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# MUDLOG TVD

**COMPANY** ExxonMobil Production  
**WELL** PCU 197-34A3  
**FIELD** PICEANCE CREEK UNIT  
**REGION** ROCKY MOUNTAINS  
**COORDINATES** LAT: 39.918037  
LONG: -108.276941  
**ELEVATION** G.L.: 6490.8'  
RKB: 30.2'  
**COUNTY, STATE** RIO BLANCO, CO  
**API INDEX** 051031154200  
**SPUD DATE** 02/27/2010  
**CONTRACTOR** HELMERICH AND PAYNE  
**CO. REP.** J. THOMAS  
**RIG/TYPE** HP 325 / FLEX 4S  
**LOGGING UNIT** MLU 48  
**GEOLOGISTS** M. GROSS  
D. NEW  
**ADD. PERSONS**  
**CO. GEOLOGIST** MELISSA SAURBORN

## LOG INTERVAL

## CASING DATA

**DEPTHS:** 3858' TO 12800'  
**DATES:** 06/15/2010 TO 07/31/2010  
**SCALE:** 5" = 100'

10.75" AT 3853'  
7.00" AT 8731'  
AT  
AT

## MUD TYPES

## HOLE SIZE

SPUD MUD TO 3858'  
LSND TO 12800'  
TO  
TO

14.75" TO 3858'  
9.875" TO 8750'  
6.125" TO 12800'  
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	





SURVEY @ 3728' MD: INC 24.16 AZI 108.32

TVD 3474.44'

EPOCH WELL SERVICES COMMENCED FULL

LOGGING ON 06/16/2010 AT 3858'

SHALE = VERY PALE GRAY, YELLOWISH GRAY;

SOFT TO MODERATELY FIRM TENACITY; PLANAR

TO IRREGULAR FRACTURE; WEDGELIKE TO

PLATY CUTTINGS HABIT; DULL EARTHY TO

SEMI WAXY LUSTER; GRADES TO PALE

YELLOWISH GRAY SILTSTONE; SOME CLAY

WASHES OUT DURING CLEANING PROCESS.

SHALE = PALE TO MODERATE YELLOWISH GRAY

MOTTLED WITH LIGHT GRAY; PLATY TO SCALY

TO TABULAR CUTTINGS HABIT; PLANAR TO

HACKLY FRACTURE; DULL EARTHY LUSTER;

MASSIVE STRUCTURE; CRUNCHY TO CRUMBLY

TENACITY; TRACE AMOUNTS OF NAHCOLITE IN

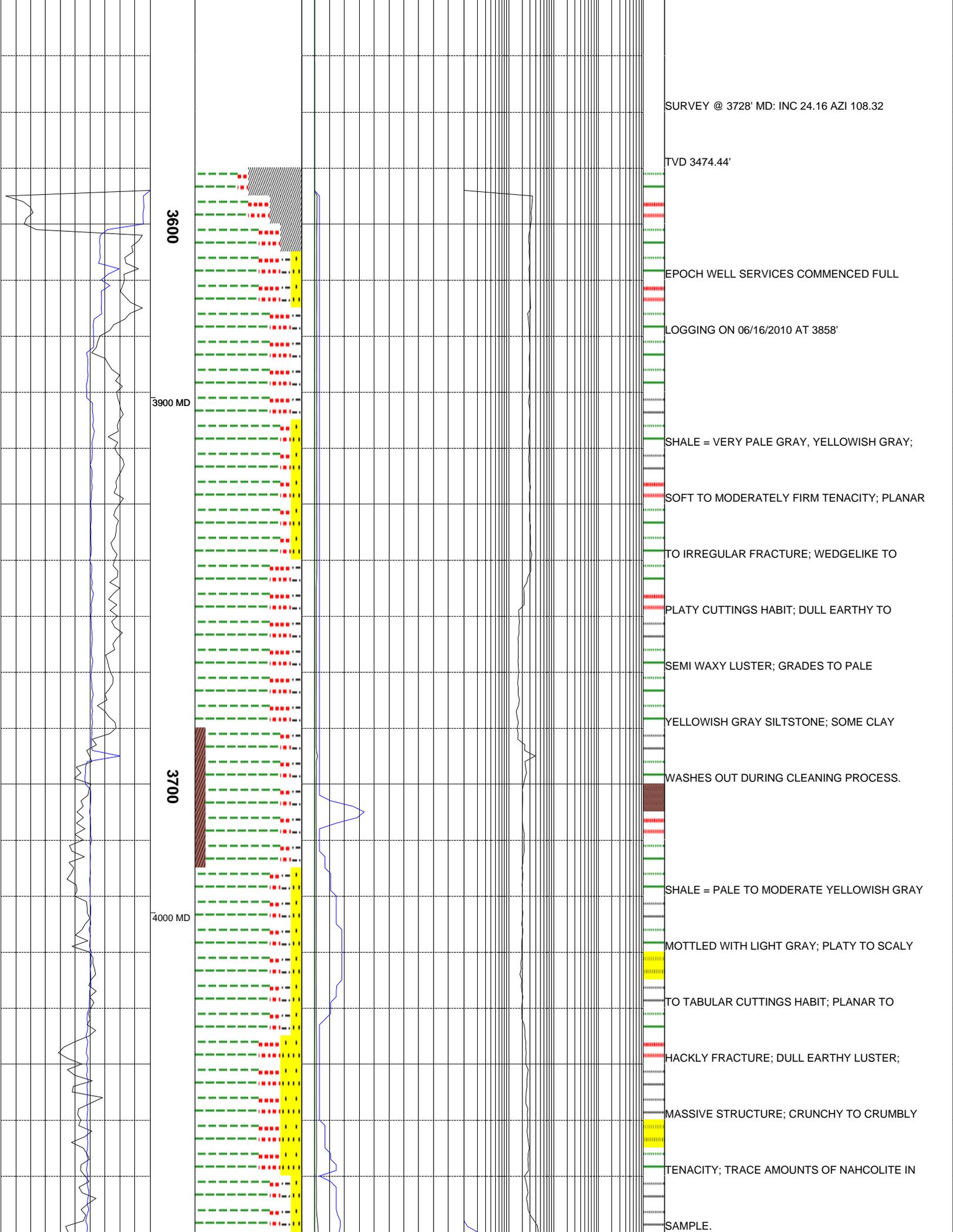
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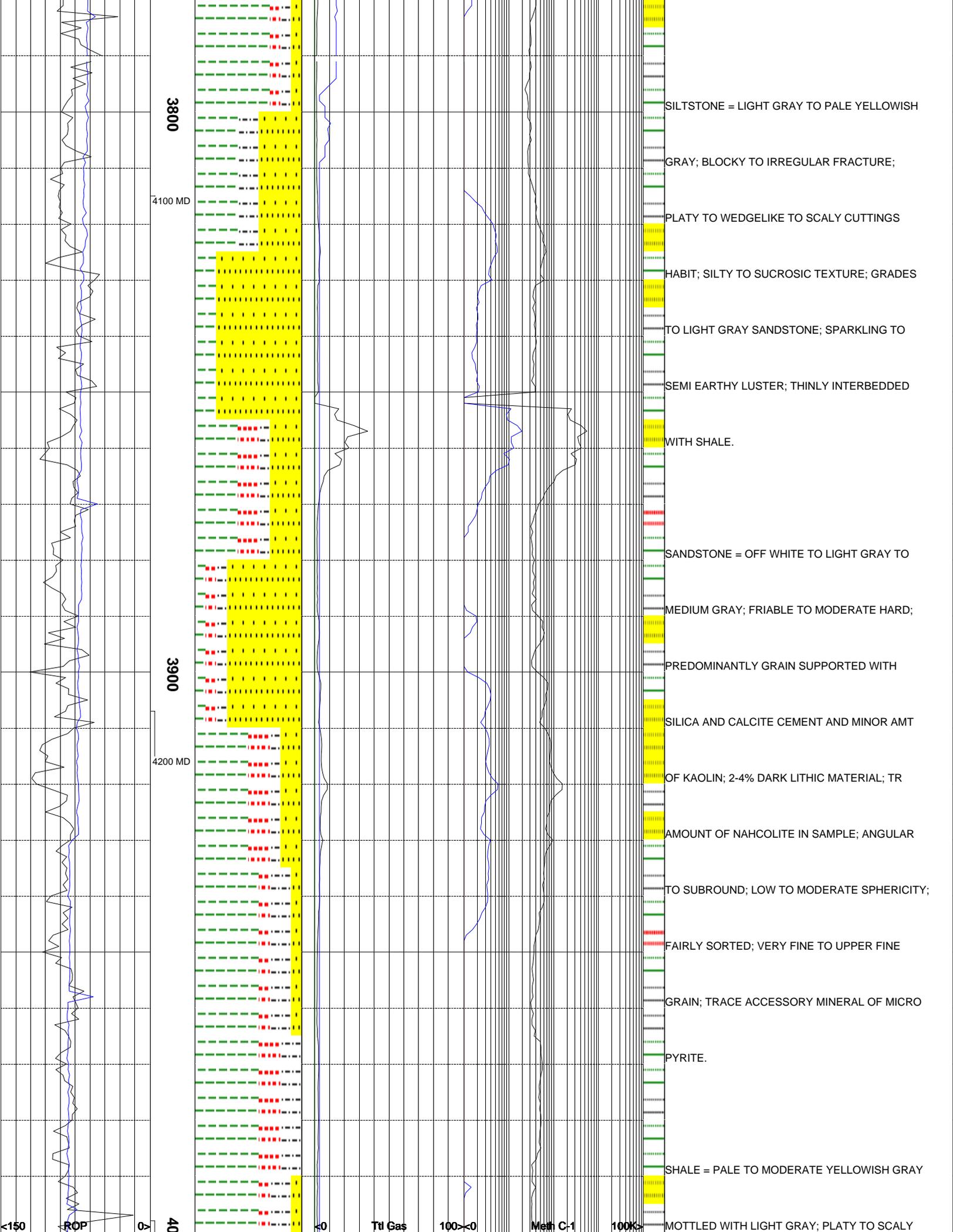
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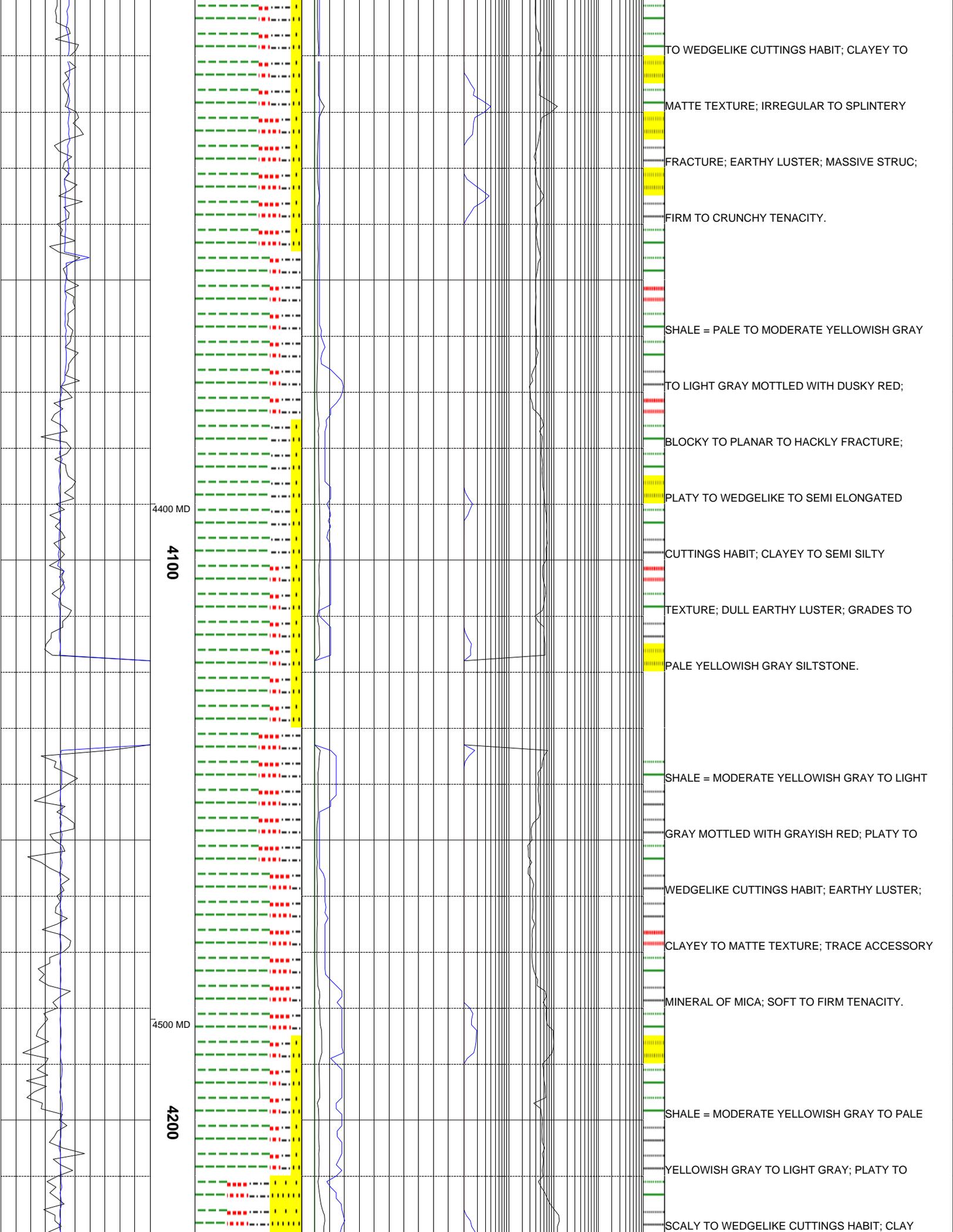
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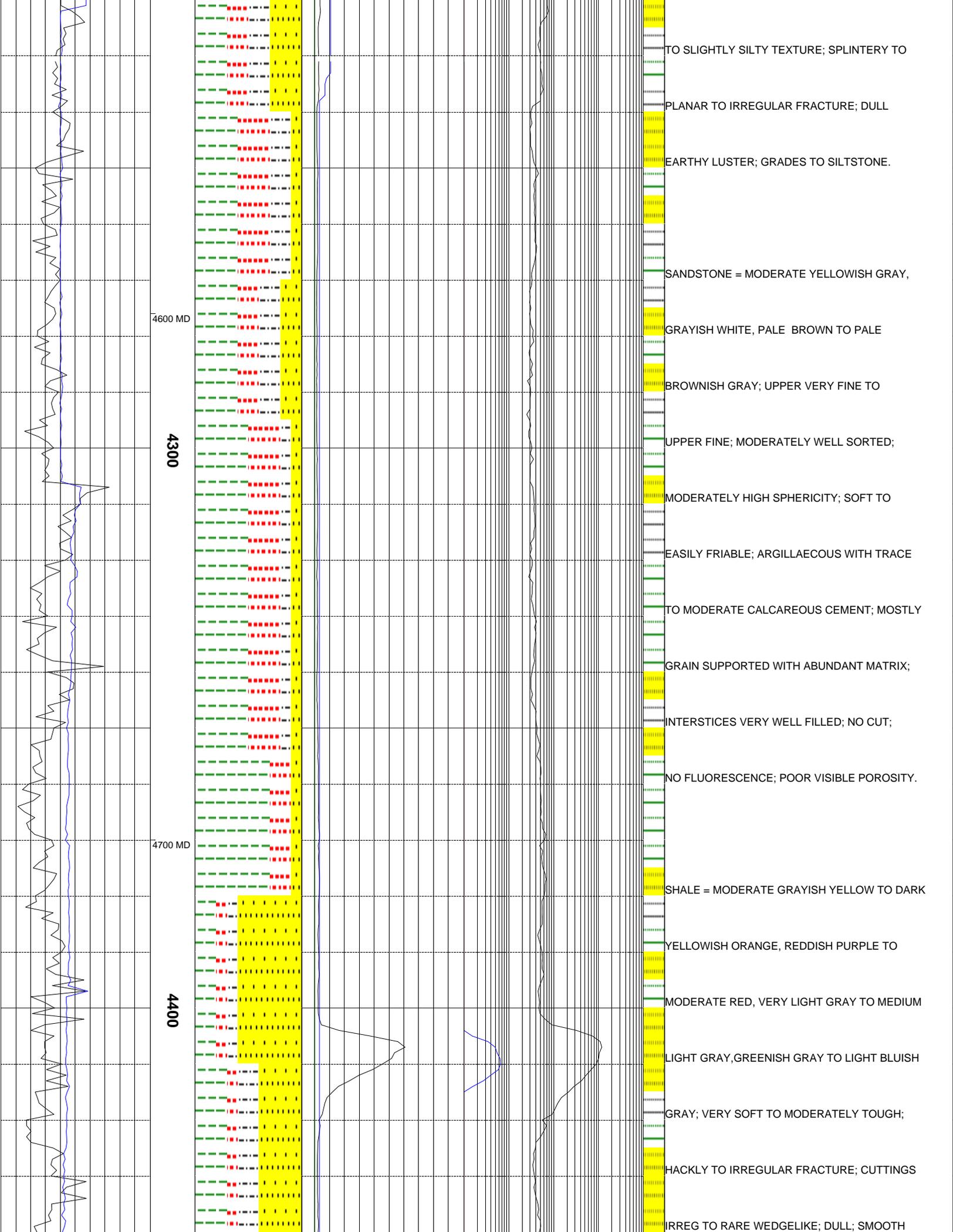
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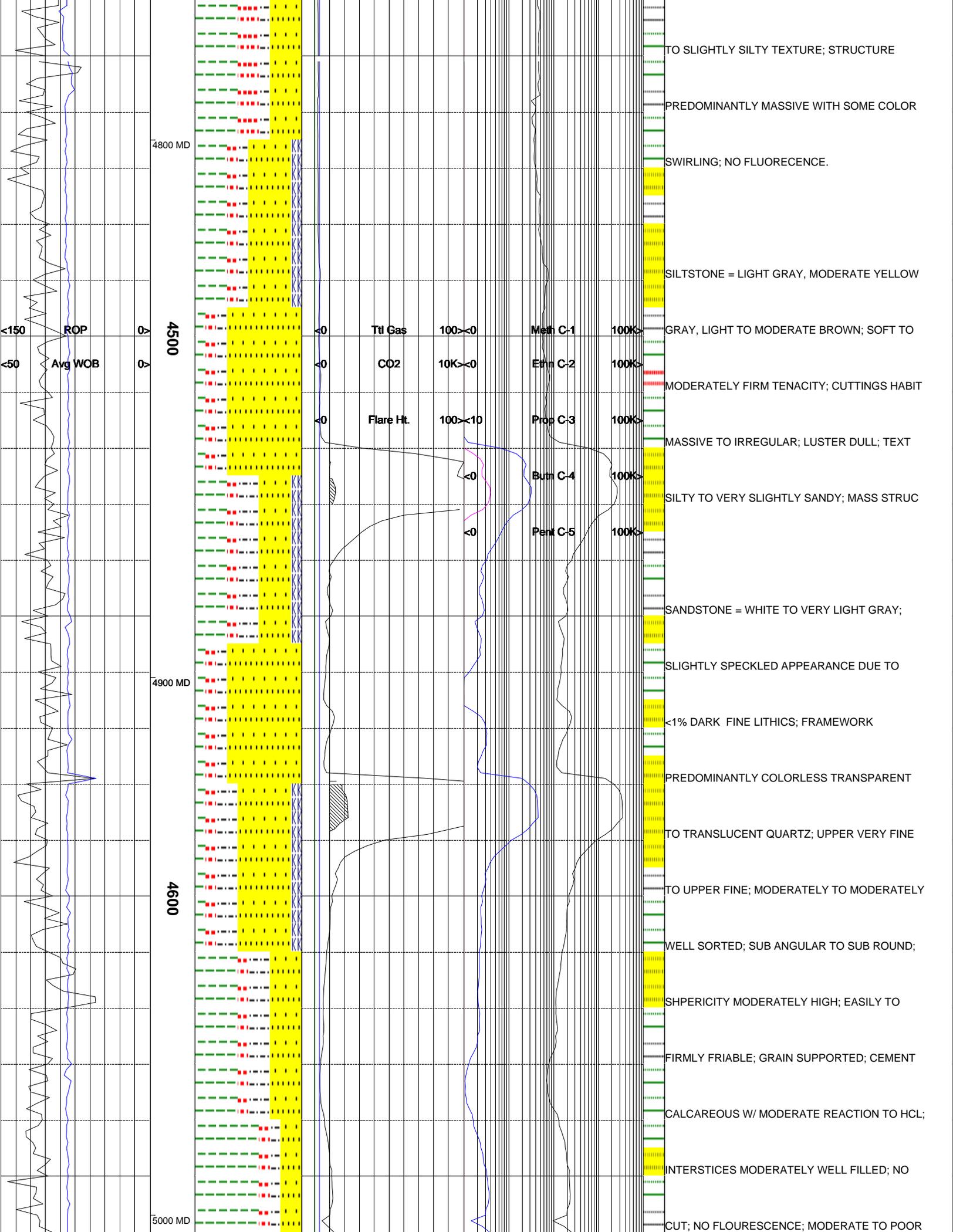
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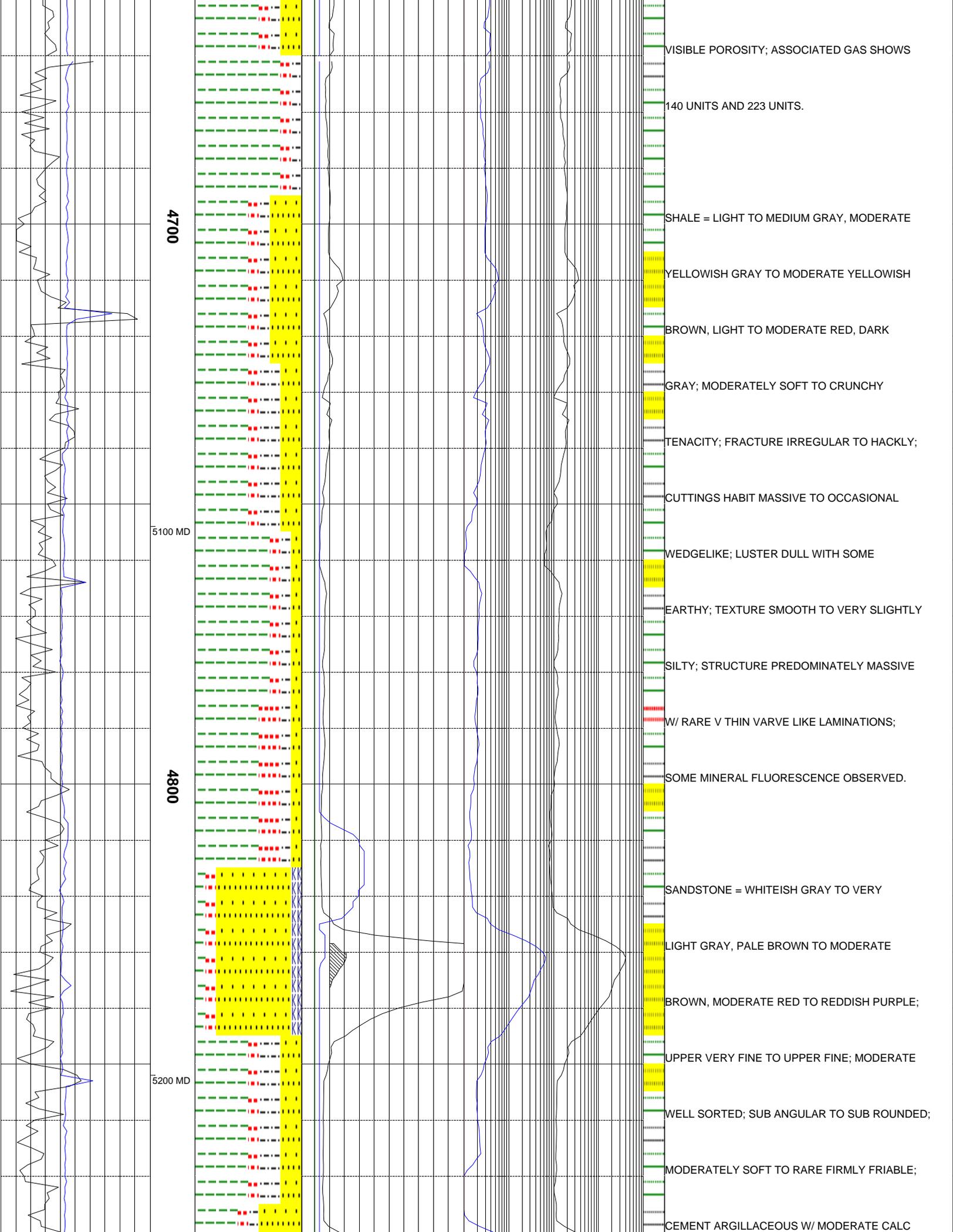


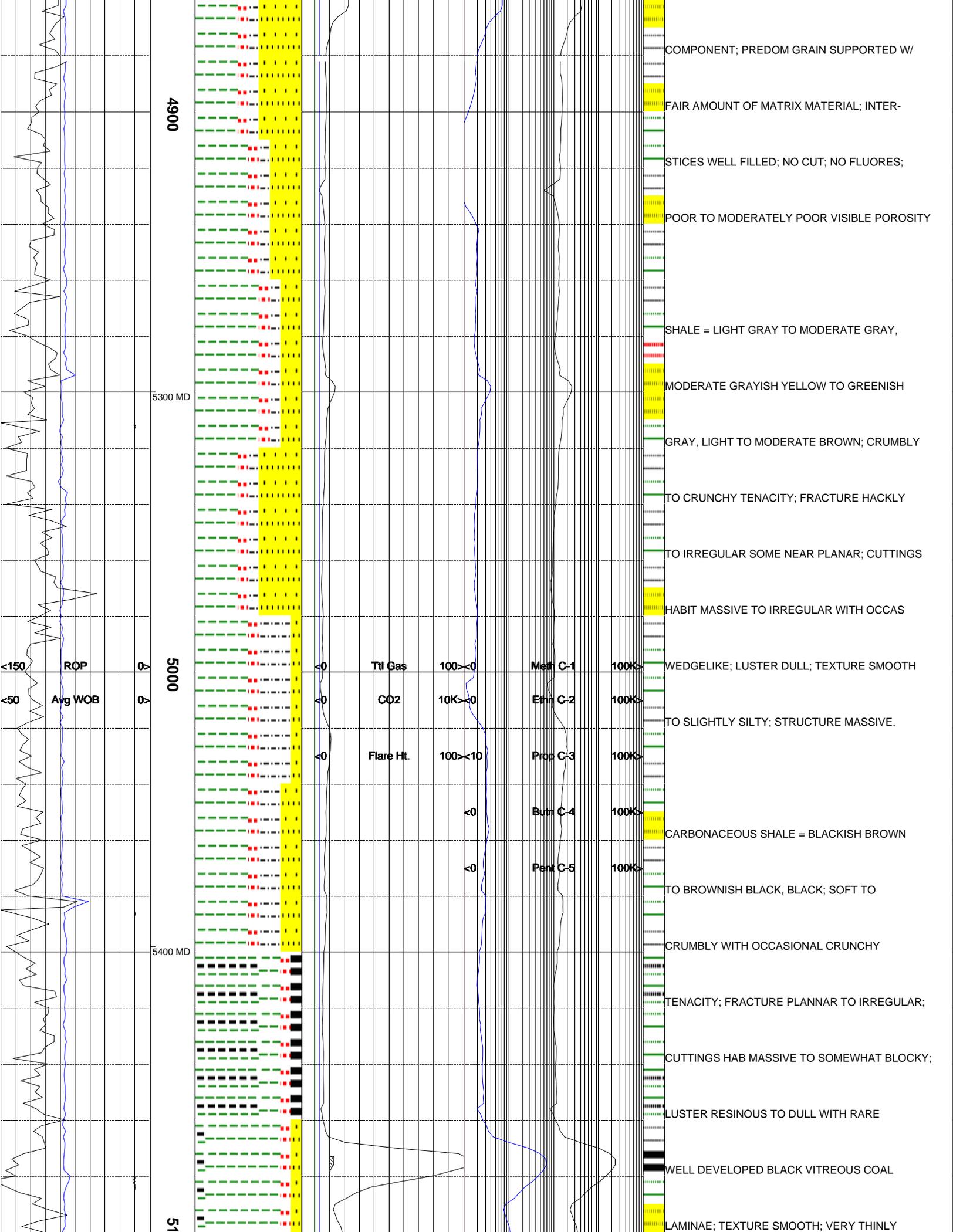












4900

5300 MD

5000

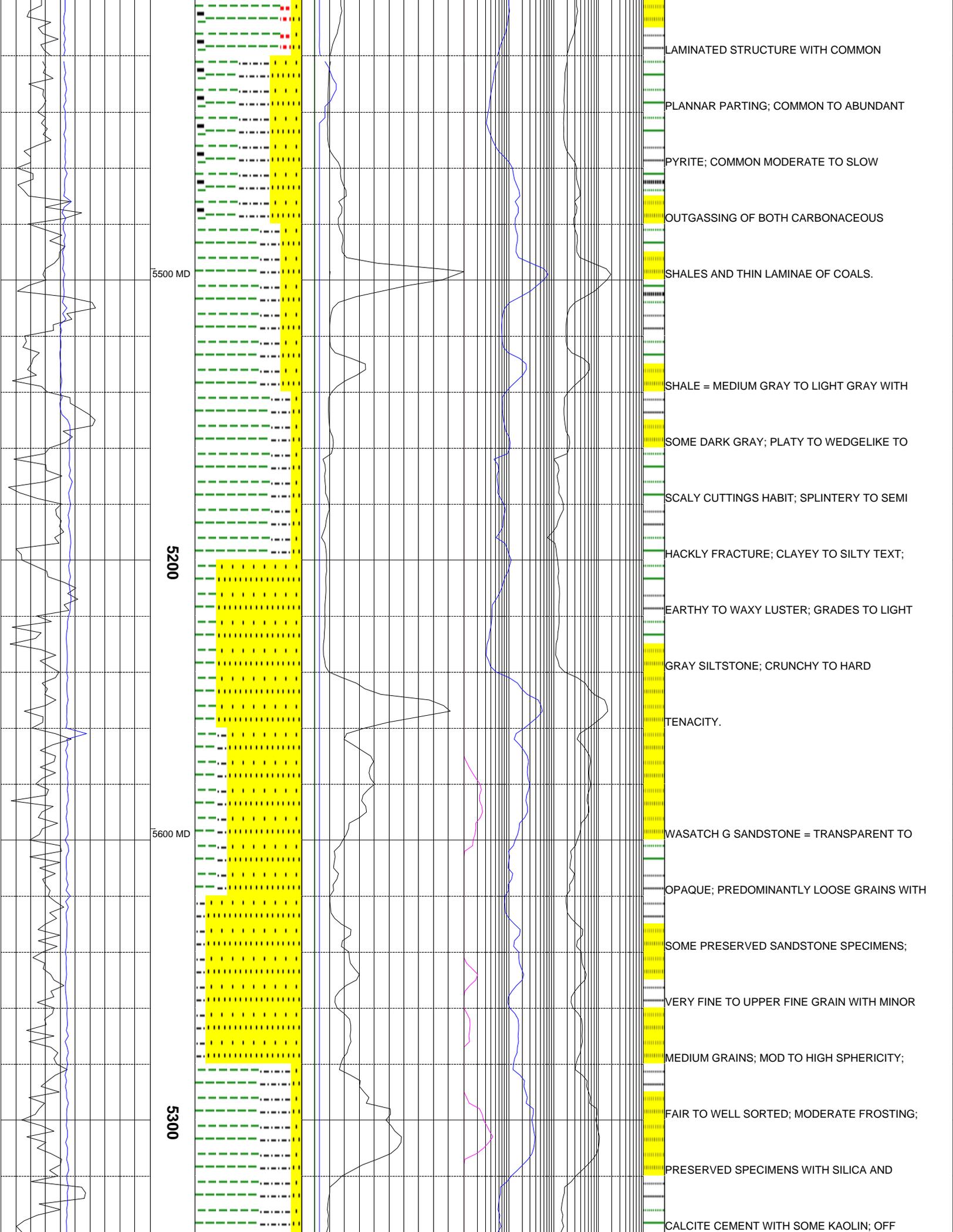
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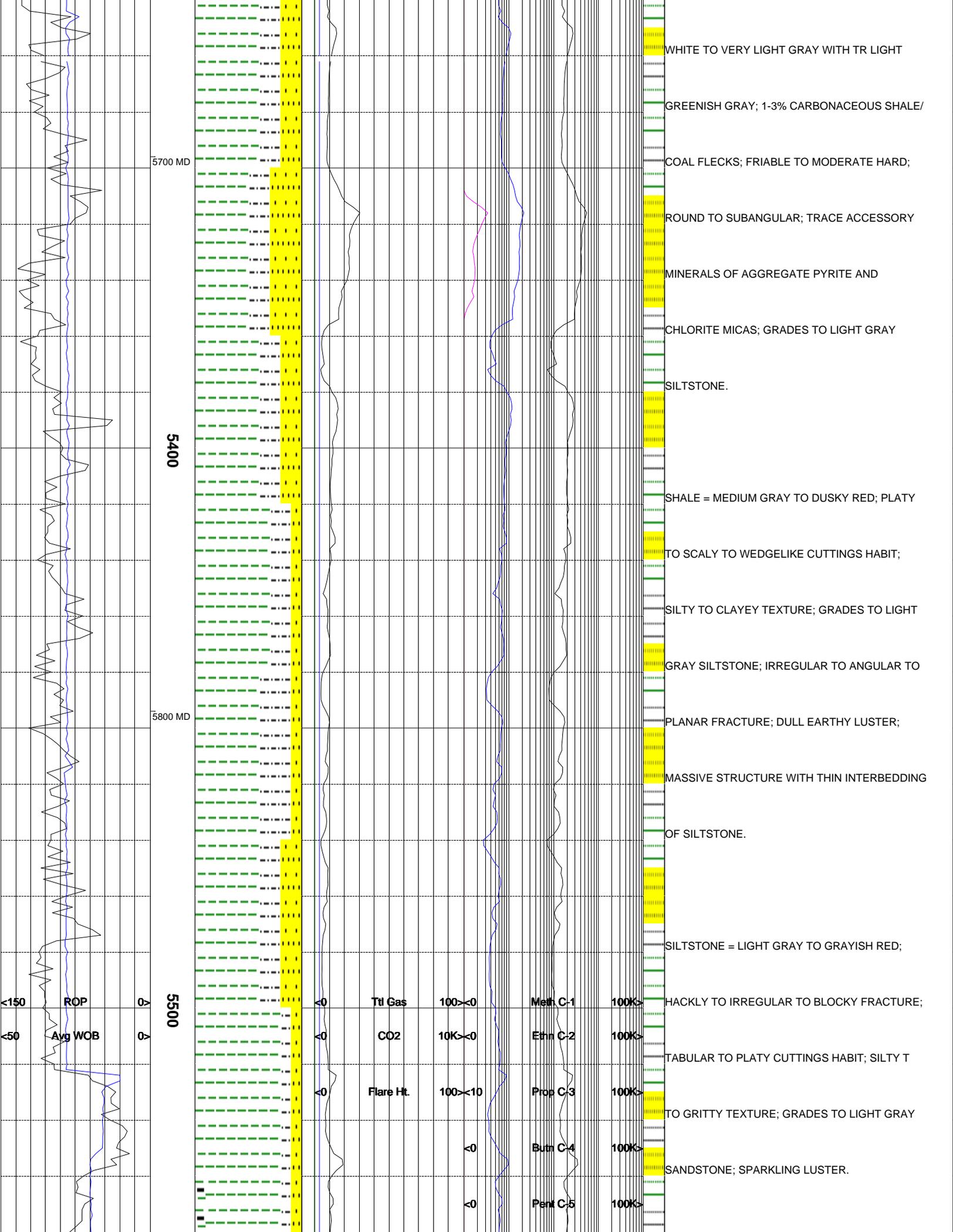
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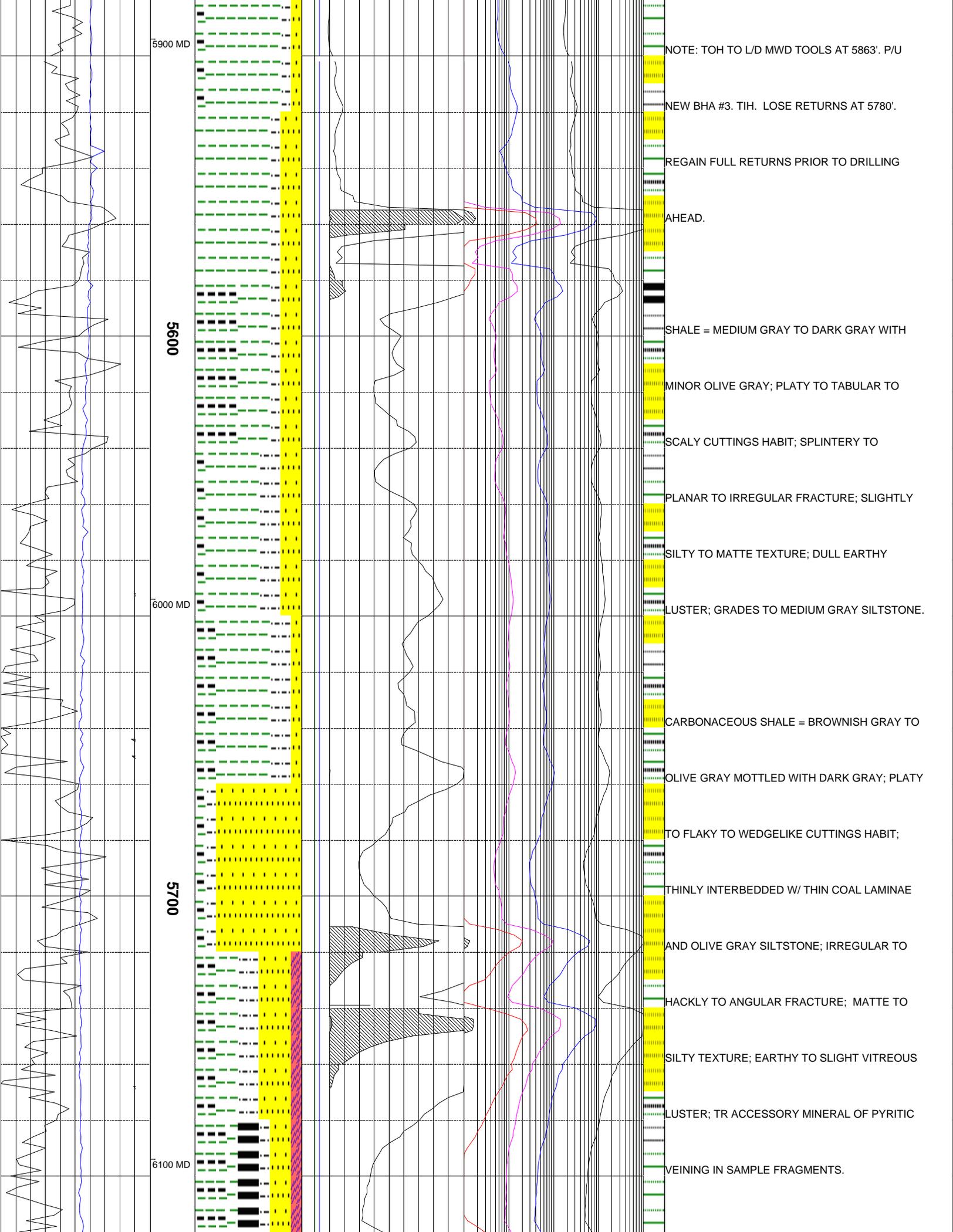
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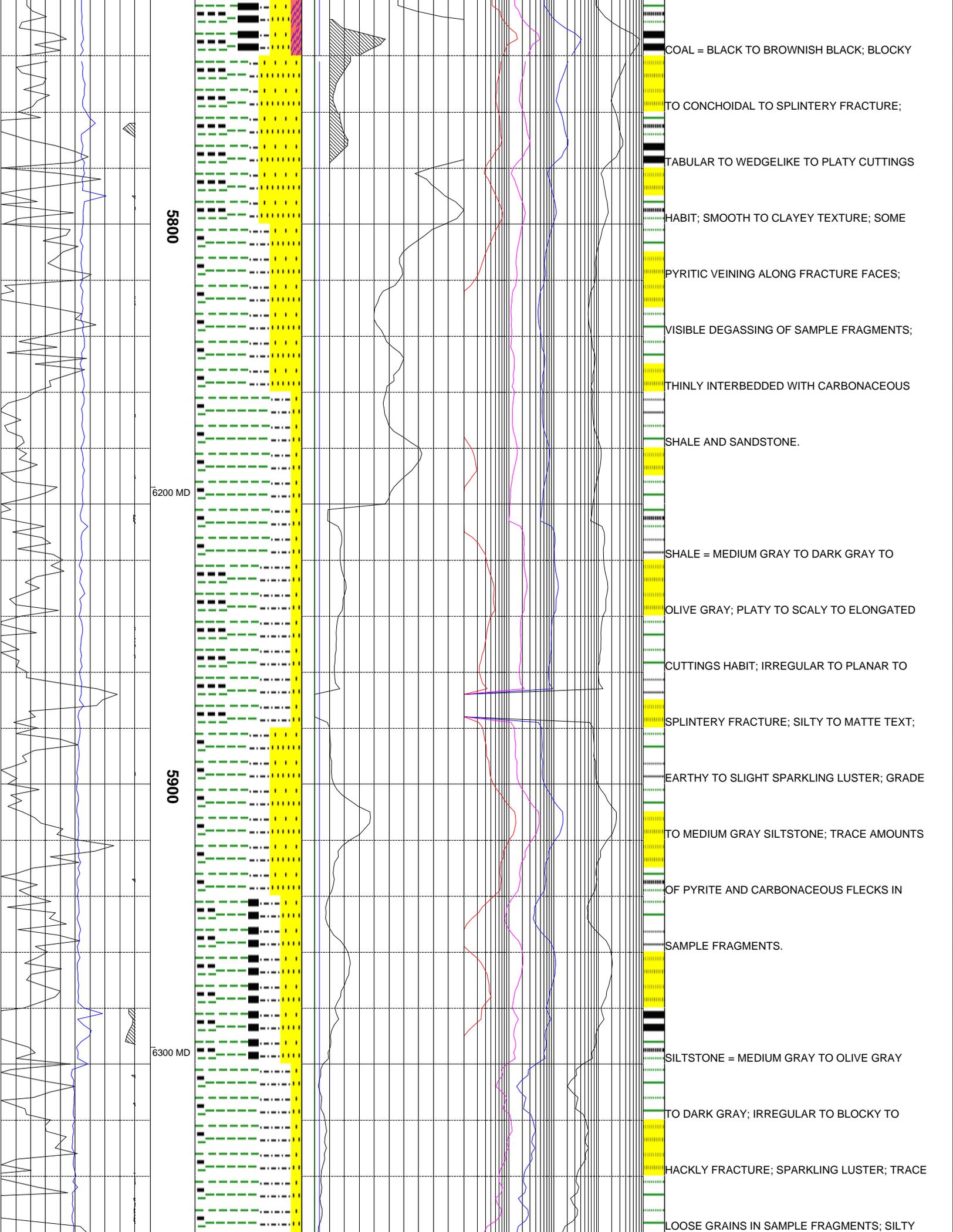
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CO2 10K > <0  
Flare Ht. 100 > <10  
Meth C-1 100K >  
Ethn C-2 100K >  
Prop C-3 100K >  
Butn C-4 100K >  
Pent C-5 100K >

COMPONENT; PREDOM GRAIN SUPPORTED W/  
FAIR AMOUNT OF MATRIX MATERIAL; INTER-  
STICES WELL FILLED; NO CUT; NO FLUORES;  
POOR TO MODERATELY POOR VISIBLE POROSITY  
SHALE = LIGHT GRAY TO MODERATE GRAY,  
MODERATE GRAYISH YELLOW TO GREENISH  
GRAY, LIGHT TO MODERATE BROWN; CRUMBLY  
TO CRUNCHY TENACITY; FRACTURE HACKLY  
TO IRREGULAR SOME NEAR PLANAR; CUTTINGS  
HABIT MASSIVE TO IRREGULAR WITH OCCAS  
WEDGELIKE; LUSTER DULL; TEXTURE SMOOTH  
TO SLIGHTLY SILTY; STRUCTURE MASSIVE.  
PROP C-3 100K >  
CARBONACEOUS SHALE = BLACKISH BROWN  
TO BROWNISH BLACK, BLACK; SOFT TO  
CRUMBLY WITH OCCASIONAL CRUNCHY  
TENACITY; FRACTURE PLANNAR TO IRREGULAR;  
CUTTINGS HAB MASSIVE TO SOMEWHAT BLOCKY;  
LUSTER RESINOUS TO DULL WITH RARE  
WELL DEVELOPED BLACK VITREOUS COAL  
LAMINAE; TEXTURE SMOOTH; VERY THINLY







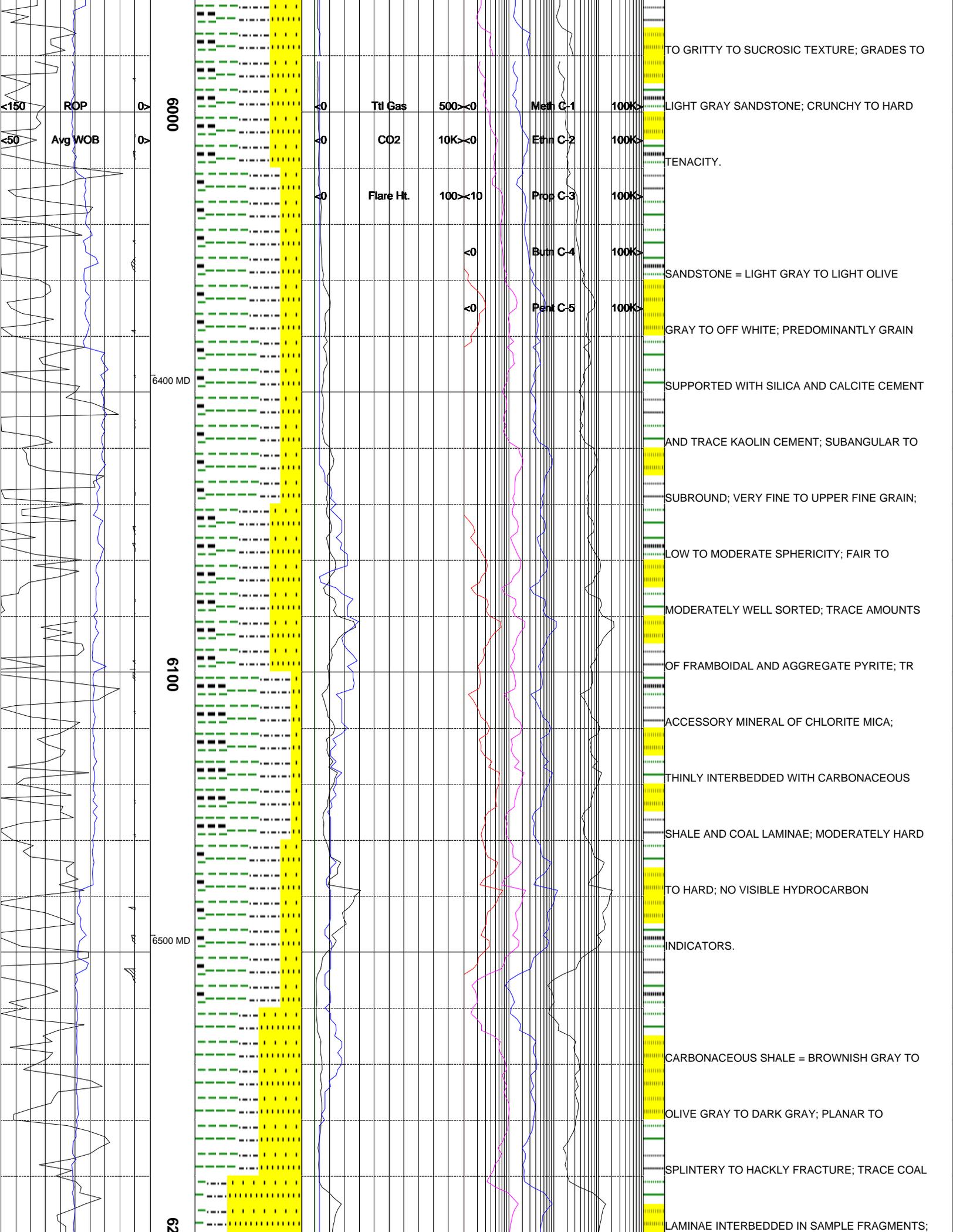


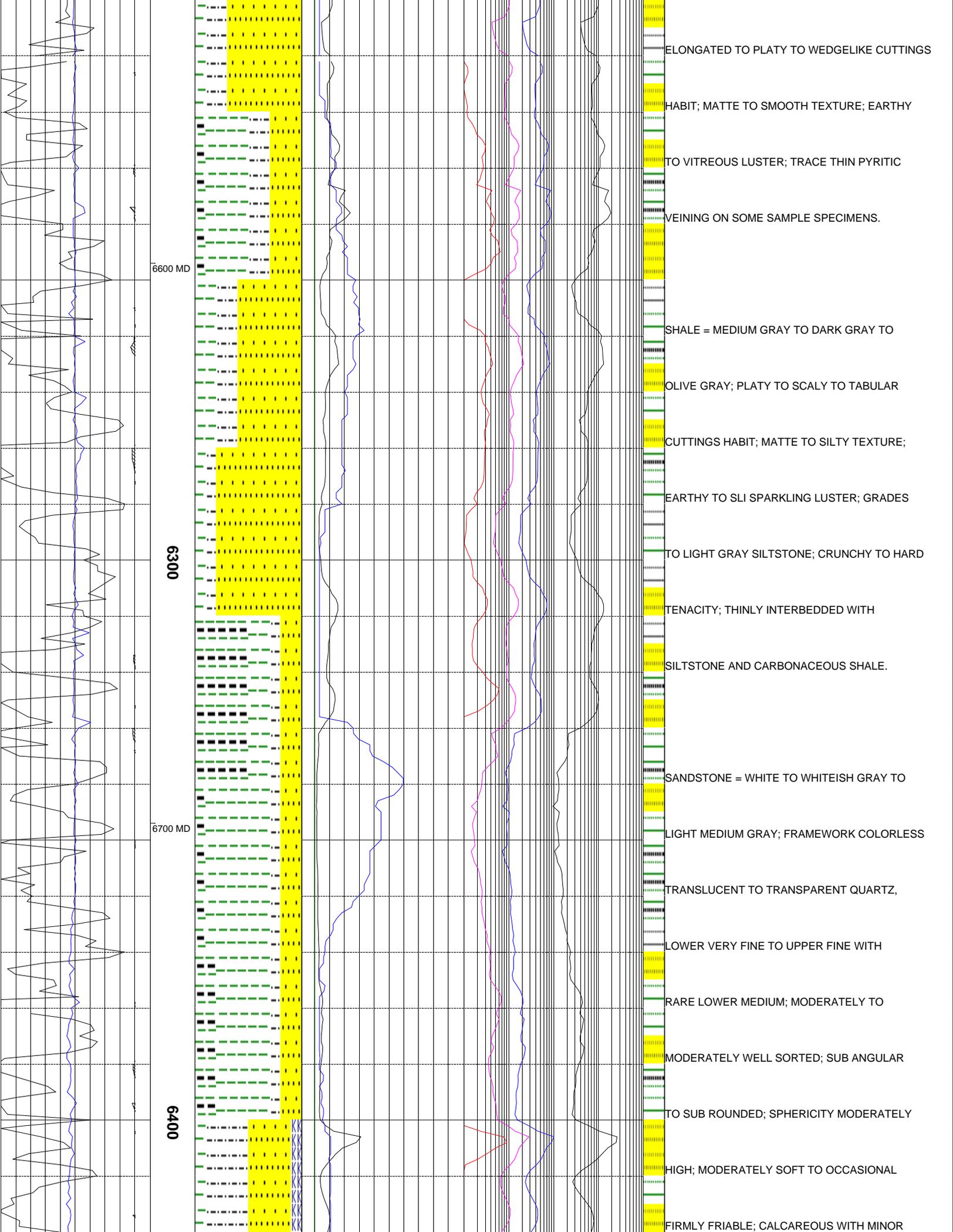
5800

6200 MD

5900

6300 MD





6600 MD

6700 MD

6300

6400

ELONGATED TO PLATY TO WEDGELIKE CUTTINGS

HABIT; MATTE TO SMOOTH TEXTURE; EARTHY

TO VITREOUS LUSTER; TRACE THIN PYRITIC

VEINING ON SOME SAMPLE SPECIMENS.

SHALE = MEDIUM GRAY TO DARK GRAY TO

OLIVE GRAY; PLATY TO SCALY TO TABULAR

CUTTINGS HABIT; MATTE TO SILTY TEXTURE;

EARTHY TO SLI SPARKLING LUSTER; GRADES

TO LIGHT GRAY SILTSTONE; CRUNCHY TO HARD

TENACITY; THINLY INTERBEDDED WITH

SILTSTONE AND CARBONACEOUS SHALE.

SANDSTONE = WHITE TO WHITEISH GRAY TO

LIGHT MEDIUM GRAY; FRAMEWORK COLORLESS

TRANSLUCENT TO TRANSPARENT QUARTZ,

LOWER VERY FINE TO UPPER FINE WITH

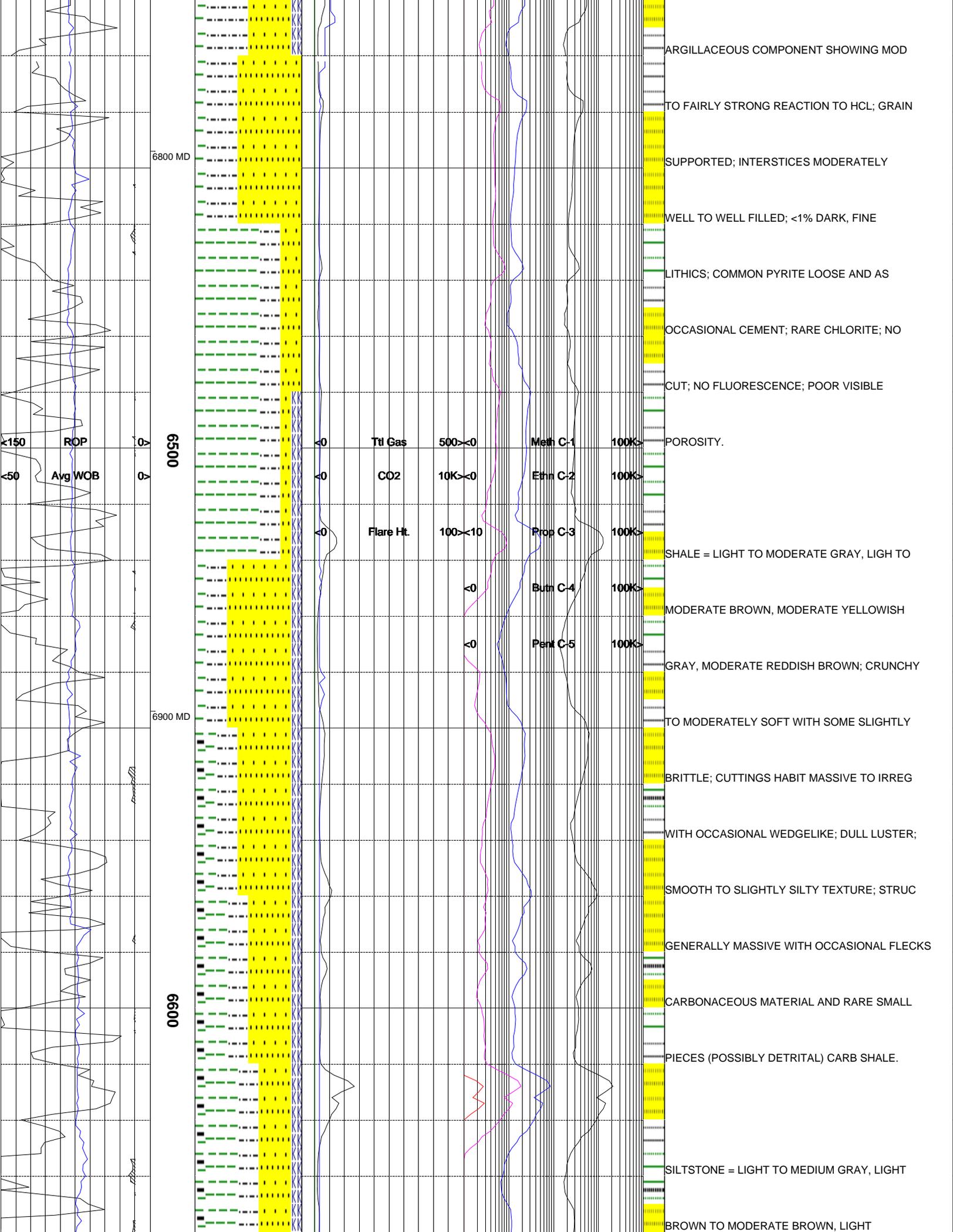
RARE LOWER MEDIUM; MODERATELY TO

MODERATELY WELL SORTED; SUB ANGULAR

TO SUB ROUNDED; SPHERICITY MODERATELY

HIGH; MODERATELY SOFT TO OCCASIONAL

FIRMLY FRIABLE; CALCAREOUS WITH MINOR



6800 MD

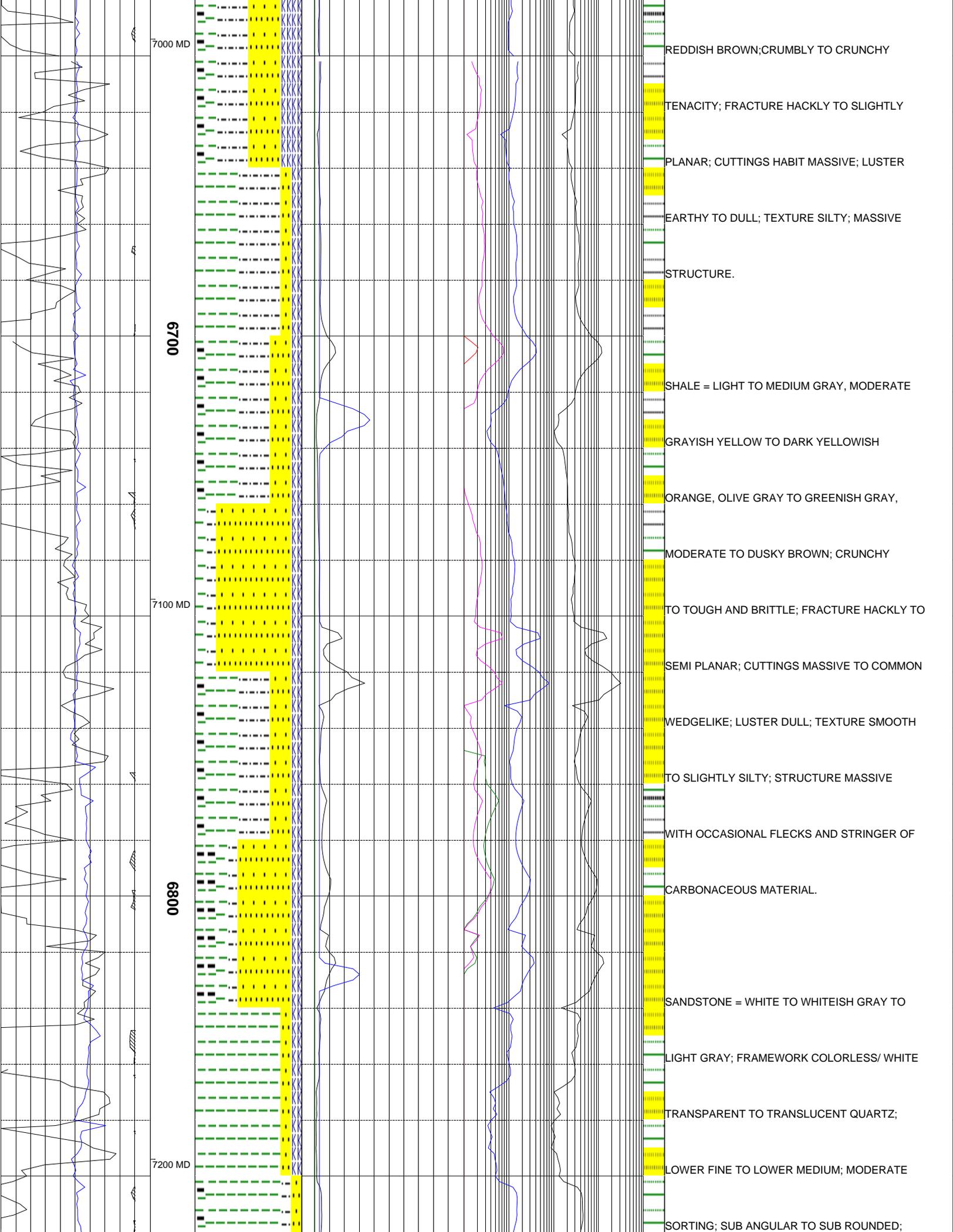
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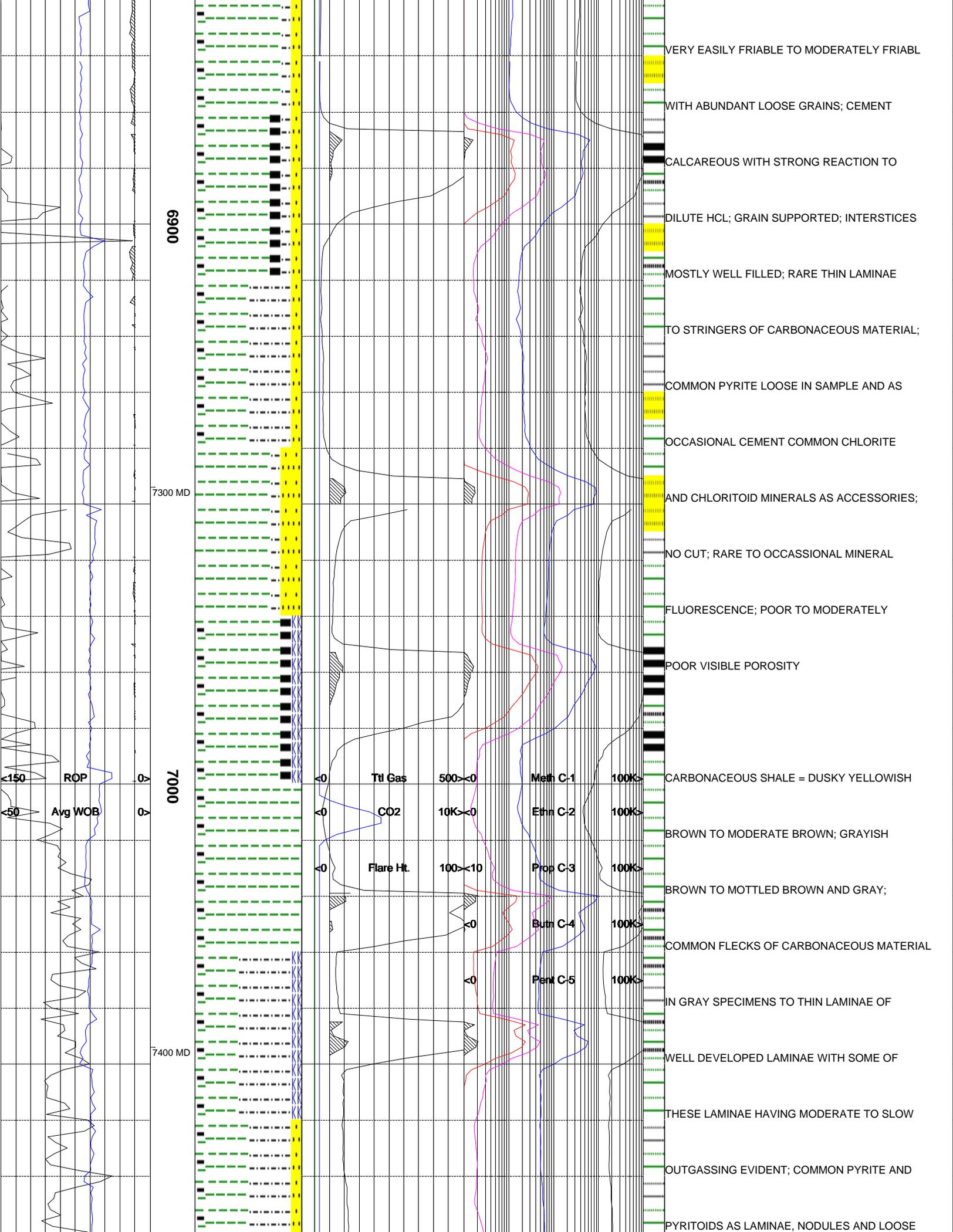
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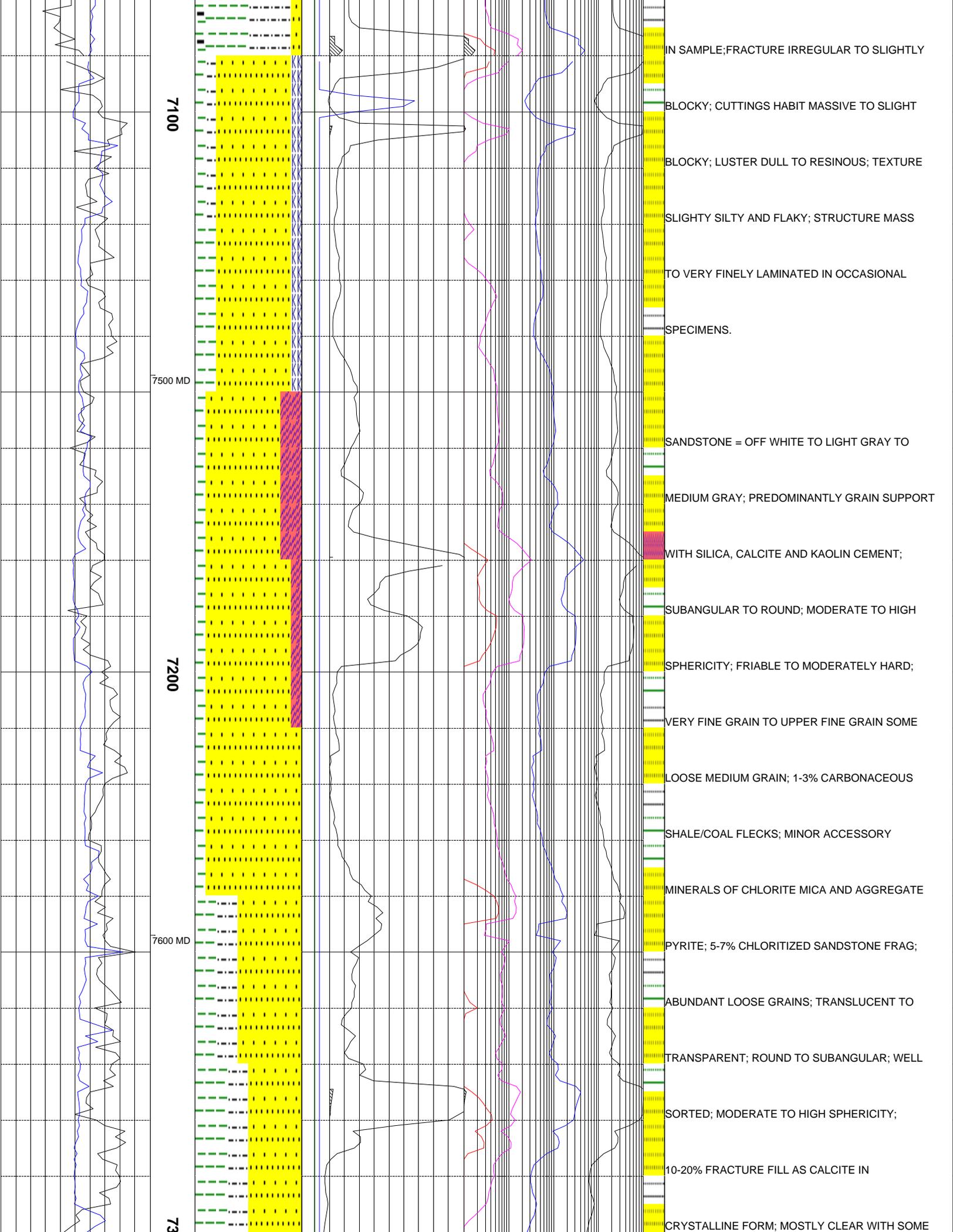
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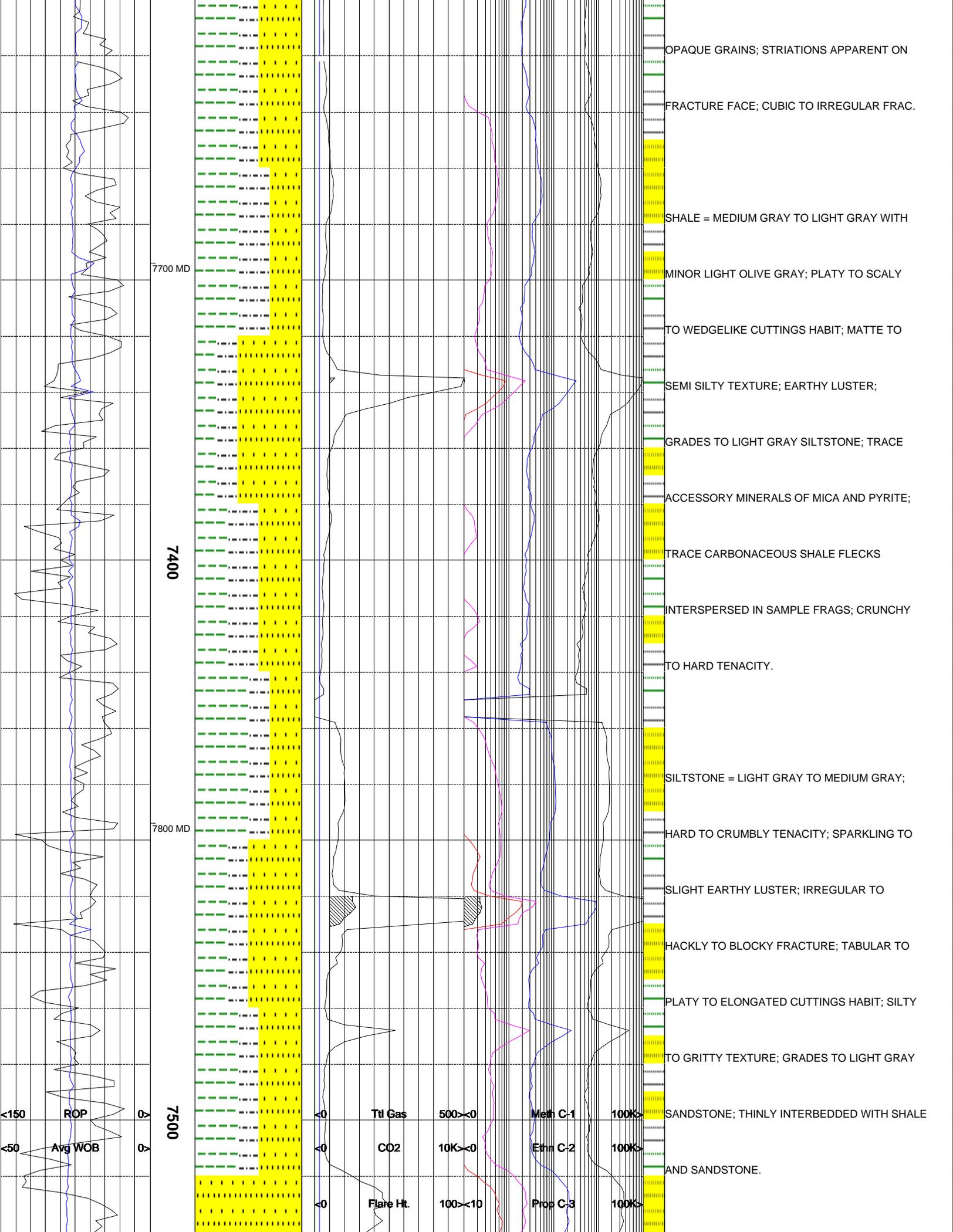
ROP  
Avg WOB

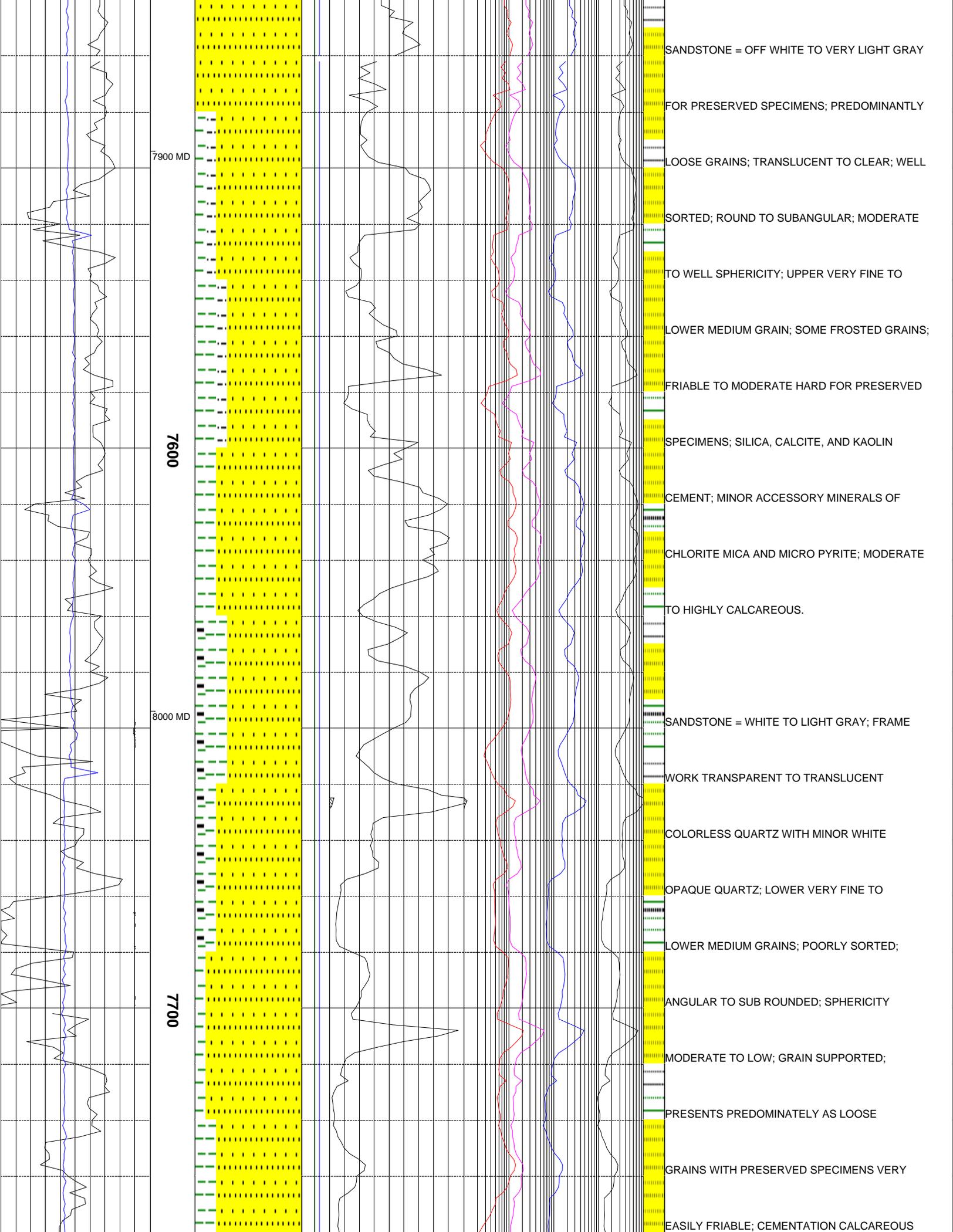
Ttl Gas 500<0  
 CO2 10K<0  
 Flare Ht. 100<10  
 Meth C-1 100K<  
 Ethn C-2 100K<  
 Prop C-3 100K<  
 Butn C-4 100K<  
 Pent C-5 100K<











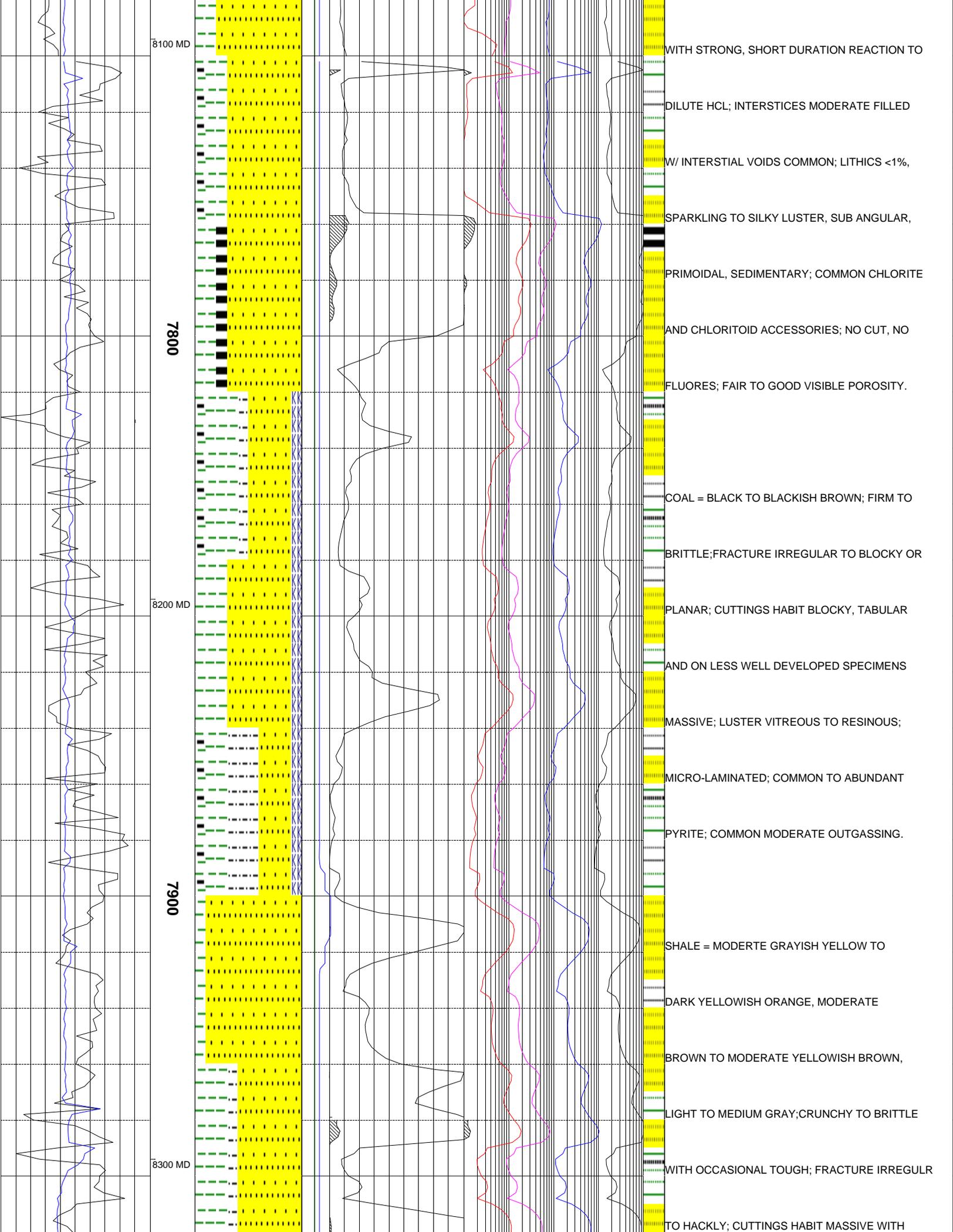
7900 MD

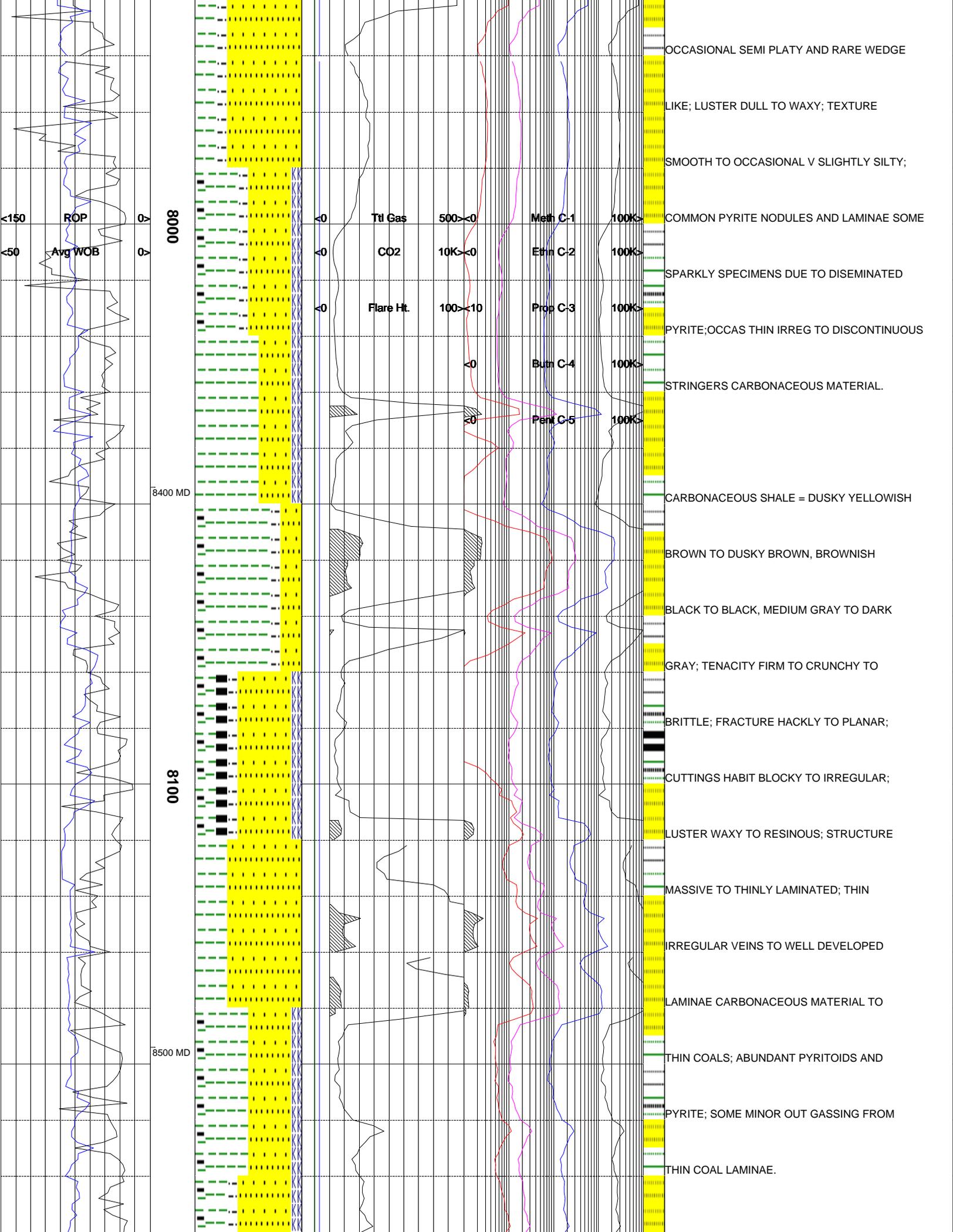
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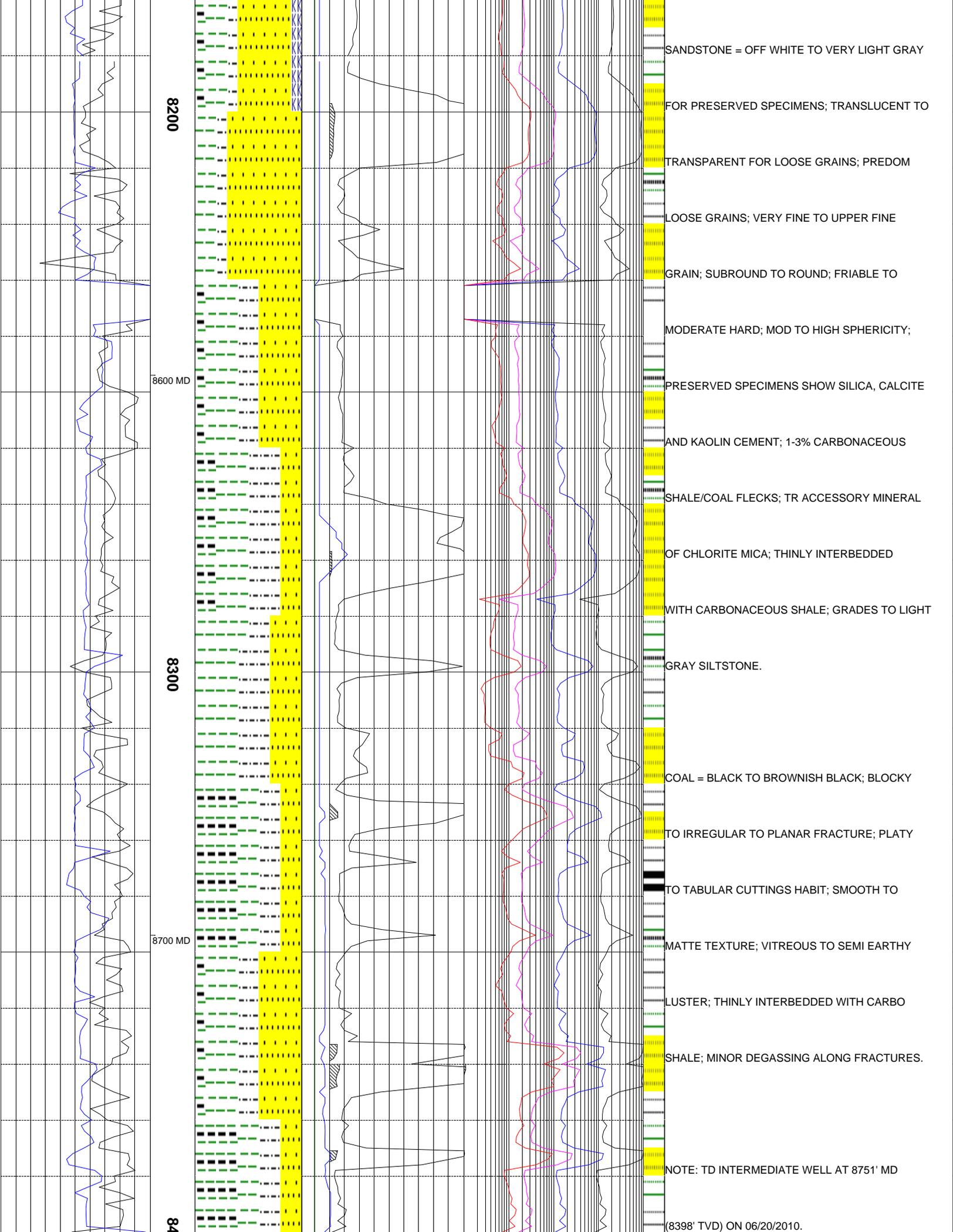
8000 MD

7700

SANDSTONE = OFF WHITE TO VERY LIGHT GRAY  
FOR PRESERVED SPECIMENS; PREDOMINANTLY  
LOOSE GRAINS; TRANSLUCENT TO CLEAR; WELL  
SORTED; ROUND TO SUBANGULAR; MODERATE  
TO WELL SPHERICITY; UPPER VERY FINE TO  
LOWER MEDIUM GRAIN; SOME FROSTED GRAINS;  
FRIABLE TO MODERATE HARD FOR PRESERVED  
SPECIMENS; SILICA, CALCITE, AND KAOLIN  
CEMENT; MINOR ACCESSORY MINERALS OF  
CHLORITE MICA AND MICRO PYRITE; MODERATE  
TO HIGHLY CALCAREOUS.  
SANDSTONE = WHITE TO LIGHT GRAY; FRAME  
WORK TRANSPARENT TO TRANSLUCENT  
COLORLESS QUARTZ WITH MINOR WHITE  
OPAQUE QUARTZ; LOWER VERY FINE TO  
LOWER MEDIUM GRAINS; POORLY SORTED;  
ANGULAR TO SUB ROUNDED; SPHERICITY  
MODERATE TO LOW; GRAIN SUPPORTED;  
PRESENTS PREDOMINATELY AS LOOSE  
GRAINS WITH PRESERVED SPECIMENS VERY  
EASILY FRIABLE; CEMENTATION CALCAREOUS







8200

8600 MD

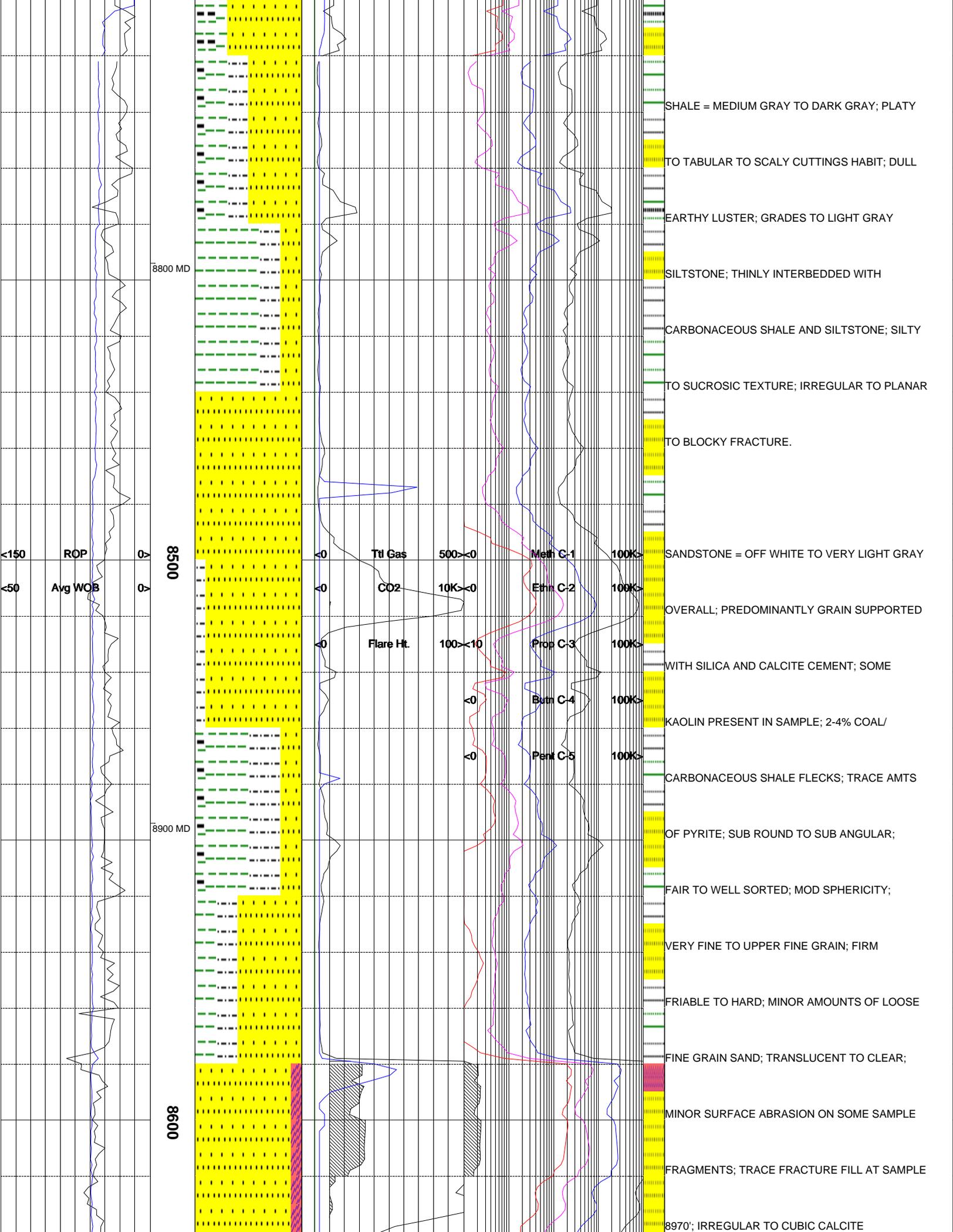
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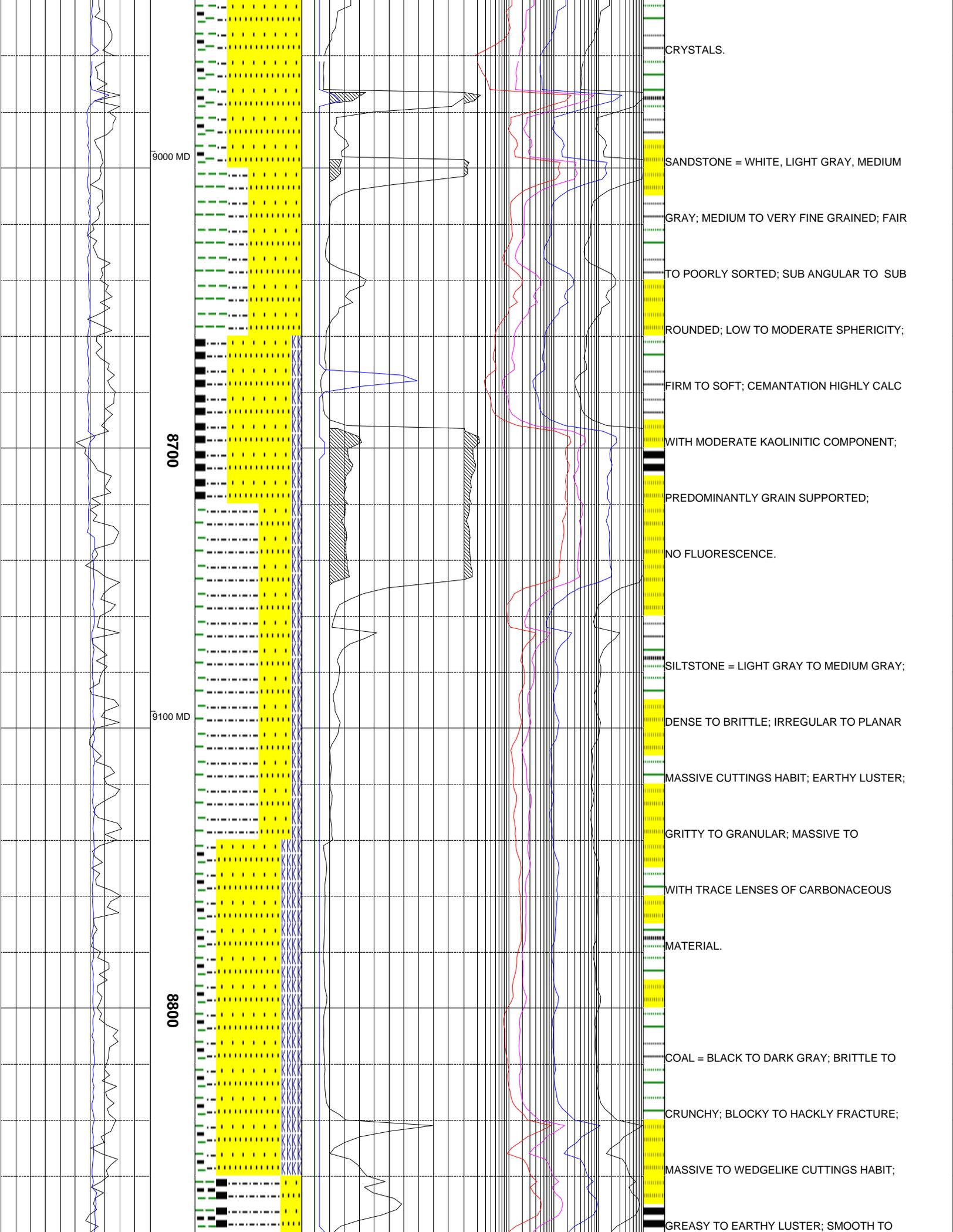
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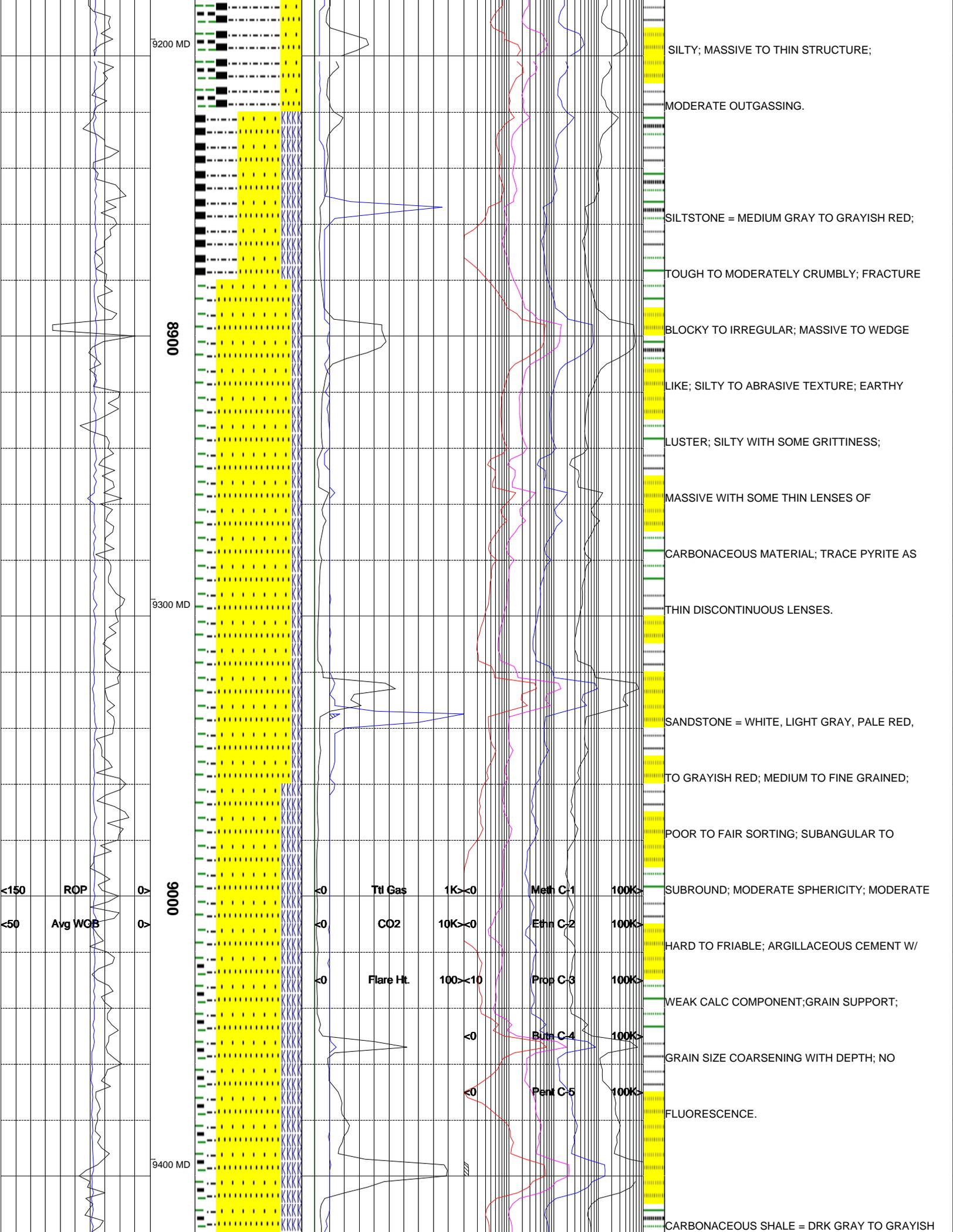
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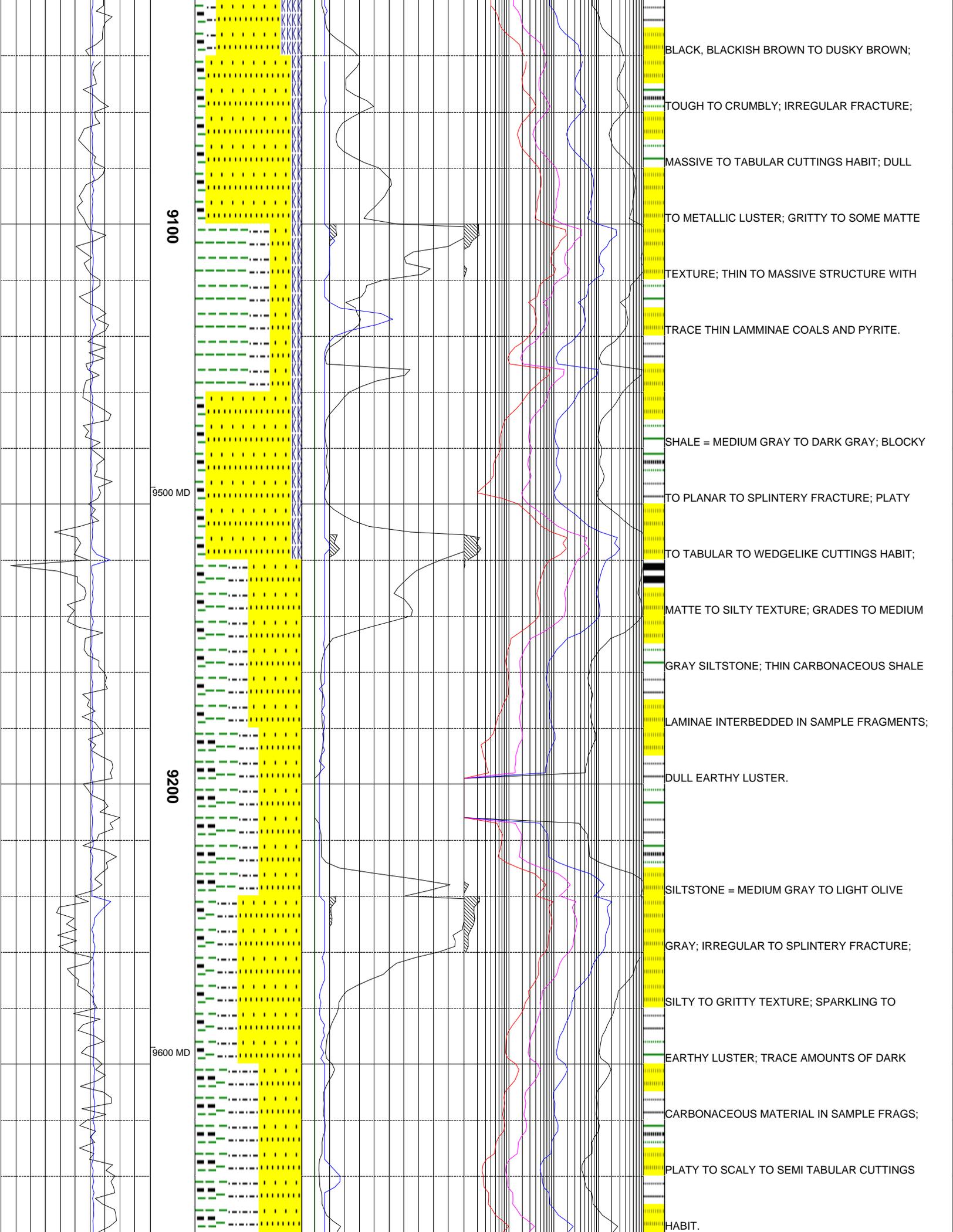
SANDSTONE = OFF WHITE TO VERY LIGHT GRAY  
 FOR PRESERVED SPECIMENS; TRANSLUCENT TO  
 TRANSPARENT FOR LOOSE GRAINS; PREDOM  
 LOOSE GRAINS; VERY FINE TO UPPER FINE  
 GRAIN; SUBROUND TO ROUND; FRIABLE TO  
 MODERATE HARD; MOD TO HIGH SPHERICITY;  
 PRESERVED SPECIMENS SHOW SILICA, CALCITE  
 AND KAOLIN CEMENT; 1-3% CARBONACEOUS  
 SHALE/COAL FLECKS; TR ACCESSORY MINERAL  
 OF CHLORITE MICA; THINLY INTERBEDDED  
 WITH CARBONACEOUS SHALE; GRADES TO LIGHT  
 GRAY SILTSTONE.  
 COAL = BLACK TO BROWNISH BLACK; BLOCKY  
 TO IRREGULAR TO PLANAR FRACTURE; PLATY  
 TO TABULAR CUTTINGS HABIT; SMOOTH TO  
 MATTE TEXTURE; VITREOUS TO SEMI EARTHY  
 LUSTER; THINLY INTERBEDDED WITH CARBO  
 SHALE; MINOR DEGASSING ALONG FRACTURES.  
 NOTE: TD INTERMEDIATE WELL AT 8751' MD

(8398' TVD) ON 06/20/2010.









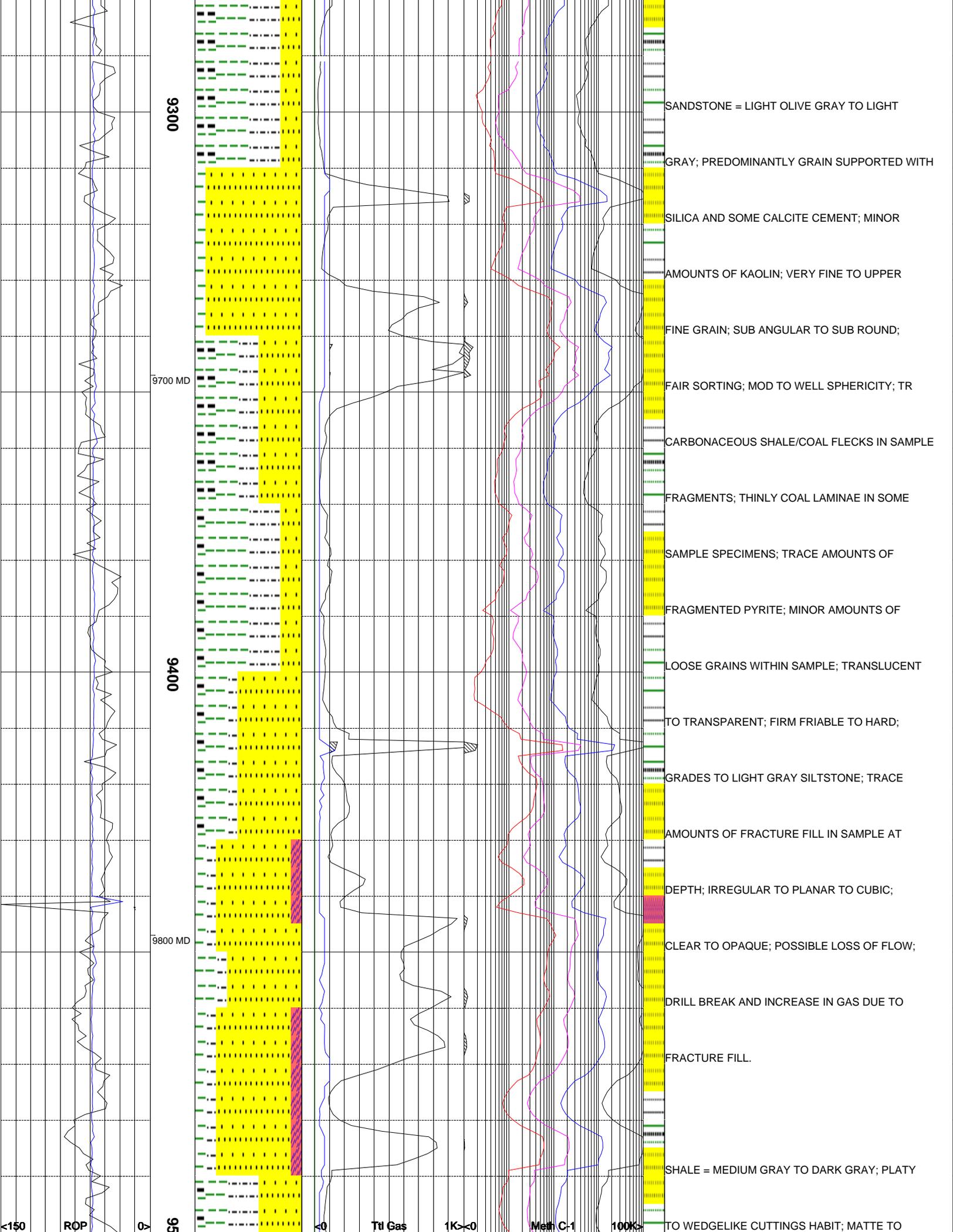
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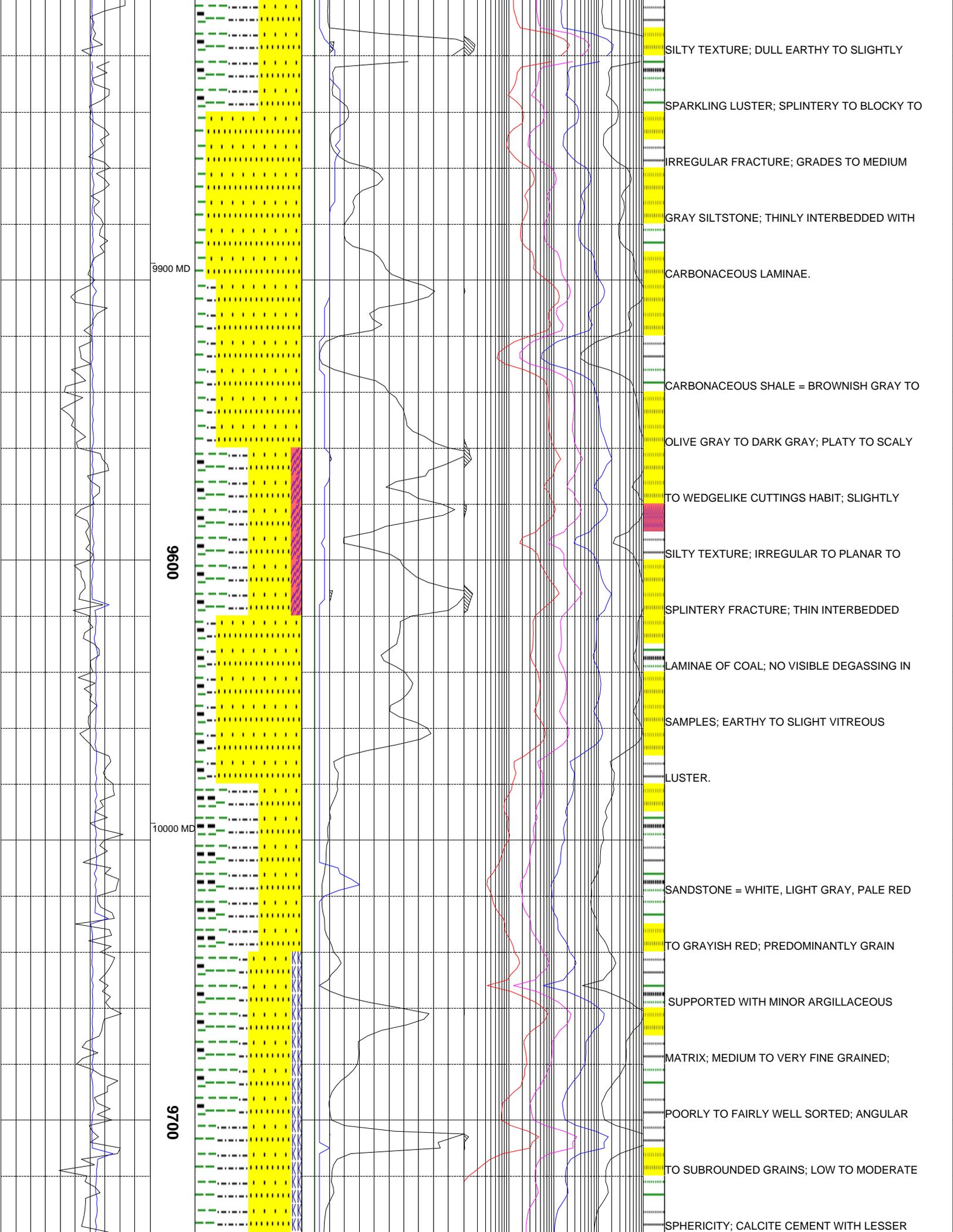
9500 MD

9200

9600 MD

BLACK, BLACKISH BROWN TO DUSKY BROWN;  
 TOUGH TO CRUMBLY; IRREGULAR FRACTURE;  
 MASSIVE TO TABULAR CUTTINGS HABIT; DULL  
 TO METALLIC LUSTER; GRITTY TO SOME MATTE  
 TEXTURE; THIN TO MASSIVE STRUCTURE WITH  
 TRACE THIN LAMMINAE COALS AND PYRITE.  
 SHALE = MEDIUM GRAY TO DARK GRAY; BLOCKY  
 TO PLANAR TO SPLINTERY FRACTURE; PLATY  
 TO TABULAR TO WEDGELIKE CUTTINGS HABIT;  
 MATTE TO SILTY TEXTURE; GRADES TO MEDIUM  
 GRAY SILTSTONE; THIN CARBONACEOUS SHALE  
 LAMINAE INTERBEDDED IN SAMPLE FRAGMENTS;  
 DULL EARTHY LUSTER.  
 SILTSTONE = MEDIUM GRAY TO LIGHT OLIVE  
 GRAY; IRREGULAR TO SPLINTERY FRACTURE;  
 SILTY TO GRITTY TEXTURE; SPARKLING TO  
 EARTHY LUSTER; TRACE AMOUNTS OF DARK  
 CARBONACEOUS MATERIAL IN SAMPLE FRAGS;  
 PLATY TO SCALY TO SEMI TABULAR CUTTINGS  
 HABIT.



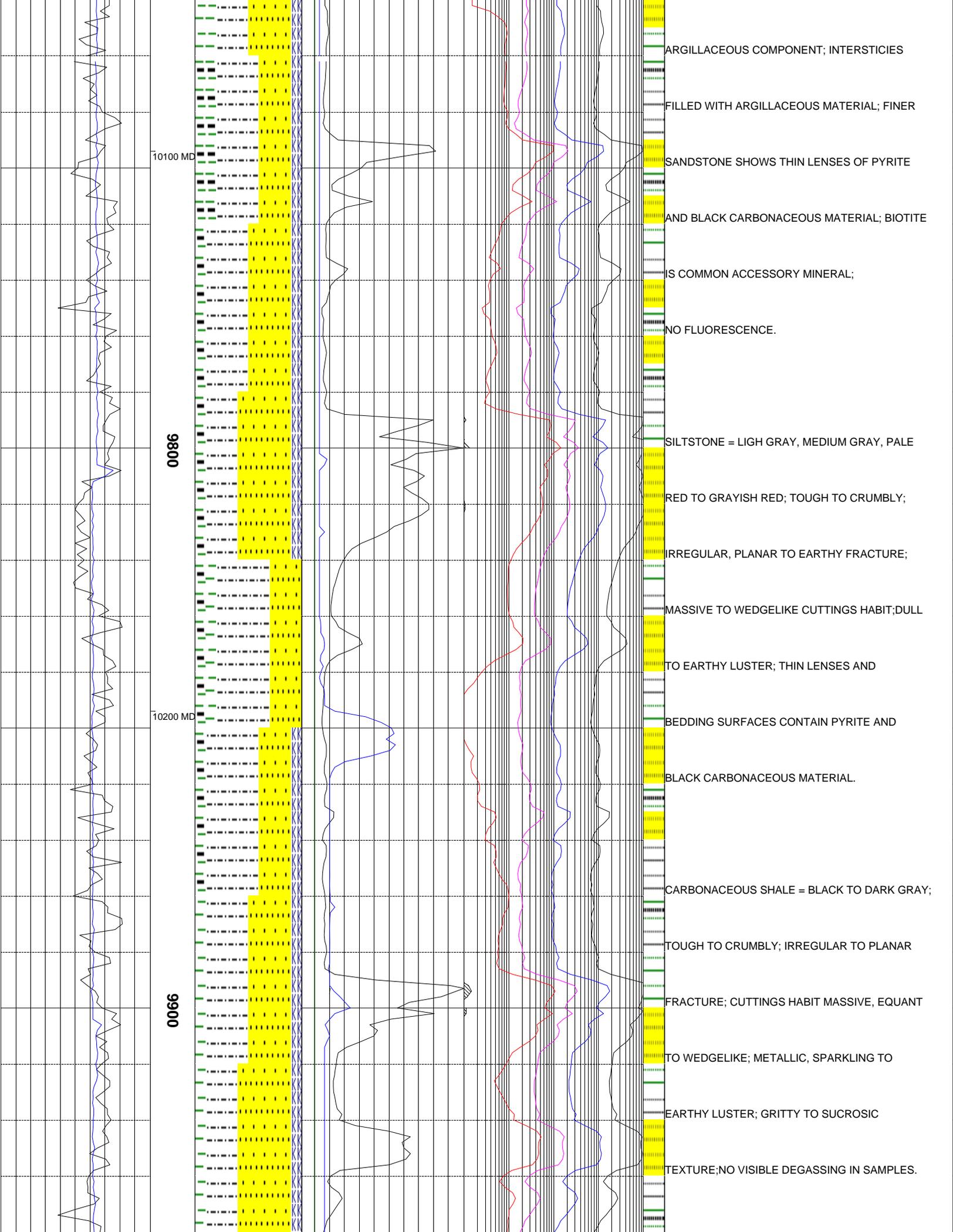


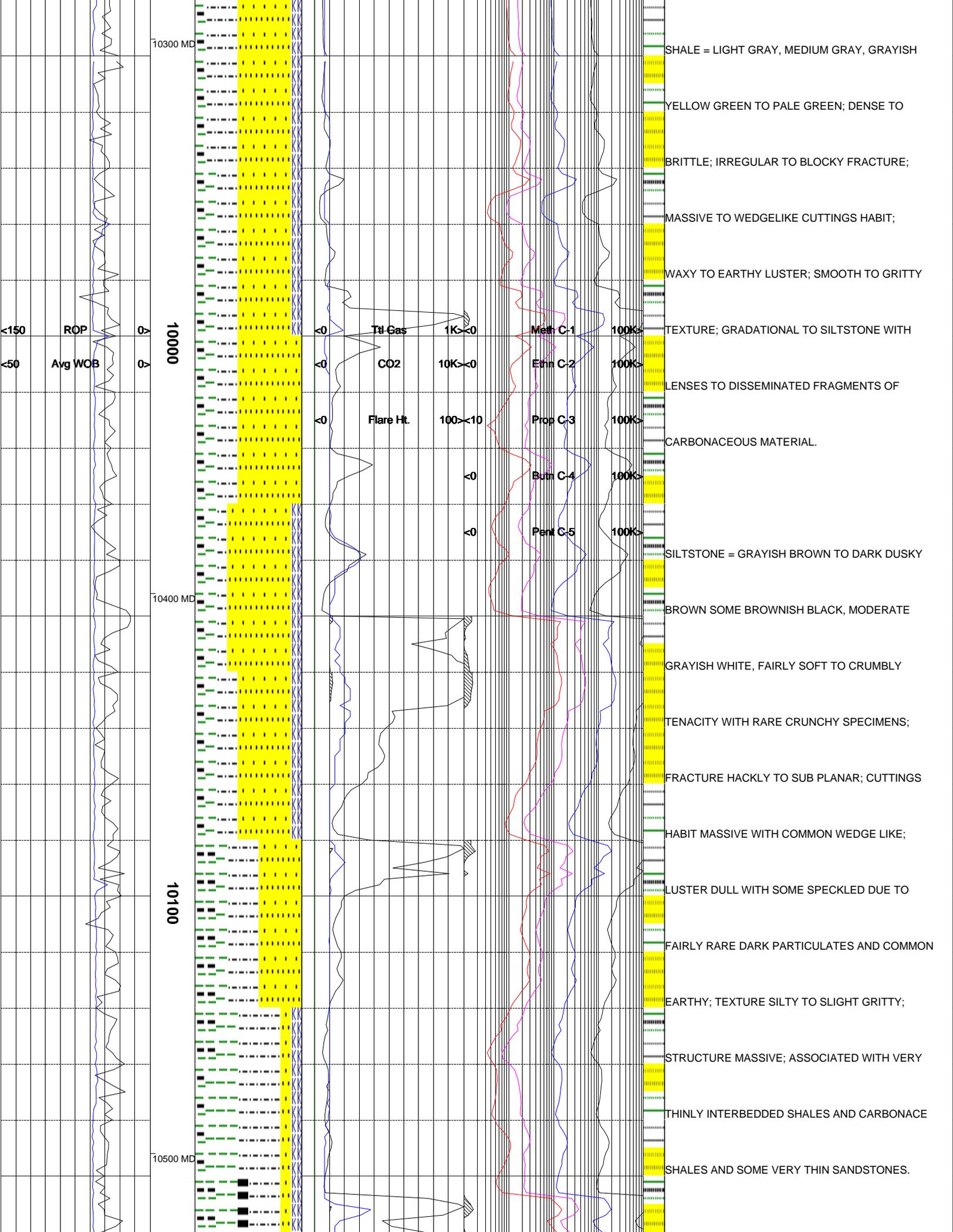
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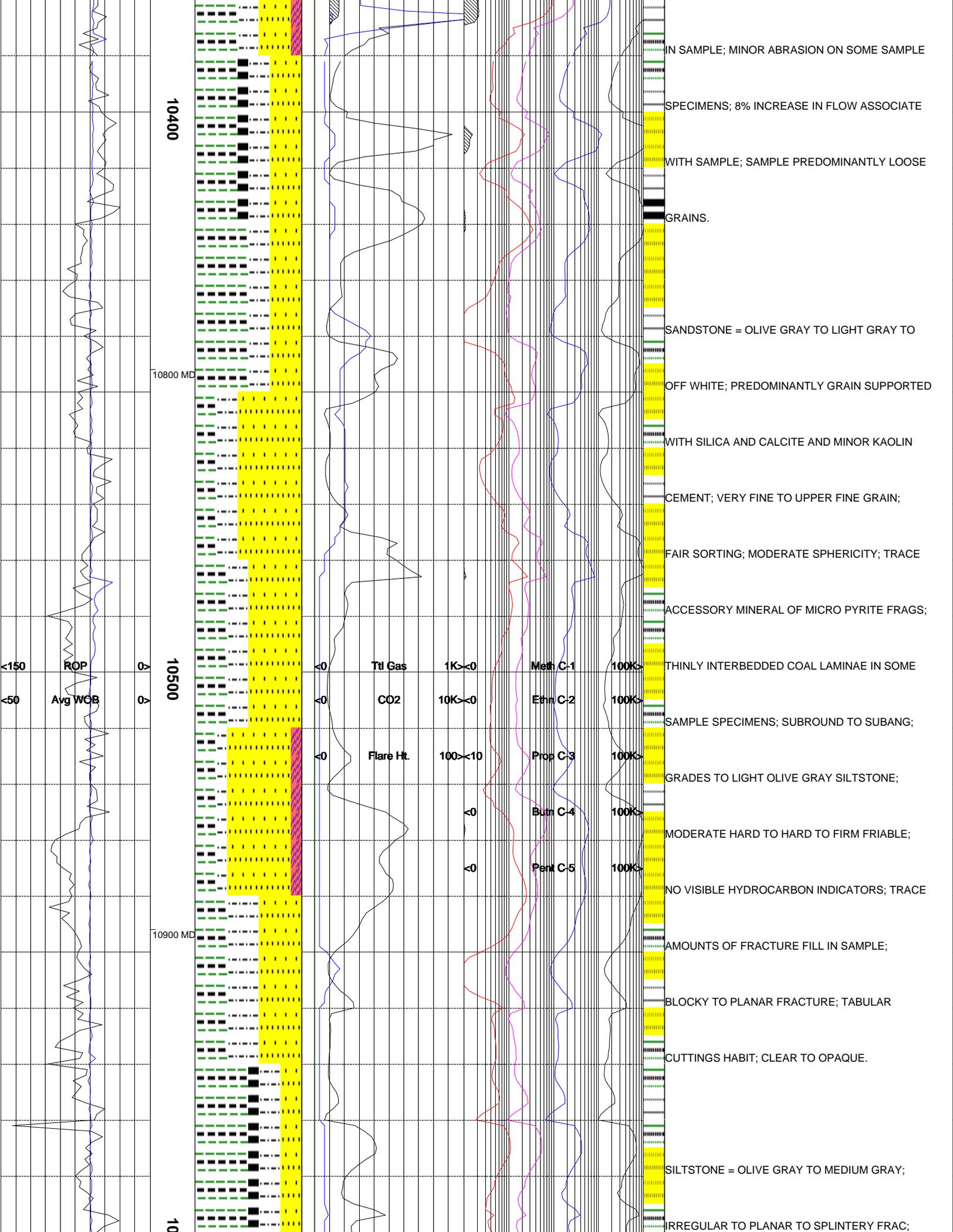
10000 MD

00700









10400

10800 MD

10500

10900 MD

10

IN SAMPLE; MINOR ABRASION ON SOME SAMPLE

SPECIMENS; 8% INCREASE IN FLOW ASSOCIATE

WITH SAMPLE; SAMPLE PREDOMINANTLY LOOSE

GRAINS.

SANDSTONE = OLIVE GRAY TO LIGHT GRAY TO

OFF WHITE; PREDOMINANTLY GRAIN SUPPORTED

WITH SILICA AND CALCITE AND MINOR KAOLIN

CEMENT; VERY FINE TO UPPER FINE GRAIN;

FAIR SORTING; MODERATE SPHERICITY; TRACE

ACCESSORY MINERAL OF MICRO PYRITE FRAGS;

THINLY INTERBEDDED COAL LAMINAE IN SOME

SAMPLE SPECIMENS; SUBROUND TO SUBANG;

GRADES TO LIGHT OLIVE GRAY SILTSTONE;

MODERATE HARD TO HARD TO FIRM FRIABLE;

NO VISIBLE HYDROCARBON INDICATORS; TRACE

AMOUNTS OF FRACTURE FILL IN SAMPLE;

BLOCKY TO PLANAR FRACTURE; TABULAR

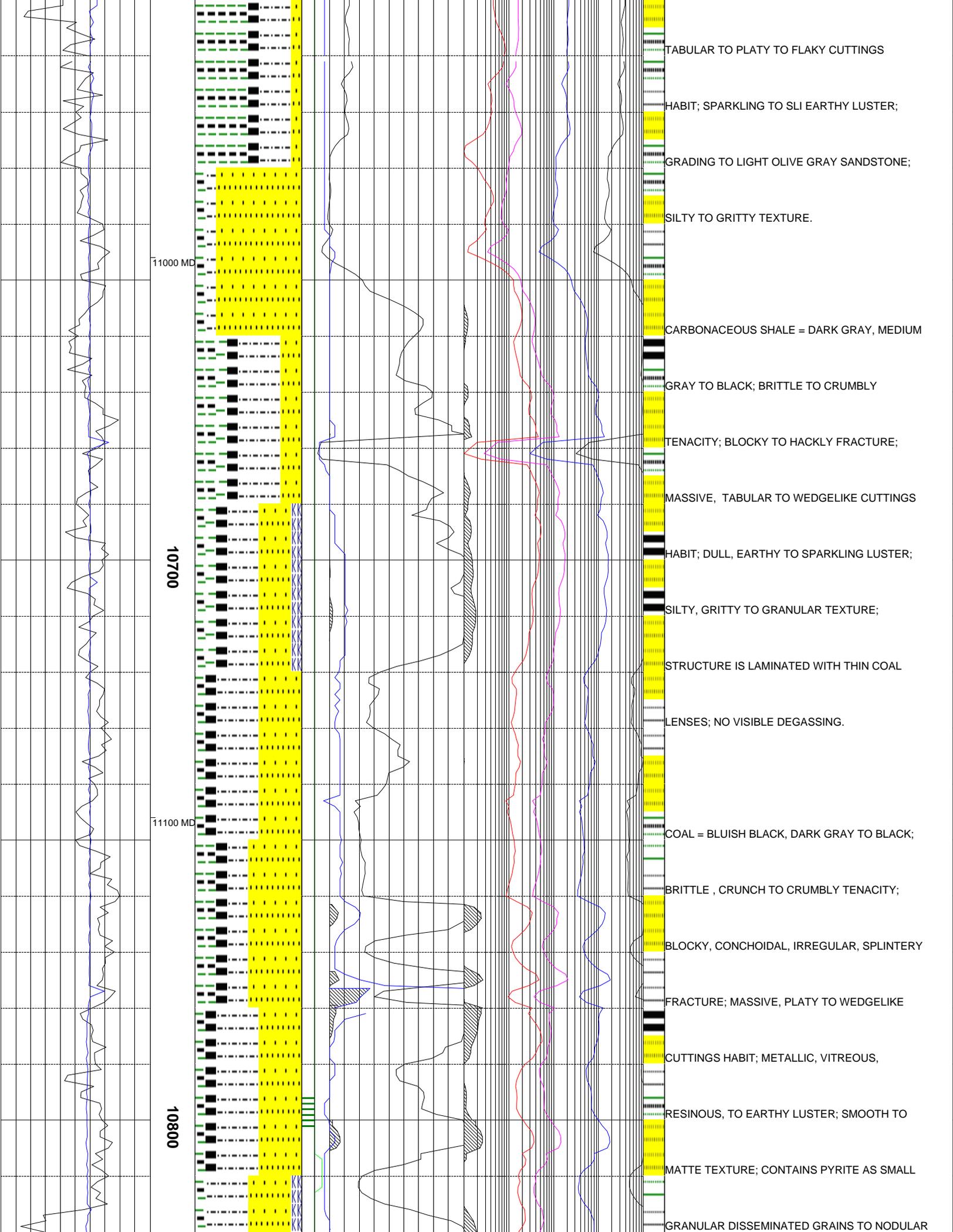
CUTTINGS HABIT; CLEAR TO OPAQUE.

SILTSTONE = OLIVE GRAY TO MEDIUM GRAY;

IRREGULAR TO PLANAR TO SPLINTERY FRAC;

ROP  
Avg WCB

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



11000 MD

10700

11100 MD

10800

TABULAR TO PLATY TO FLAKY CUTTINGS

HABIT; SPARKLING TO SLI EARTHY LUSTER;

GRADING TO LIGHT OLIVE GRAY SANDSTONE;

SILTY TO GRITTY TEXTURE.

CARBONACEOUS SHALE = DARK GRAY, MEDIUM

GRAY TO BLACK; BRITTLE TO CRUMBLY

TENACITY; BLOCKY TO HACKLY FRACTURE;

MASSIVE, TABULAR TO WEDGELIKE CUTTINGS

HABIT; DULL, EARTHY TO SPARKLING LUSTER;

SILTY, GRITTY TO GRANULAR TEXTURE;

STRUCTURE IS LAMINATED WITH THIN COAL

LENSES; NO VISIBLE DEGASSING.

COAL = BLUISH BLACK, DARK GRAY TO BLACK;

BRITTLE, CRUNCH TO CRUMBLY TENACITY;

BLOCKY, CONCHOIDAL, IRREGULAR, SPLINTERY

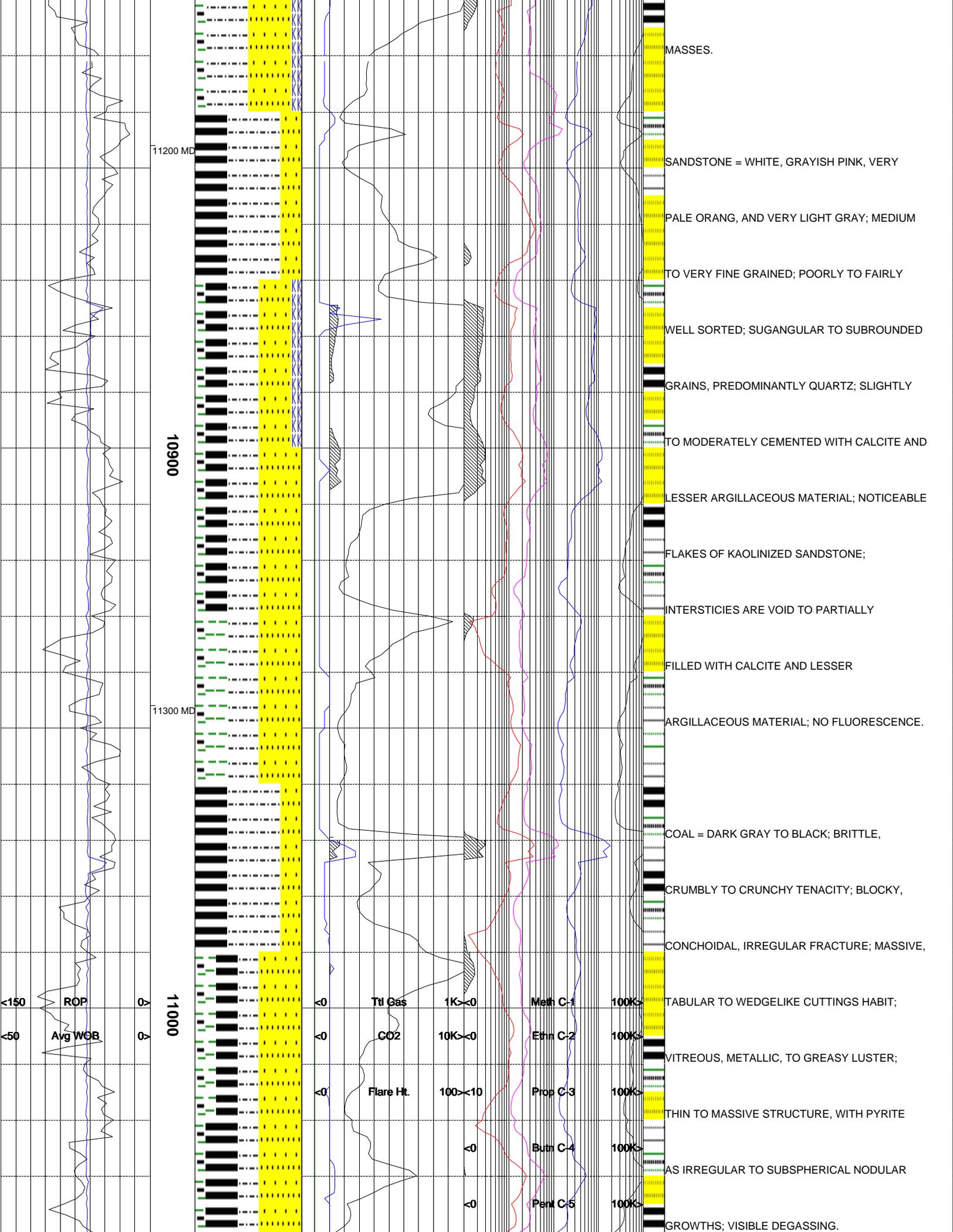
FRACTURE; MASSIVE, PLATY TO WEDGELIKE

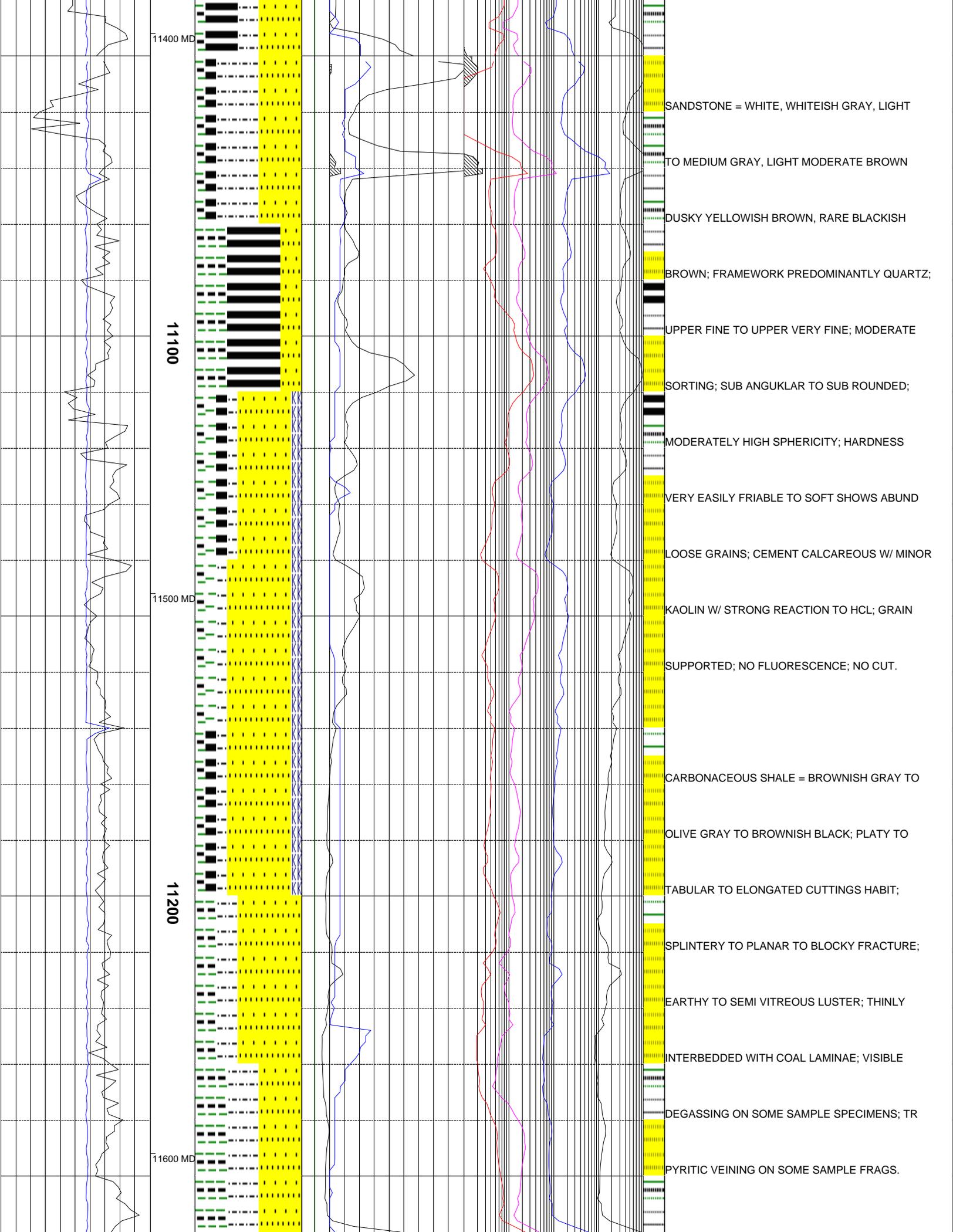
CUTTINGS HABIT; METALLIC, VITREOUS,

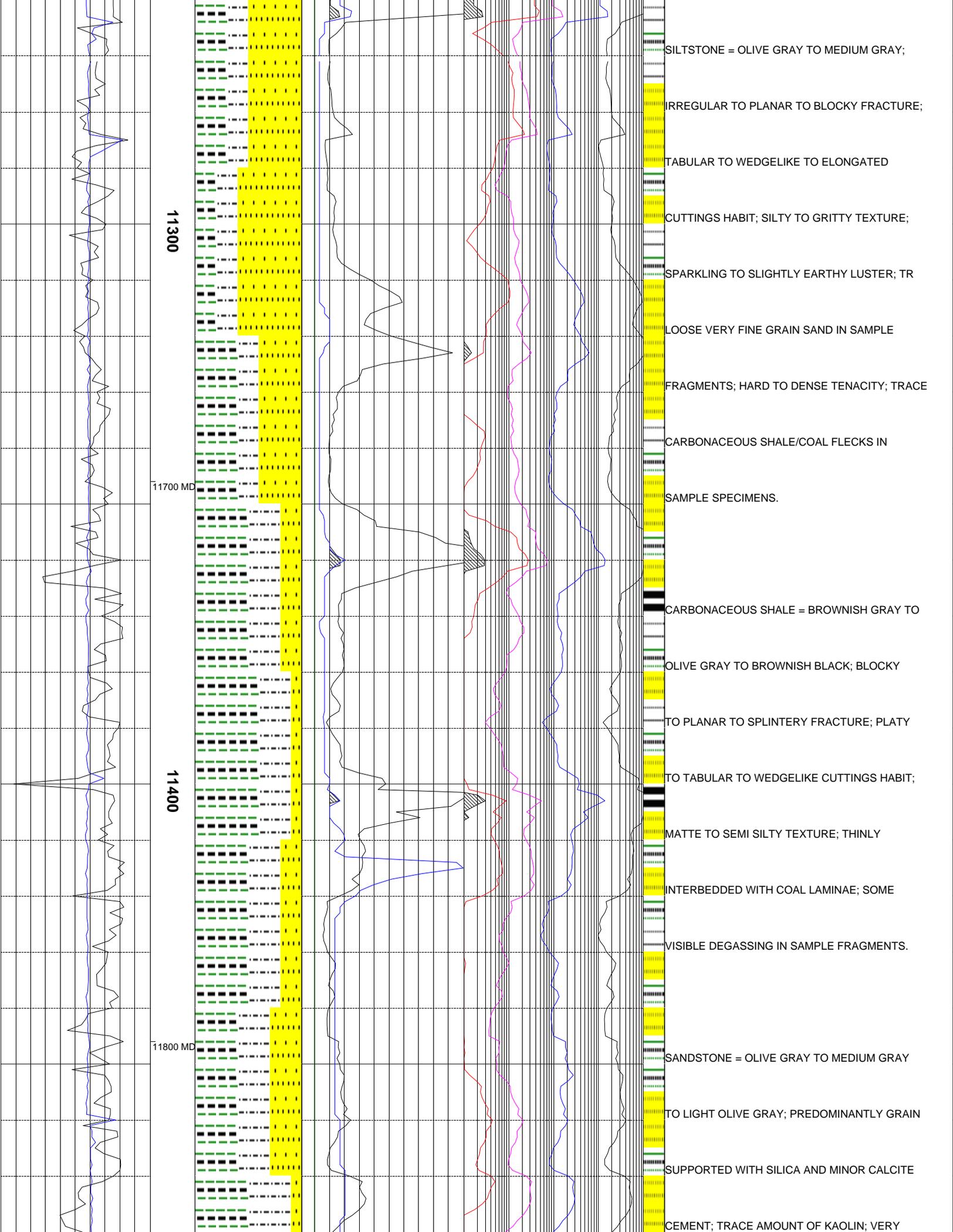
RESINOUS, TO EARTHY LUSTER; SMOOTH TO

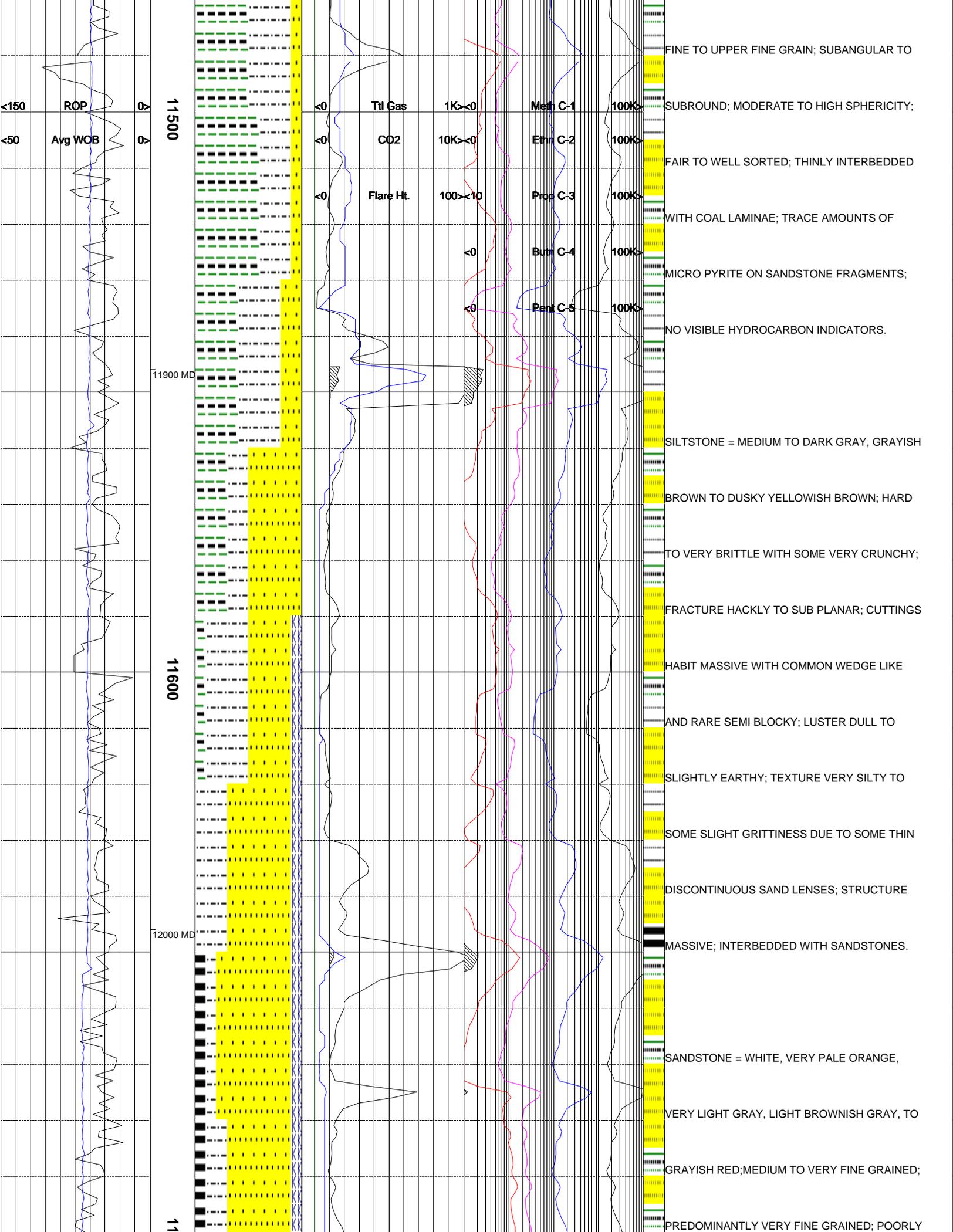
MATTE TEXTURE; CONTAINS PYRITE AS SMALL

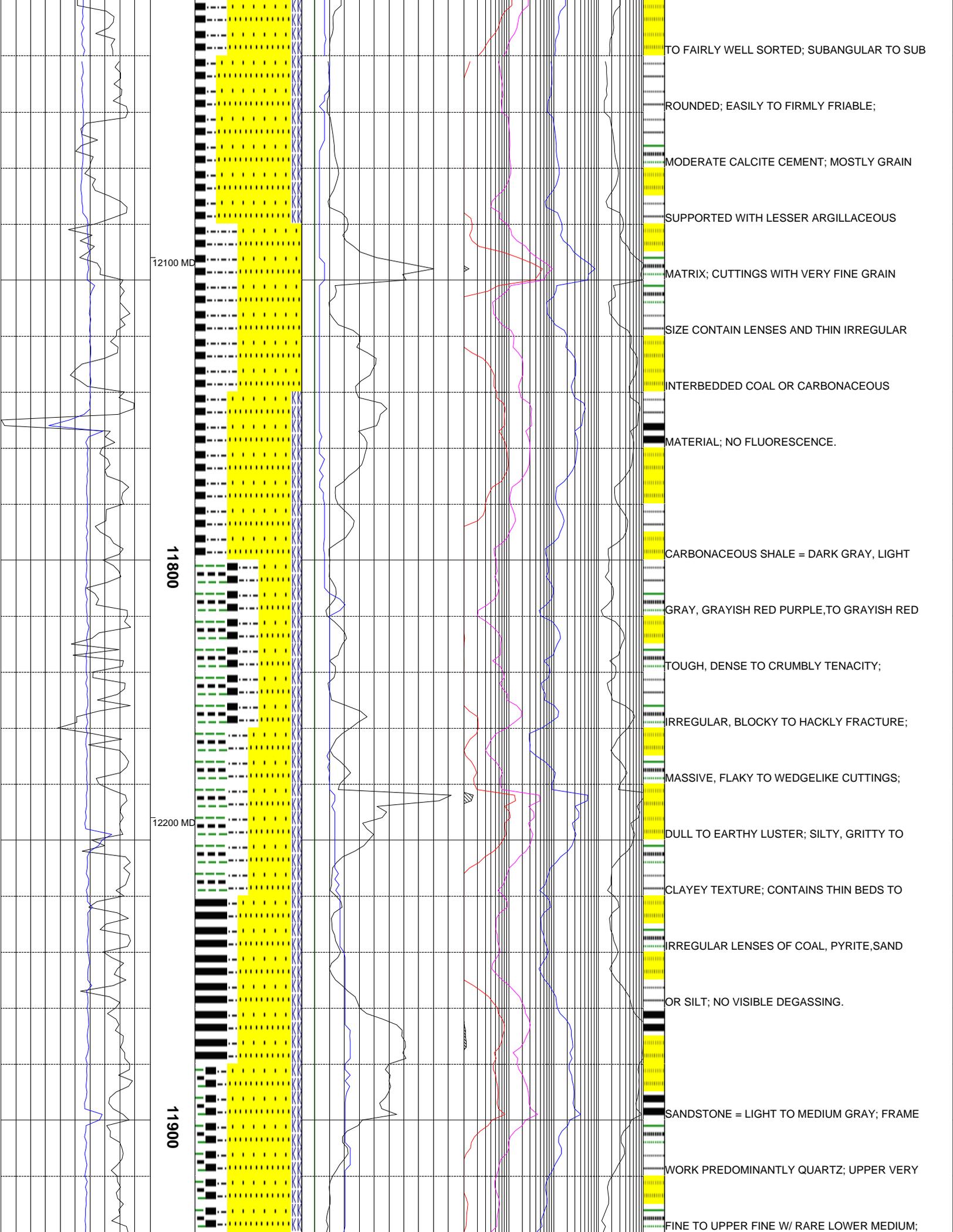
GRANULAR DISSEMINATED GRAINS TO NODULAR









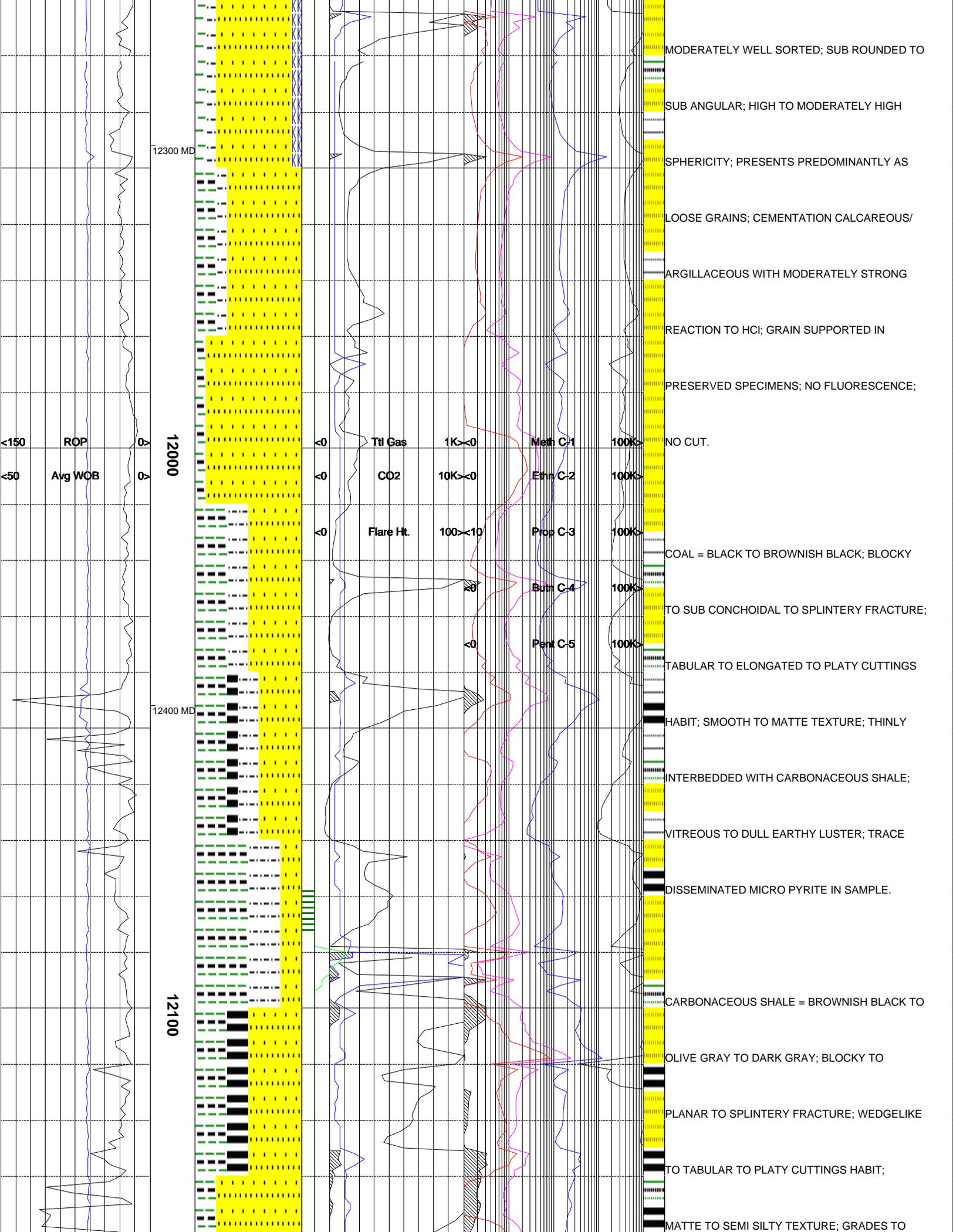


12100 MD

11800

12200 MD

11900



12300 MD

12000

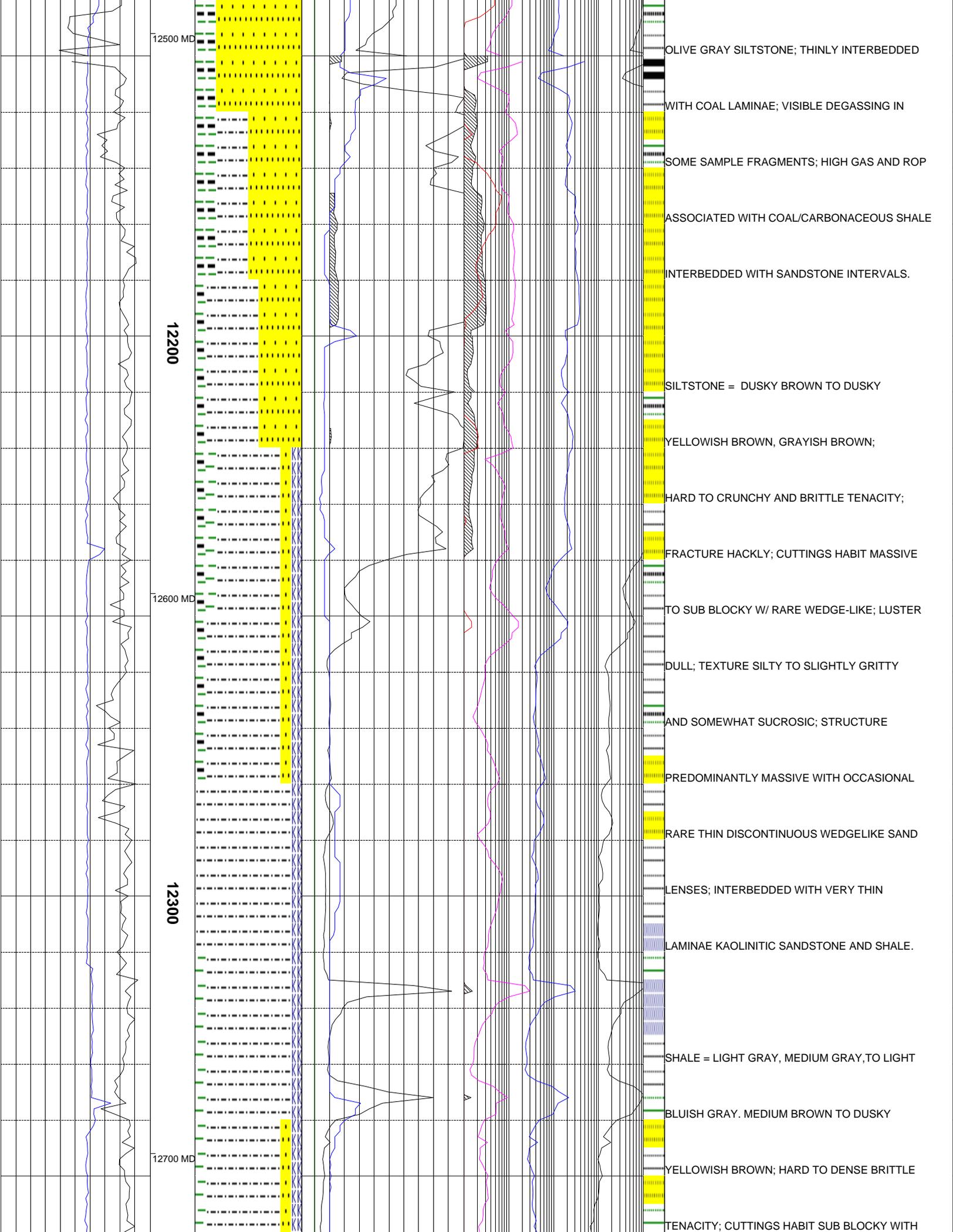
12400 MD

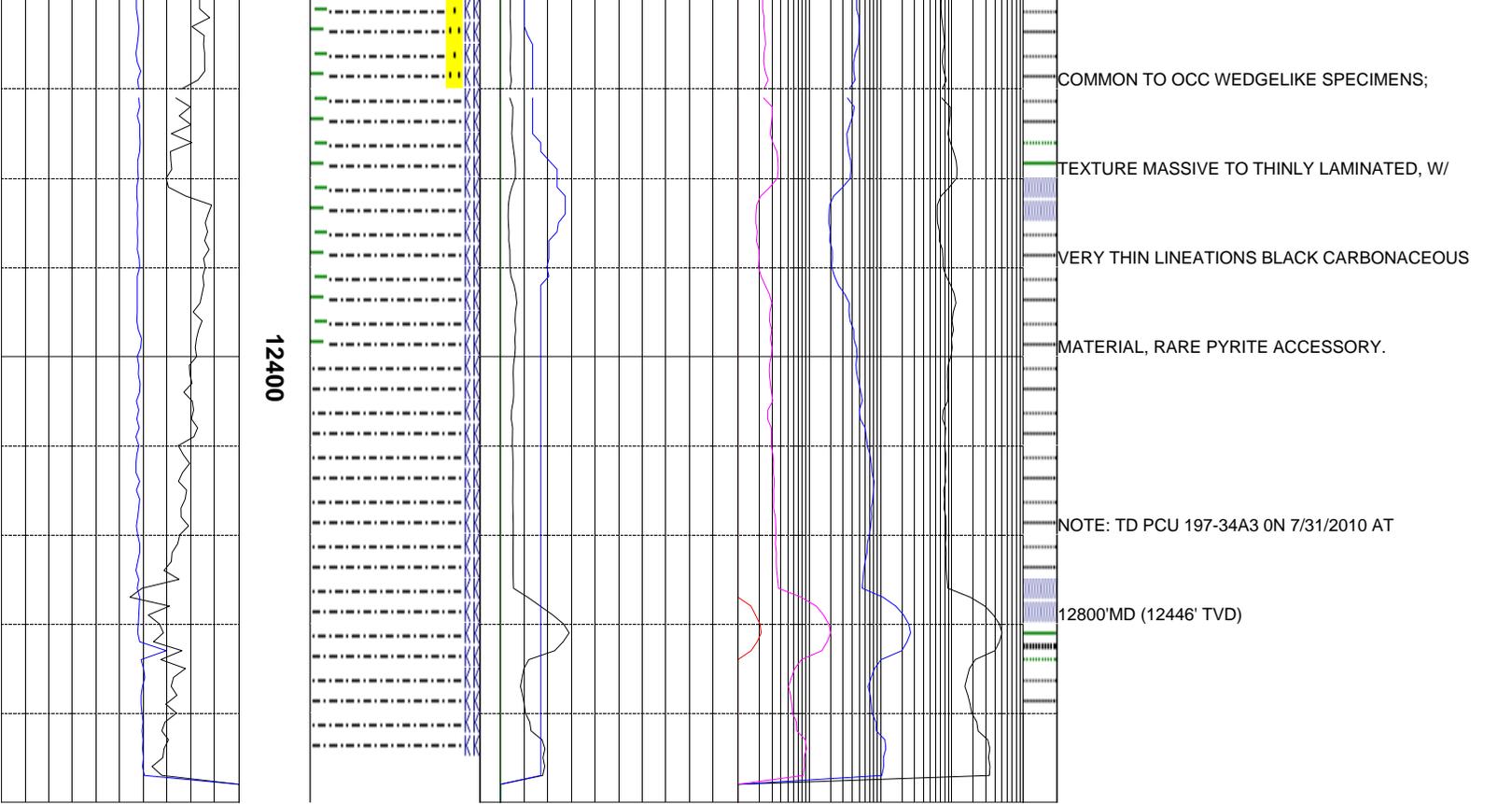
12100

<150 ROP  
<50 Avg WOB

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

MODERATELY WELL SORTED; SUB ROUNDED TO  
SUB ANGULAR; HIGH TO MODERATELY HIGH  
SPHERICITY; PRESENTS PREDOMINANTLY AS  
LOOSE GRAINS; CEMENTATION CALCAREOUS/  
ARGILLACEOUS WITH MODERATELY STRONG  
REACTION TO HCl; GRAIN SUPPORTED IN  
PRESERVED SPECIMENS; NO FLUORESCENCE;  
NO CUT.  
COAL = BLACK TO BROWNISH BLACK; BLOCKY  
TO SUB CONCHOIDAL TO SPLINTERY FRACTURE;  
TABULAR TO ELONGATED TO PLATY CUTTINGS  
HABIT; SMOOTH TO MATTE TEXTURE; THINLY  
INTERBEDDED WITH CARBONACEOUS SHALE;  
VITREOUS TO DULL EARTHY LUSTER; TRACE  
DISSEMINATED MICRO PYRITE IN SAMPLE.  
CARBONACEOUS SHALE = BROWNISH BLACK TO  
OLIVE GRAY TO DARK GRAY; BLOCKY TO  
PLANAR TO SPLINTERY FRACTURE; WEDGELIKE  
TO TABULAR TO PLATY CUTTINGS HABIT;  
MATTE TO SEMI SILTY TEXTURE; GRADES TO





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