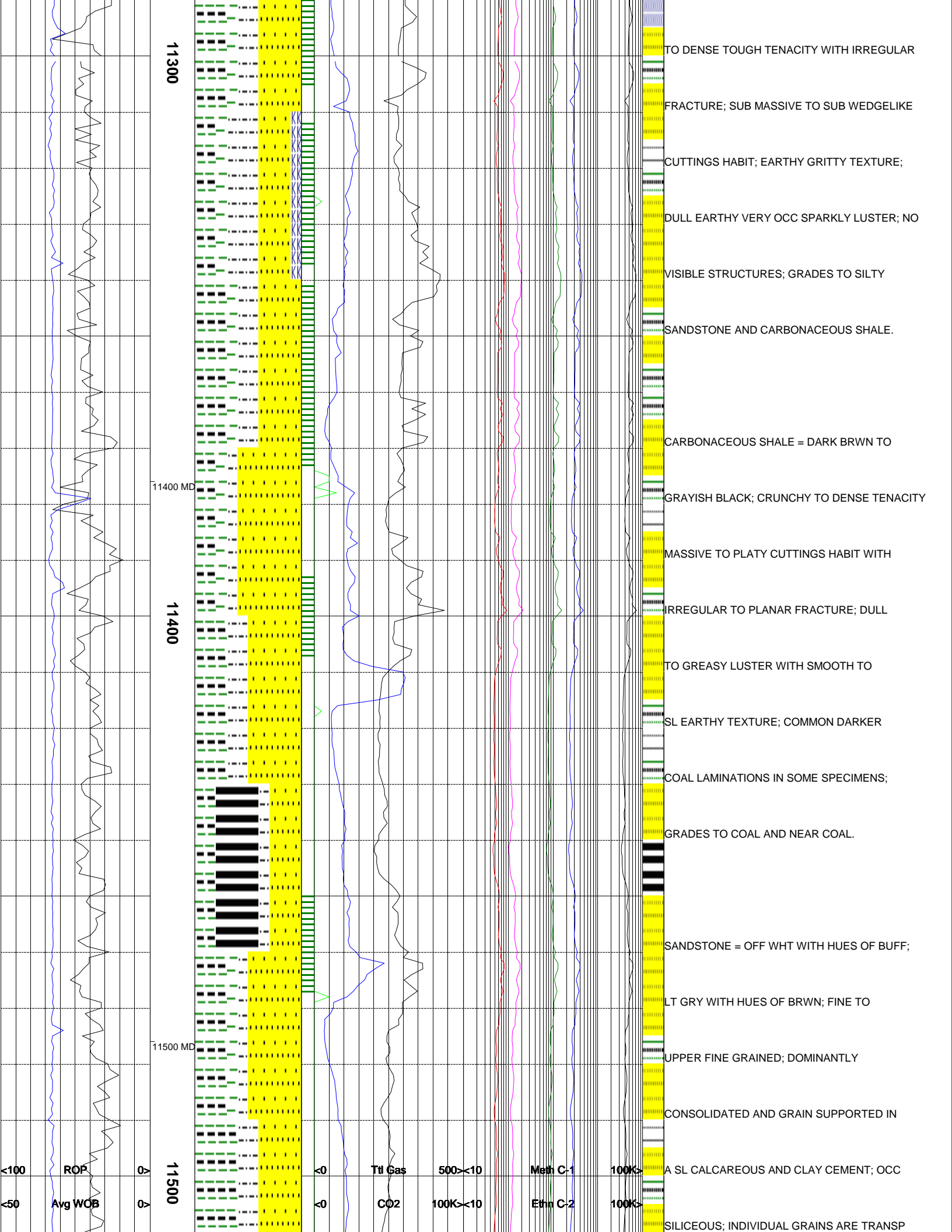
IRREGULAR TO PLANAR FRACTURE; MASSIVE TO

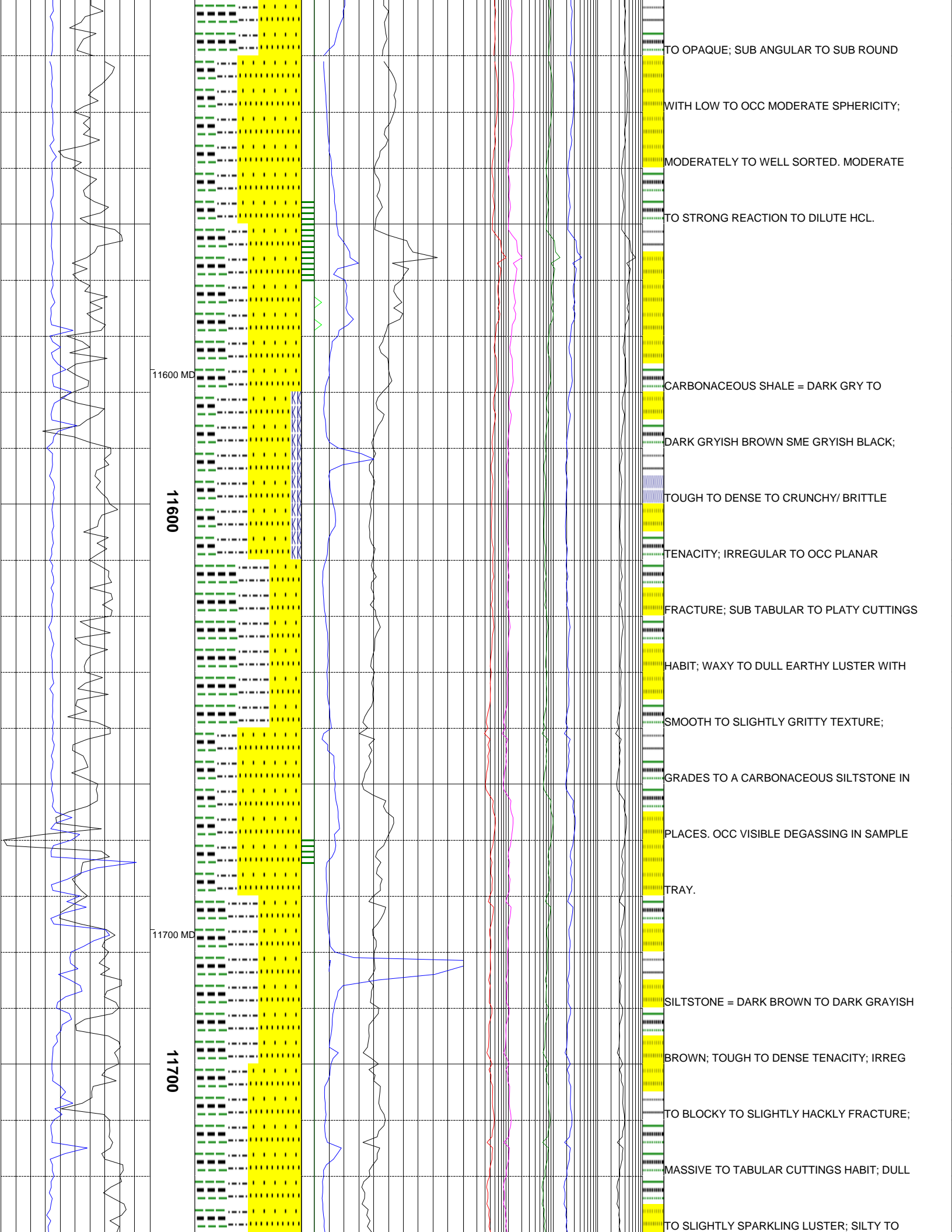
ROP
Avg WOB

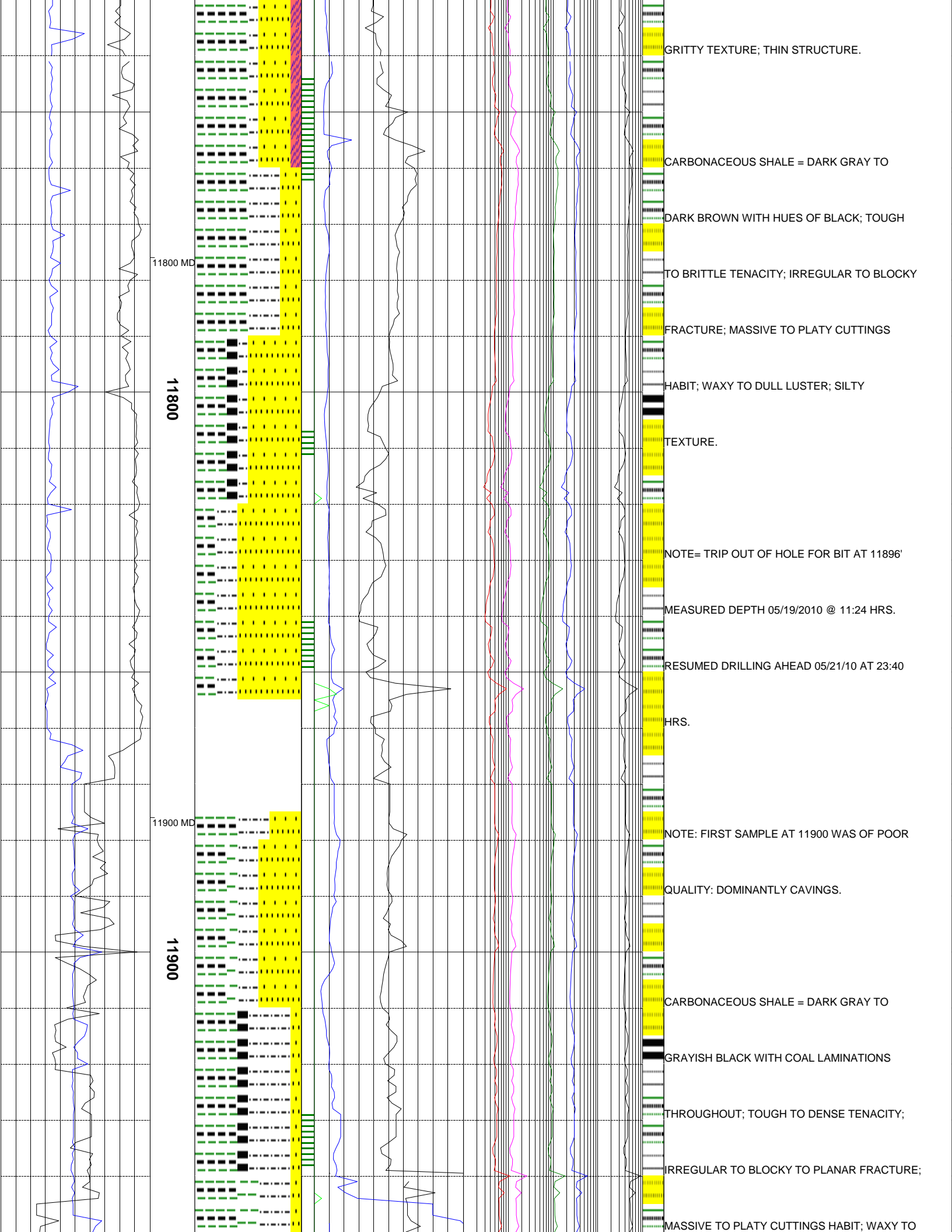
Ttl Gas 500 < 10
CO2 100K < 10
Flare Ht. 100 < 10
< 10
< 10

Meth C-1 100K >
Ethn C-2 100K >
Prop C-3 100K >
Butn C-4 100K >
Pent C-5 100K >









GRITTY TEXTURE; THIN STRUCTURE.

CARBONACEOUS SHALE = DARK GRAY TO

DARK BROWN WITH HUES OF BLACK; TOUGH

11800 MD

TO BRITTLE TENACITY; IRREGULAR TO BLOCKY

FRACTURE; MASSIVE TO PLATY CUTTINGS

11800

HABIT; WAXY TO DULL LUSTER; SILTY

TEXTURE.

NOTE= TRIP OUT OF HOLE FOR BIT AT 11896'

MEASURED DEPTH 05/19/2010 @ 11:24 HRS.

RESUMED DRILLING AHEAD 05/21/10 AT 23:40

HRS.

11900 MD

NOTE: FIRST SAMPLE AT 11900 WAS OF POOR

QUALITY: DOMINANTLY CAVINGS.

11900

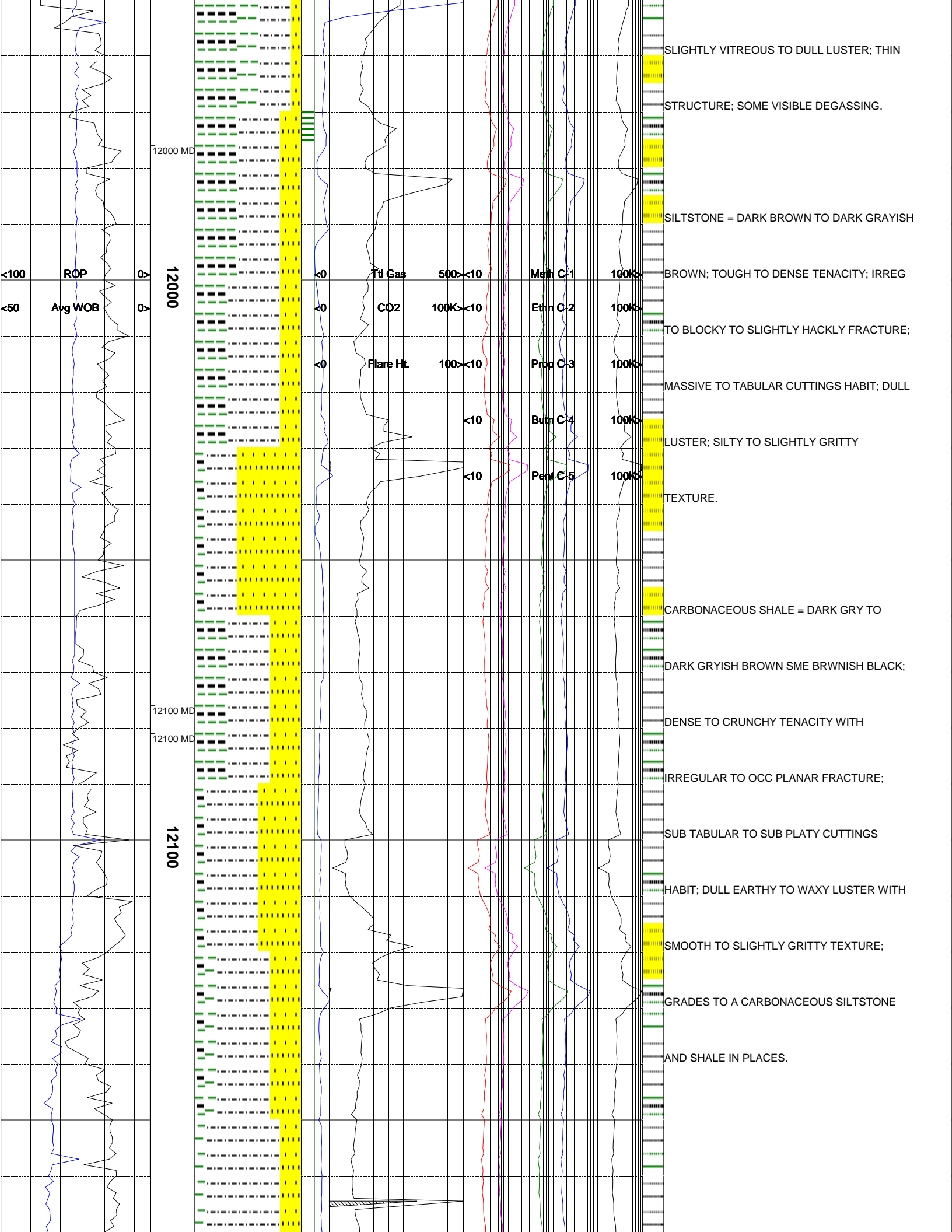
CARBONACEOUS SHALE = DARK GRAY TO

GRAYISH BLACK WITH COAL LAMINATIONS

THROUGHOUT; TOUGH TO DENSE TENACITY;

IRREGULAR TO BLOCKY TO PLANAR FRACTURE;

MASSIVE TO PLATY CUTTINGS HABIT; WAXY TO



12000 MD

12000

12100 MD

12100 MD

12100

SLIGHTLY VITREOUS TO DULL LUSTER; THIN

STRUCTURE; SOME VISIBLE DEGASSING.

SILTSTONE = DARK BROWN TO DARK GRAYISH

BROWN; TOUGH TO DENSE TENACITY; IRREG

TO BLOCKY TO SLIGHTLY HACKLY FRACTURE;

MASSIVE TO TABULAR CUTTINGS HABIT; DULL

LUSTER; SILTY TO SLIGHTLY GRITTY

TEXTURE.

CARBONACEOUS SHALE = DARK GRAY TO

DARK GRAYISH BROWN SME BRWNISH BLACK;

DENSE TO CRUNCHY TENACITY WITH

IRREGULAR TO OCC PLANAR FRACTURE;

SUB TABULAR TO SUB PLATY CUTTINGS

HABIT; DULL EARTHY TO WAXY LUSTER WITH

SMOOTH TO SLIGHTLY GRITTY TEXTURE;

GRADES TO A CARBONACEOUS SILTSTONE

AND SHALE IN PLACES.

ROP

Avg WOB

Fl Gas

CO2

Flare Ht.

Meth C-1

Ethn C-2

Prop C-3

Butn C-4

Pent C-5

500 < 10

100K < 10

100 < 10

< 10

< 10

100K >

100K >

100K >

100K >

100K >

100K >

100K >

100K >

100K >

100K >

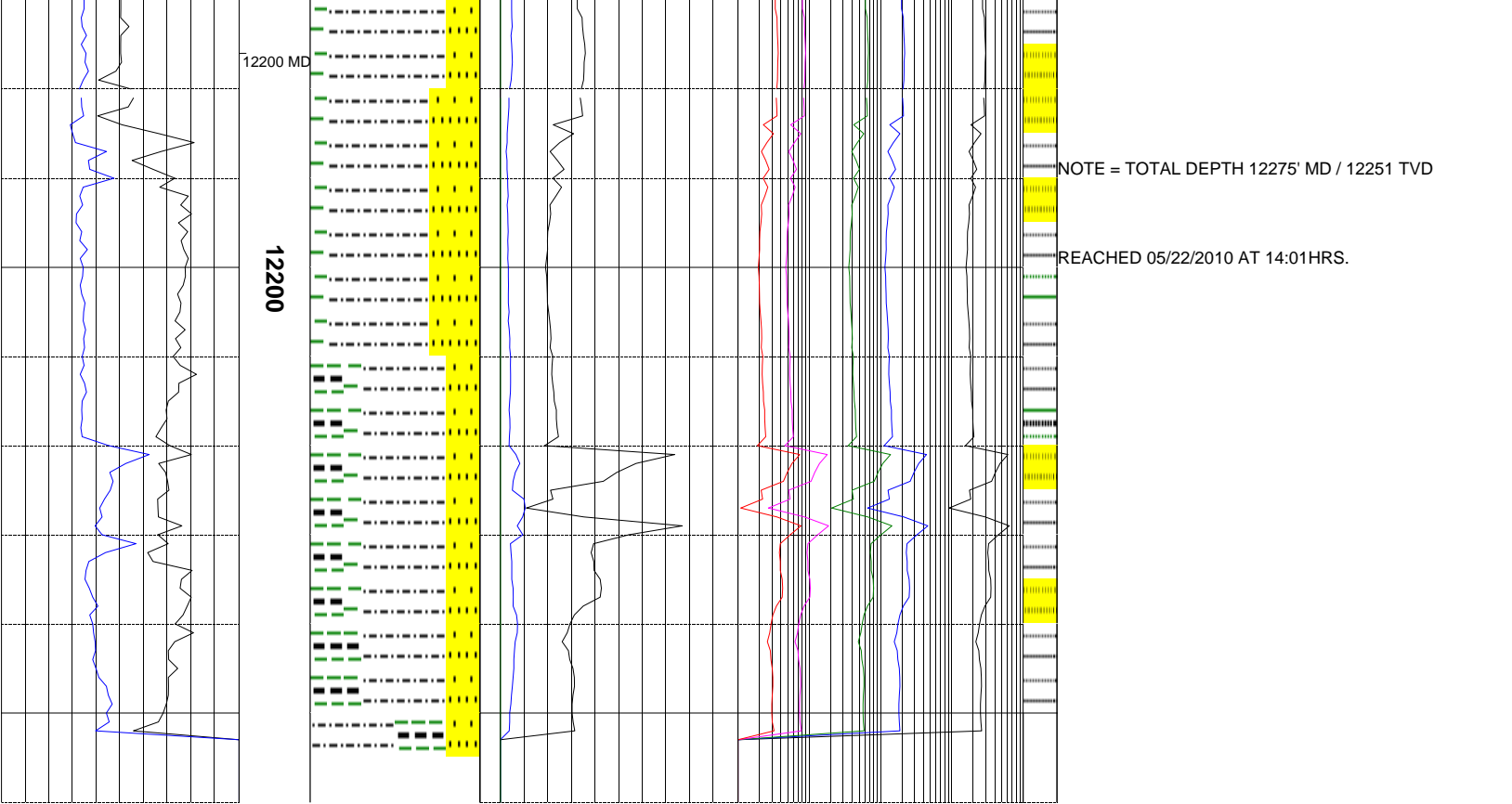
100K >

100K >

100K >

100K >





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