DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 377TH AIR BASE WING (AFMC)

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NMED Hazardous Waste Bureau

Colonel John C. Kubinec
377 ABW/CC
2000 Wyoming Blvd SE
Kirtland AFB NM 87117-5600

Mr. John Kieling, Manager
RCRA Permits Management Program
Hazardous Waste Bureau (HWB)
New Mexico Environment Department (NMED)
2905 Rodeo Park Road
Santa Fe New Mexico 87505

Dear Mr. Kieling

The attached document is being submitted in response to your letter, dated 17 February 2012 regarding questions relative to the scope and quality of geophysical borehole logging. The attached document describes actions taken by Shaw Environmental Inc. to review and validate the extent and quality of data submitted during 2011. The quantity of the referenced geophysical logs dictated that we provide an electronic version as appendices to this submitted document. We appreciate your efforts to insure only the most accurate geophysical data is reported.

Please contact Mr. L. Wayne Bitner at (505) 853-3484 or at ludie.bitner@kirtland .af.mil or Ms. Victoria R. Martinez at (505) 846-6362 or at victoria.martinez@kirtland.af.mil if you have any questions.

Sincerely

JOHN C. KUBINEC, Colonel USAF
Commander

Attachment:
Borehole Geophysical Logs, Bulk Fuels Facility Spill, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111, 17 Feb 2012 letter Re: Email of December 14, 2011 Kirtland Air Force Base New Mexico

cc:
NMED-RPD (Davis), w/out attach
NMED-HWB (Moats, McDonald, Salem, Brandwein), w/ attach
NMED-GWQB (J. Schoeppner), w/ attach
NMED-OGC w/out attach
EPA Region 6 (L. King), w/out attach
AFCEE/CMSE (Mr. Oyelowo), w/out attach
Public Info Repository (Central New Mexico), w/ attach
Administrative Record/Information Repository (AR/IR), w/ attach
File, w/ attach

KAFB3896

40 CFR 270.11
DOCUMENT CERTIFICATION
APRIL 2012

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

JOHN C. KUBINEC, Colonel, USAF
Commander, 377th Air Base Wing

This document has been approved for public release.

KIRTLAND AIR FORCE BASE
377 ABW Public Affairs

Shaw Environmental, Inc.

2440 Louisiana Blvd NE, Suite 300
Albuquerque, NM 87110
Phone: 505.262.8928

Shaw®
Shaw Environmental and Infrastructure, Inc.

May 16, 2012

Subject: **Borehole Geophysical Logs, Bulk Fuels Facility Spill**
Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111
17 February 2012 Letter Re: Email of December 14, 2011
Kirtland Air Force Base, New Mexico

This letter is being submitted in response to the New Mexico Environment Department (NMED) letter, dated 17 February 2012 regarding an email delivered to the NMED on 14 December 2011 with a response to comments table included as an attachment. The response to comments table was summarizing Kirtland Air Force Base's (AFB's) response to the 28 September 2011 letter received in regard to the submittal *Replacement Pages, Quarterly Pre-Remedy Monitoring and Site Investigation Report for January – March 2011, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111*, dated May 2011. This letter is in response to the contents of the 17 February 2012 letter, following Shaw's review of relevant data and documents for the Bulk Fuels Facility (BFF) spill site.

The scope and data quality objectives specific to the geophysical borehole logging at Kirtland AFB are included in the following final and approved work plans:

- *Groundwater Investigation Work Plan, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111, March 2011* (Section 4.2.5)
- *Vadose Zone Investigation Work Plan, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111, March 2011* (Section 4.2.3)
- *Interim Measures Work Plan, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111, March 2011 (Section* 4.6.3)

As stated in the above referenced work plans, the ultimate goal of the geophysical borehole logging investigations is to use the data to refine the conceptual site model (CSM) of the potential source location(s) and the extent of light non-aqueous phase liquid (LNAPL) contamination in order to optimize placement of remedial soil vapor extraction (SVE) and groundwater extraction wells and potential future monitoring wells. Additionally, the work plans state that the borehole logging will follow standard industry practices, such as those presented in the ASTM 5753 (*Standard Guide for Planning Borehole Geophysical Logging*), ASTM D6274 (*Standard Guide for Conducting Borehole Geophysical Logging – Gamma*), ASTM D6127 (*Standard Guide for Conducting Borehole Geophysical Logging – Neutron*), and ASTM 6726 (*Standard Guide for Conducting Borehole Geophysical Logging: Electromagnetic Induction*).

The following quality control metric were established in the approved final work plans:

- The after-survey depth error (ASDE) will be 0.2 percent of the total distance the logging tool travels between the start and the end of a logging run, where the tool is referenced to a zero depth at a pre-defined point prior to and at the end of the logging sequence (Section 4.2.5 of the Groundwater Investigation Work Plan);

- All logging equipment will be calibrated in accordance with manufacturer's specifications. "Shop" calibrations will be performed within 30 days of the logging event. Daily calibrations (functionality checks) will be performed prior to and at the conclusion of each day's activities and may occur at a calibration point located within the installation boundaries of Kirtland AFB;

- A minimum of 100 feet of repeat log will be performed after the initial logging of each well.

These quality control steps were completed as defined in all three NMED approved work plans. Additionally, the tools were checked for accurate calibrations and recorded at the start and end of each day. Furthermore, in the 17 February 2012 letter, NMED stated that the Jet West Geophysical Services' (Jet West) induction logs were not calibrated or not calibrated correctly prior to each mobilization. However, "Shop" calibrations were conducted on the induction, neutron, and gamma probes utilized by Jet West prior to each mobilization. The Jet West "shop" calibration logs and pre and post functionality checks were included in Appendix M of the Fourth Quarter 2011 Report and are included with this letter as Attachment A. Daily Quality Control (QC) logs were completed for each logging event by a Shaw representative; these forms were also included in Appendix M of the Fourth Quarter 2011Report and are included with this letter as Attachment B. The calibration documentation demonstrates that the QC requirements of the work plans have been met by Jet West.

NMED expressed additional concern over the validity of the electrical resistivities prepared under the current characterization effort. As standard practice for Jet West's dual induction probe, the deep and medium induction tool is calibrated using two points from known standards before mobilization, 0 and 606 millimhos (mmhos) for the deep induction and 0 and 2005 mmhos for the medium induction. The 606 and 2005 mmhos calibrations are achieved by placing a known standard on the tool itself during "shop" calibration. The 0 mmhos values for both medium and deep induction are normally generated by orienting the induction tool away from all conductive sources. However, Jet West stated that it was physically impossible to isolate the induction tool from nearby conductive sources. Therefore, as their method of correction, Jet West mathematically shifts their 0 mmhos calibration value in order to keep the conductivity measurements above zero and to make the calculated resistivity measurements more consistent with known resistivity values of shale/clays and sandstone/sands. Through past empirical trials, in open uncased boreholes and using the basic equation R=1000/C where R is resistance and C is conductivity, Jet West identified this baseline shift by comparing the measured electric resistivity values with the measured induction resistivity values collected from the same uncased borehole and determined that their induction tool's zero baseline needed to be shifted approximately 58 mmhos, thereby forcing all conductivity measurements above zero (non negative) and generating a shale baseline of approximately 160 mmhos (conductivity), which is equal to 6.25 ohmm (resistivity). After the reinvestigation of Jet West logs, it appears that this shift may be an over correction for a cased hole scenario, thus forcing the resistivity logs to appear anomalously low for all lithologies at the BFF spill site.

After discussions with Jet West regarding NMEDs concerns, Kirtland AFB and its contractors propose to reprocess the induction logs using a control point, KAFB-10624. Electrical resistivities (64 inch normal and 16 inch normal) obtained from an open borehole (KAFB-10624) by Jet West in 2009 will be used to adjust the dual induction calibrations obtained by Jet West in 2011 to emulate the electric log readings. More specifically, Shaw and Jet West propose to reprocess the logs for qualitative purposes by:

- Picking two points on the control electrical resistivity log (KAFB-10624) to represent SAND and CLAY lines. The SAND line chosen is the saturated sand at 445 feet = 100 ohmm for 64" Normal, 116 ohmm for 16" Normal resistivities. The CLAY line chosen is the clay at 123 feet = 10 ohmm for both 64" Normal and16" Normal resistivities.

- Adjusted Slope and Intercept of originally generated Deep and Medium Induction curves to match the SAND & CLAY line responses.

This proposed approach will resolve the order of magnitude difference in the electrical resistivities of silty and sandy units and clearly differentiate the lithology break between the silty upper "Unit A" and the underlying, coarser "Unit B". Four examples of the reprocessed logs (KAFB-10624, KAFB-106045, KAFB-106081, and KAFB-106118) using this approach are provided in Attachment C. In addition, a comparison file is provided in Attachment D that plots the electric logs obtained in 2009 (open hole) against the induction logs obtained in 2011 (cased) for KAFB-10624. If NMED approves the proposed approach, then all induction logs that were obtained by Jet West in 2011 will be reprocessed.

All wells drilled for the Kirtland BFF spill site in 2010 and 2011 were geophysically logged after well materials were installed. Consequently, the use of induction data (or any geophysical logs) for a quantitative investigation is not appropriate as there is no industry standard for processing the data for quantitative applications. In order to process the data for quantitative purposes, many factors must be accounted for such as: the PVC casing and differences in the well diameters across the site, the annular space of each borehole, the placement of multiple borehole centralizers in each borehole, different annular fill materials in each borehole across the site, known washed out areas, etc. Currently, there is no industry standard/model that can correct for all the inherent factors attributed to geophysically logging in PVC cased wells. Therefore, geophysical data collected for the Kirtland BFF spill site, including the induction logs, cannot be used quantitative analysis or be used to calculate hydraulic properties such as porosity and hydraulic conductivity. However, the project has an extensive dataset of site-specific hydraulic conductivity, porosity, and grain size analysis associated with site characterization activities: slug tests, laboratory analysis of bucket samples for porosity, grain size, hydraulic conductivity, and permeability, radius of influence tests, and lithology logs. This data is essential to the development of the site CSM and to fully characterize physical conditions across the site. Additionally, the above listed data, in combination with the qualitative evaluation of the geophysical logs, are in compliance with the final and approved work plans and the over-arching objective of refining the conceptual site model.

Kirtland AFB and Shaw's position is that all geophysical logs collected by Jet West in 2011 meet the objectives of the final and approved work plan and that all data quality objectives have been met. The logs are valid for qualitative analysis only and useful for identifying major lithologic contacts and saturated zones, as needed to inform the conceptual site model. The geophysical log data is secondary to the large dataset that exists of quantitative measurements of hydraulic conductivity (38 wells), porosity and grain size (68 wells), and lithology (all wells). As stated in the response to comments submitted on 14 December 2011, "shop" calibrations and field functionality checks were performed and calibration records are attached demonstrating that Kirtland AFB completed and fulfilled the work plan objective of collecting calibrated geophysical logs. Moreover, Kirtland AFB and Shaw do not deem it necessary to repeat the geophysical logging of the wells as directed in the 17 February 2012 letter as the final result of the geophysical reinvestigation will be identical to the 2011 logging events.

If NMED does not agree with the proposed approach, Kirtland AFB and Shaw requires examples of calibrated, quantitative geophysical logs that were acquired from cased wells and that were used quantitatively to calculate hydraulic parameters across a given site that is similar to Kirtland AFB. In addition, if NMED requires Kirtland AFB to geophysically relog all wells, then NMED must provide clearly stated directions and improvements such that the aforementioned work plans can be amended.

ATTACHMENT A

ATTACHMENT B

ATTACHMENT C

JET WEST GEOPHYSICAL SERVICES, LLC.

State Plane 1927
Northing: 1473519.6961
Easting: 1541587.5621

COMPANY	SHAW ENVIRONMENTAL/KAFB-BFF, PROJECT #140705
WELL ID	KAFB-10624
FIELD	KAFB-BFF
COUNTY	Bernalillo STATE New Mexico

TYPE OF LOG: **Dual Induction, Gamma Ray Neutron**

OTHER SERVICES

LOCATION

SEC TWP RGE API No.

ERMANENT DATUM	Ground Level	ELEVATION	5343.68	K.B.
OG MEAS. FROM	Ground Level	ABOVE PERM. DATUM		T.O.C
RILLING MEAS. FROM	Ground Level			G.L.

ATE	March 22, 2011	TYPE FLUID IN HOLE	Formation water
UN No.	one	SALINITY	
YPE LOG	DIL-45, QL-Neutron	DENSITY	
EPTH DRILLER	511 ft.	LEVEL	486 ft.
EPTH LOGGER	511.6 ft.	MAX. REG. TEMP	
TM LOGGED INTERVAL	511.6 ft.	DIGITIZE INTERVAL	0.1 ft.
OP LOGGED INTERVAL	Surface	DEPTH ERROR INDUCTION	
PERATING RIG TIME		DEPTH ERROR NEUTRON	
ECORDED BY	D. Walker/M.Peterson		
ITNESSED BY	D. Castaneda		

UN	BOREHOLE RECORD			CASING RECORD			
O.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
	11 3/4 in.	0 ft.	200 ft.	in.		0 ft.	ft.
	10 in.	200 ft.	511 ft.	4 in.	PVC	0 ft.	511.6 ft.

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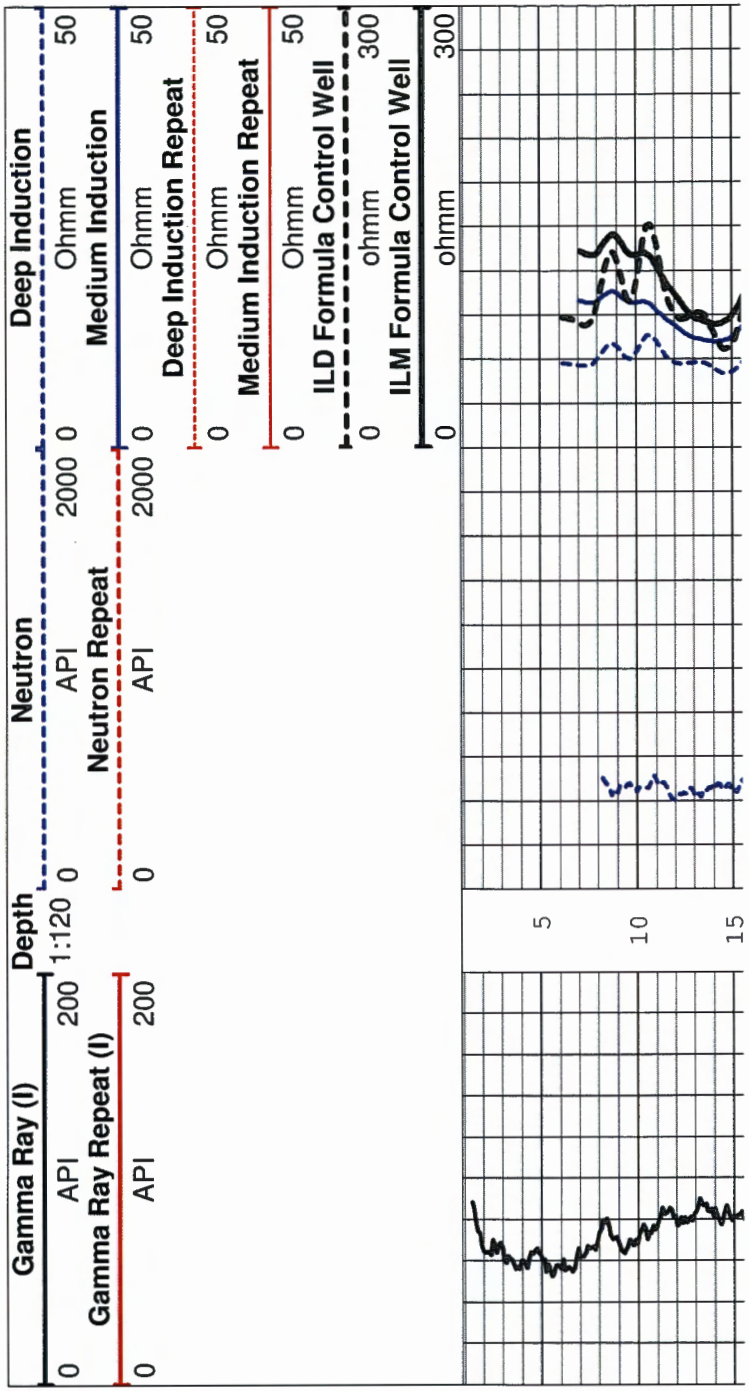

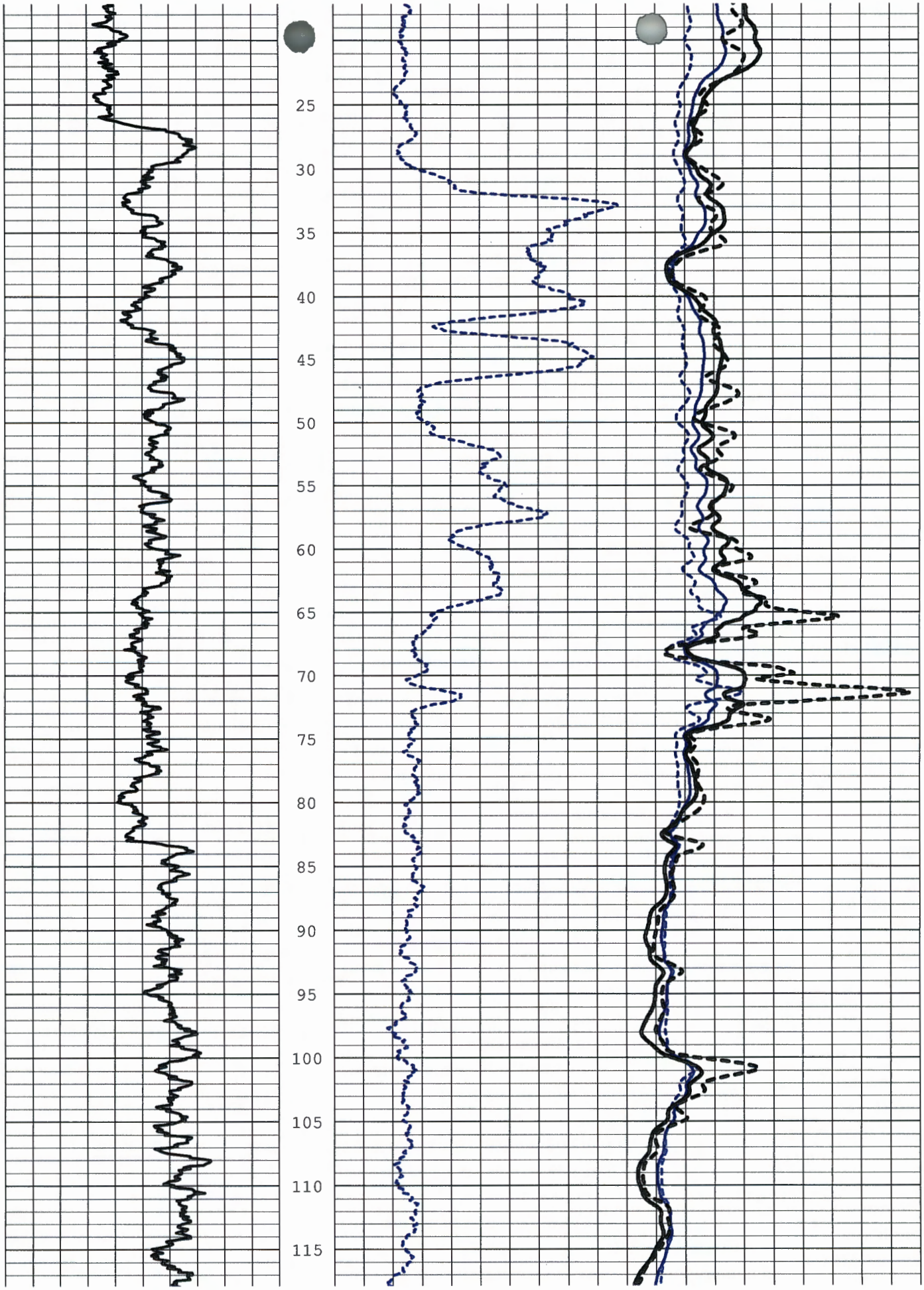
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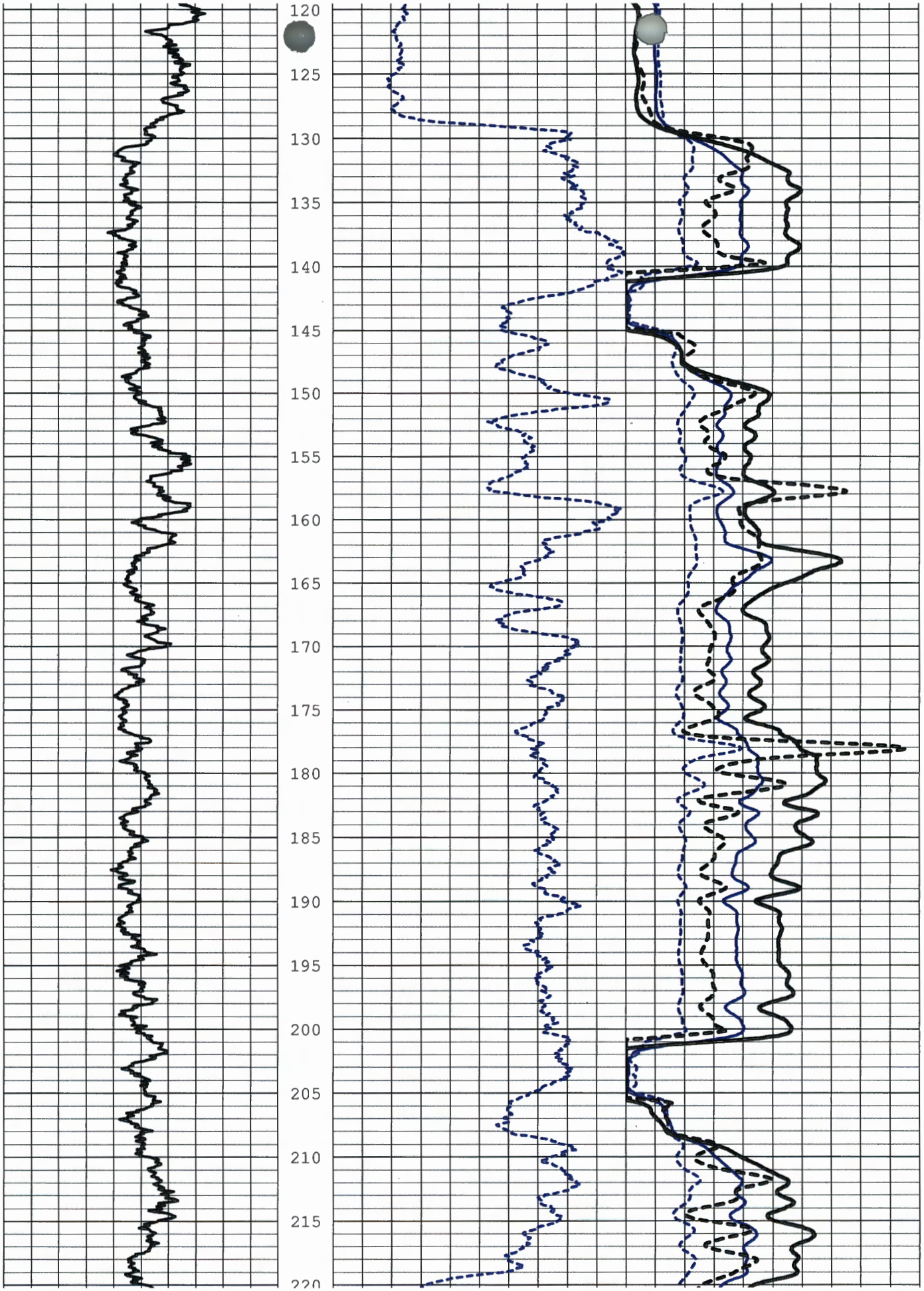
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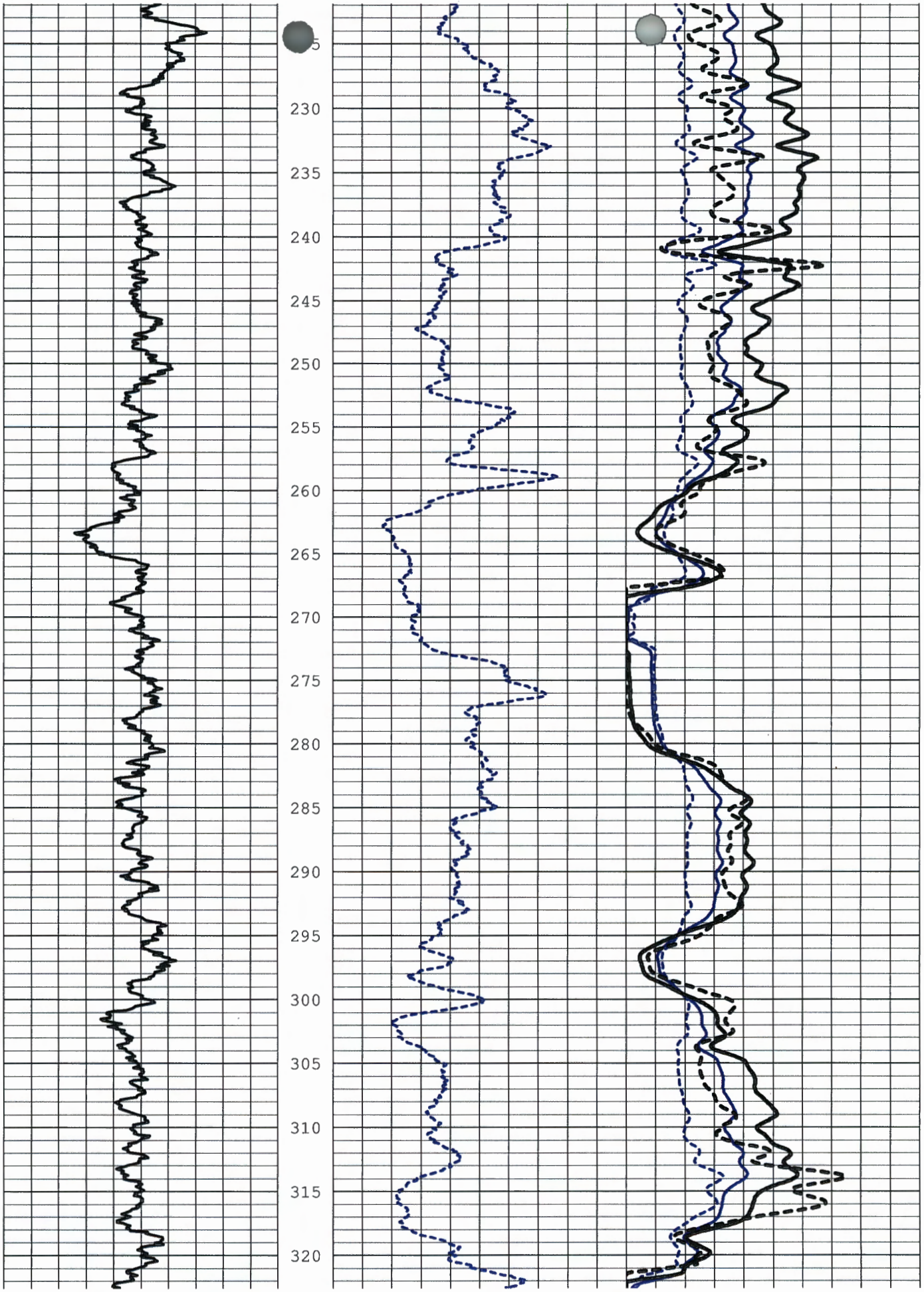
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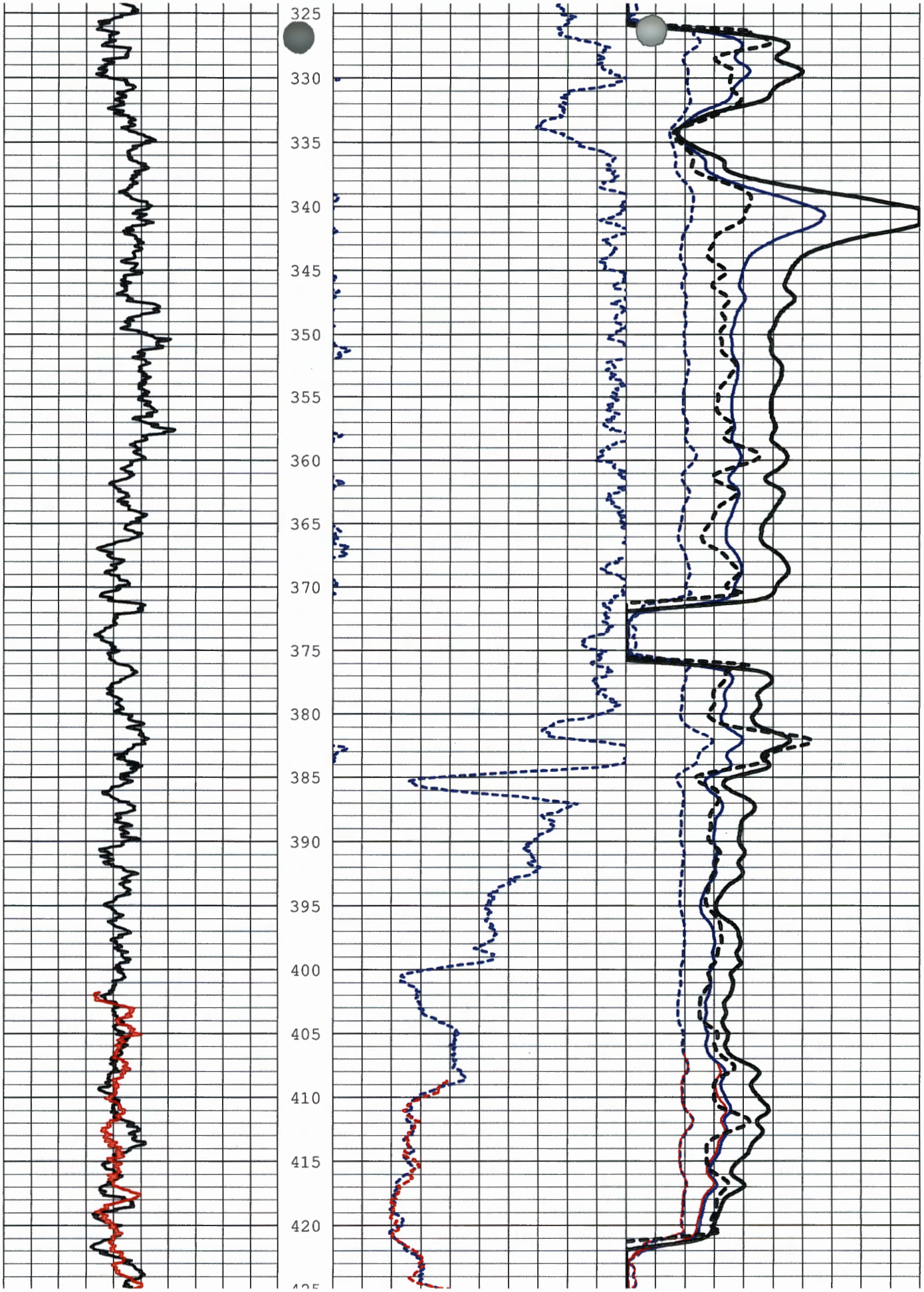
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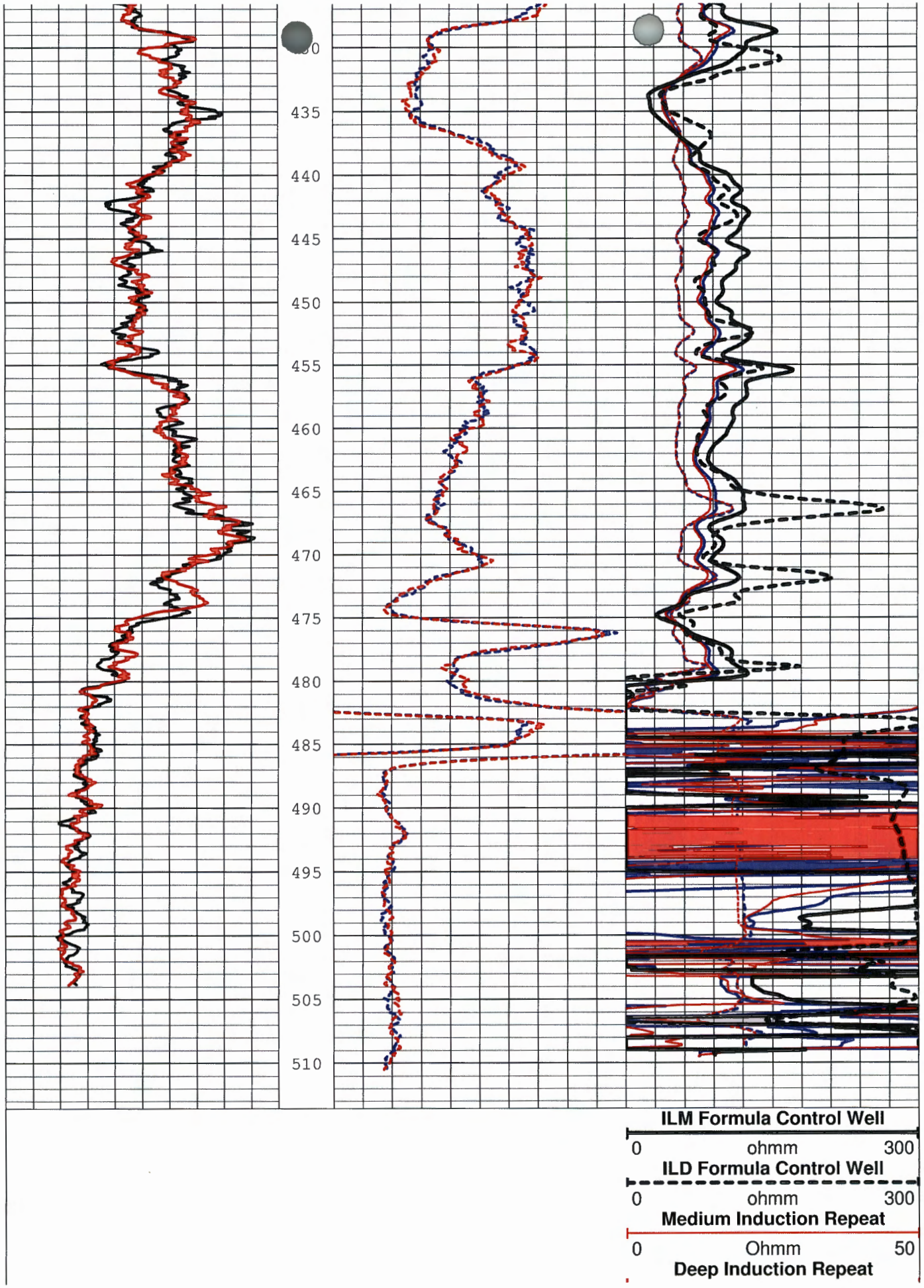
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ILM Formula Control Well
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ILD Formula Control Well
0 ohmm 300
Medium Induction Repeat
0 Ohmm 50
Deep Induction Repeat

Gamma Ray Repeat (I)			Neutron Repeat			Medium Induction		
0	API	200	0	API	2000	0	Ohmm	50
Gamma Ray (I)			Neutron			Deep Induction		
0	API	200	0	API	2000	0	Ohmm	50

Depth 1:120

JET WEST
GEOPHYSICAL SERVICES, LLC.

State Plane 1927
Northing: 1472400.6491
Easting: 1541417.9611

COMPANY	SHAW ENVIRONMENTAL/KAFB-BFF, PROJECT #140705
WELL ID	KAFB-106045
FIELD	KAFB-BFF
COUNTY	Bernalillo STATE New Mexico

TYPE OF LOG: **Dual Induction, Gamma Ray Neutron**

OTHER SERVICES

LOCATION

SEC TWP RGE API No.

ERMANENT DATUM	Ground Level	ELEVATION	5348.48	K.B.
OG MEAS. FROM	Ground Level	ABOVE PERM. DATUM		T.O.C
RILLING MEAS. FROM	Ground Level			G.L.

ATE	March 21, 2011	TYPE FLUID IN HOLE	Formation water
UN No.	one	SALINITY	
YPE LOG	DIL-45, QL-Neutron	DENSITY	
EPTH-DRILLER	540 ft.	LEVEL	486 ft.
EPTH-LOGGER	524.3 ft.	MAX. REG. TEMP	
TM LOGGED INTERVAL	524.3 ft.	DIGITIZE INTERVAL	0.1 ft.
OP LOGGED INTERVAL	Surface	DEPTH ERROR INDUCTION	0.47 ft.
PERATING RIG TIME		DEPTH ERROR NEUTRON	0.34 ft.
ECORDED BY	D. Walker/M.Peterson		
ITNESSED BY	D. Castaneda		

UN	BOREHOLE RECORD			CASING RECORD			
O.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
	11 3/4 in.	0 ft.	240 ft.	in.		0 ft.	ft.
	9 5/8 in.	240 ft.	540 ft.	5 in.	PVC	-2.96 ft.	524.3 ft.

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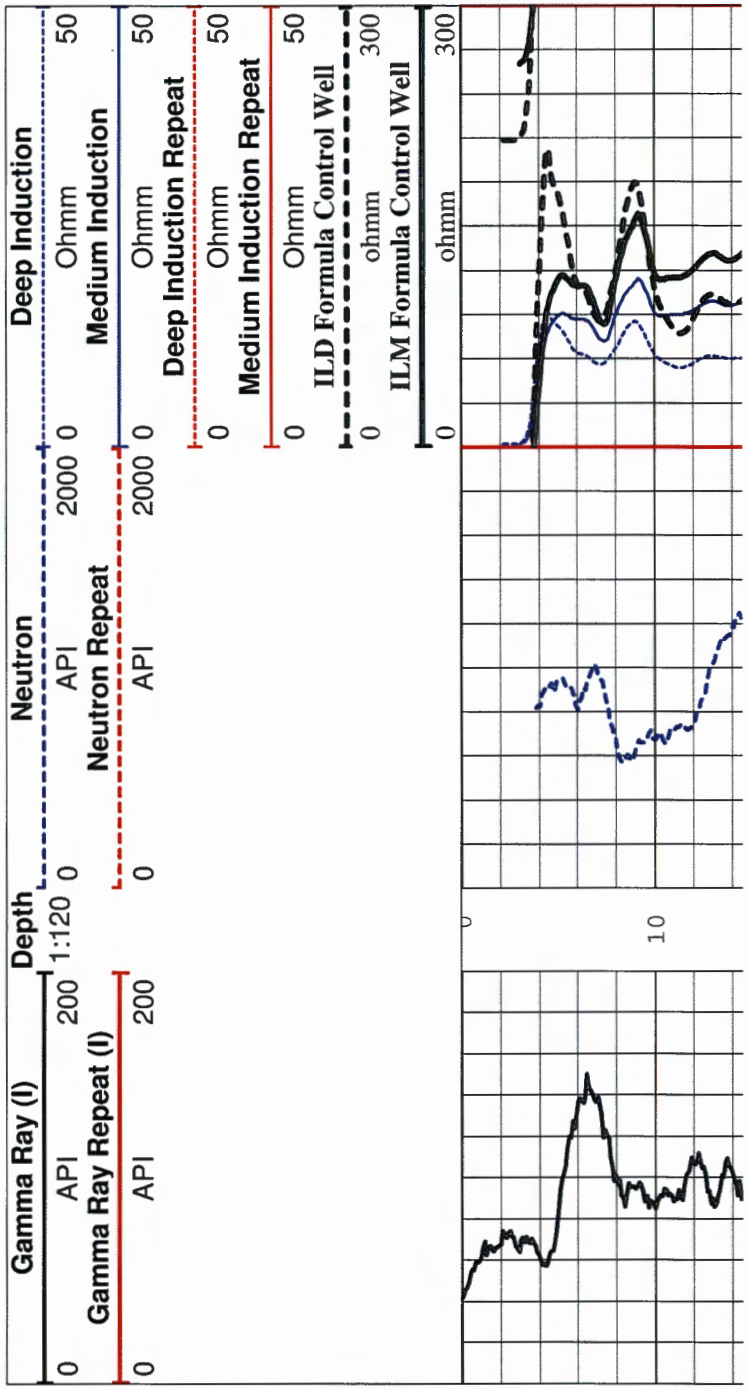

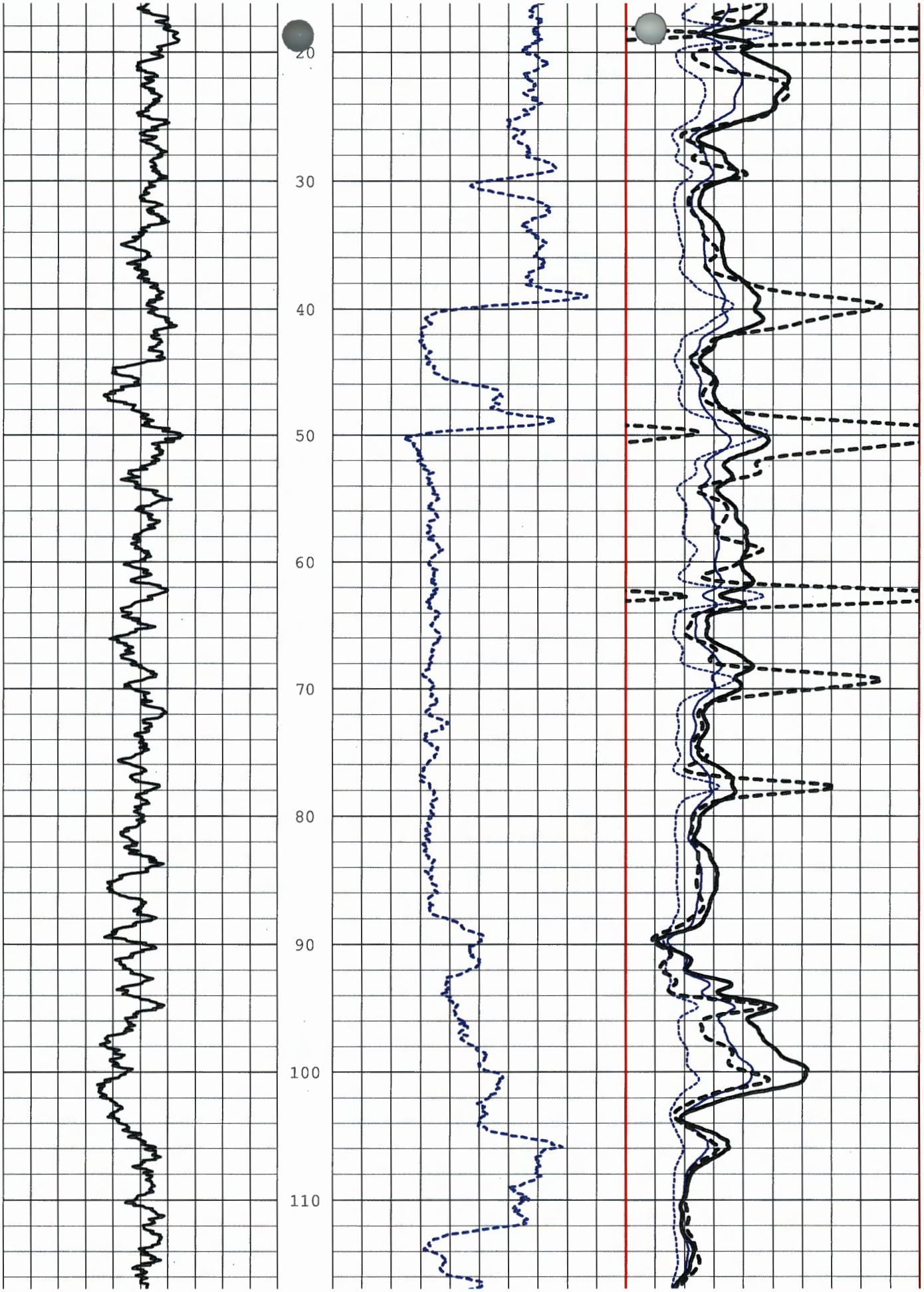
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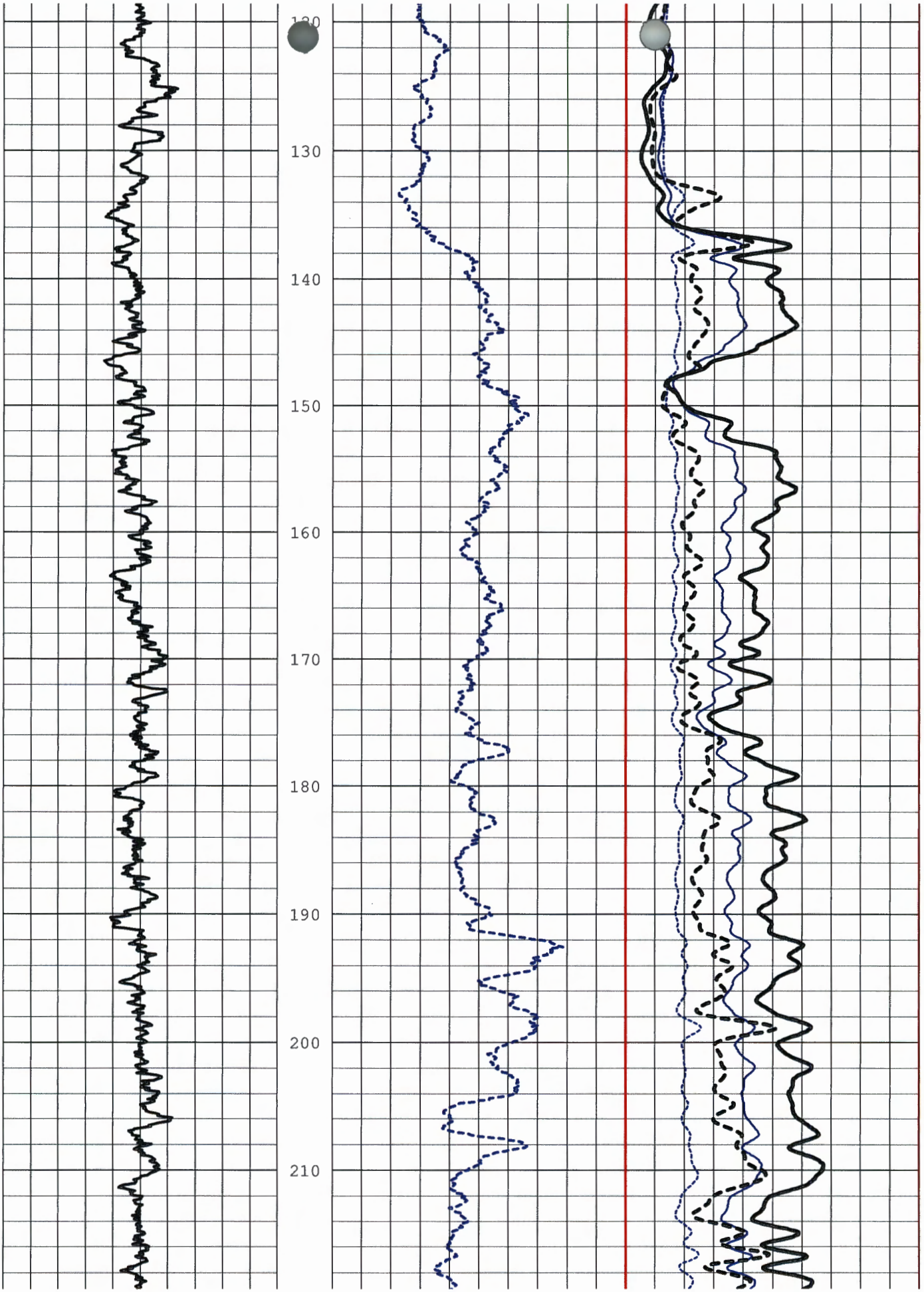
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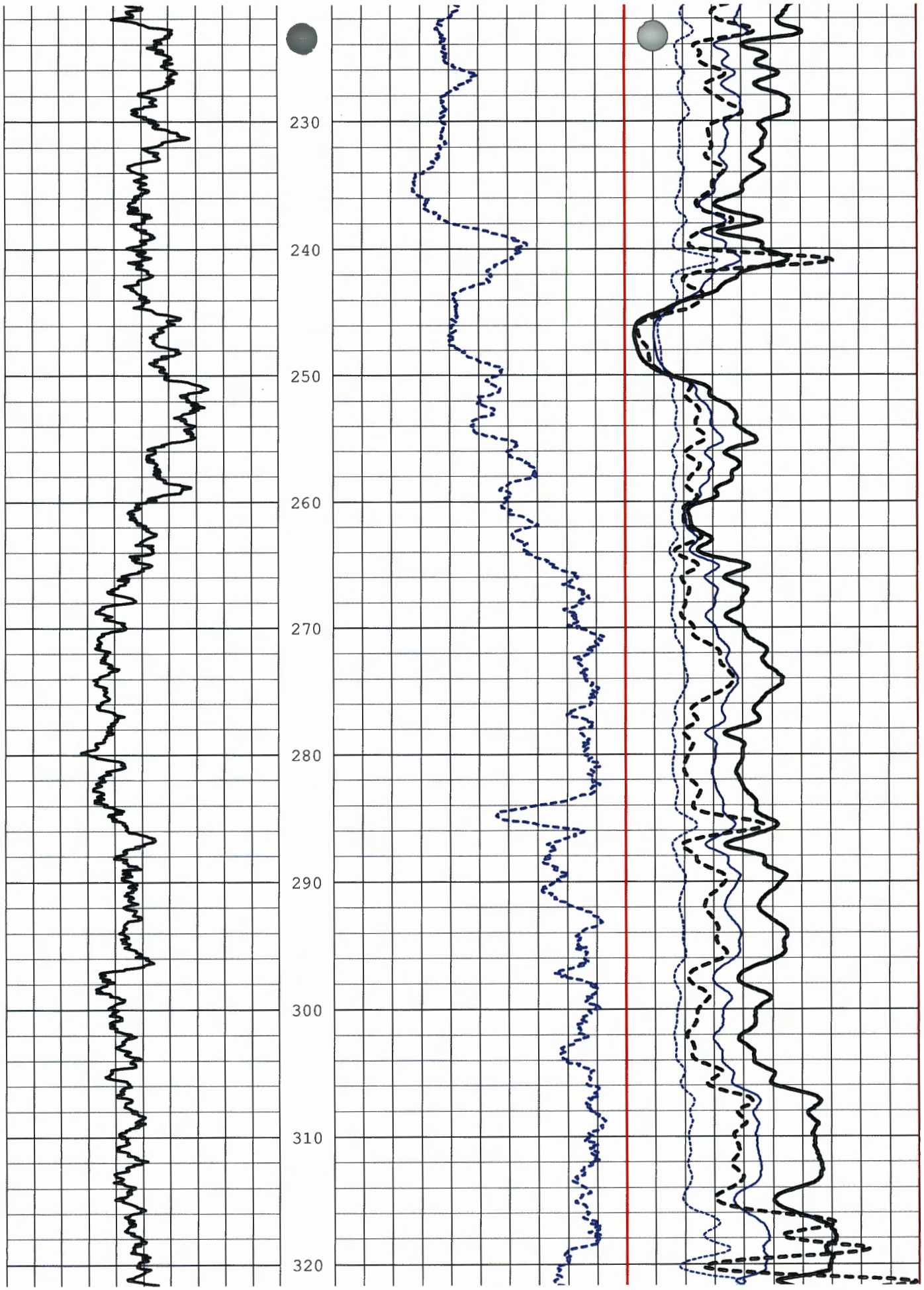
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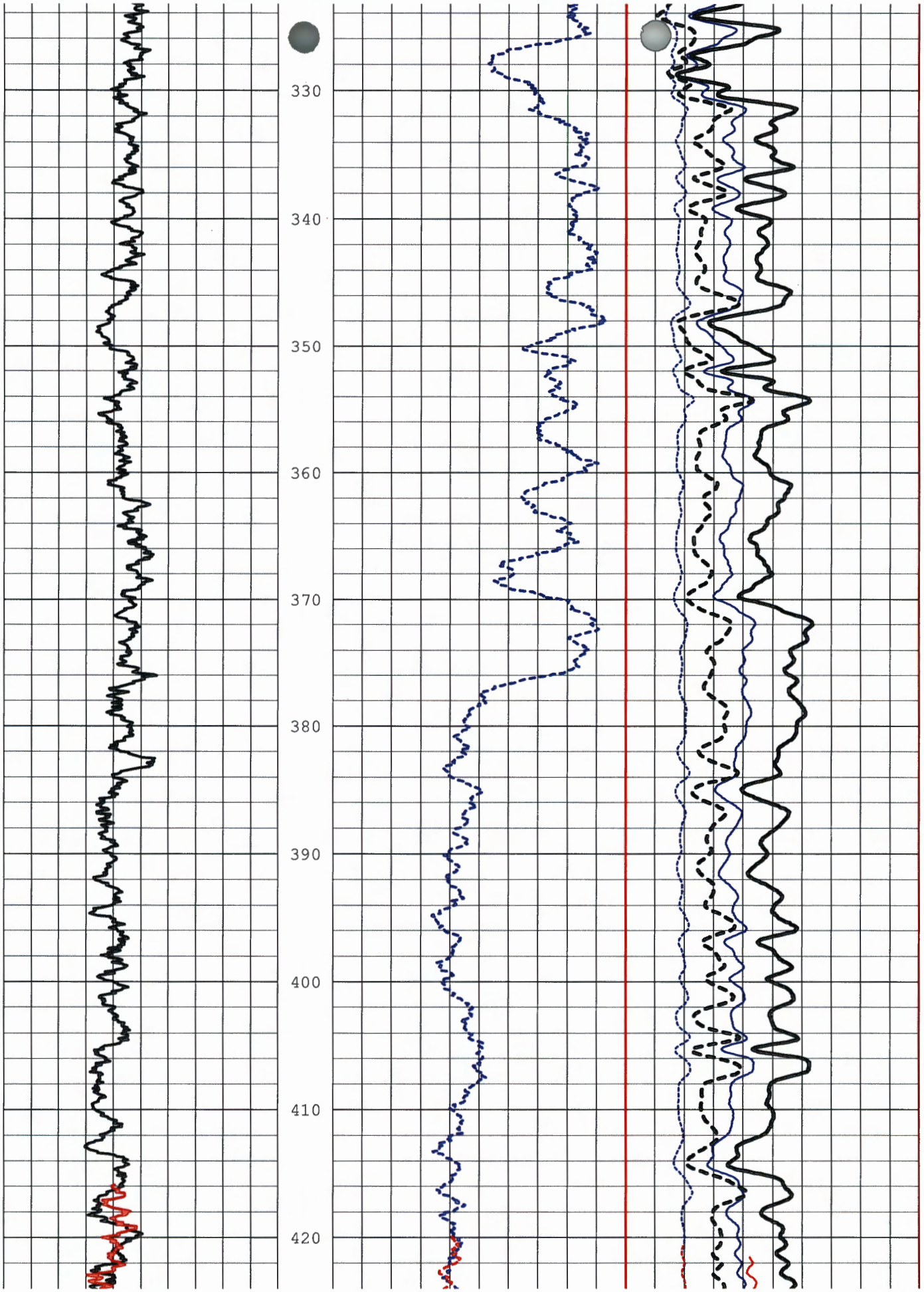
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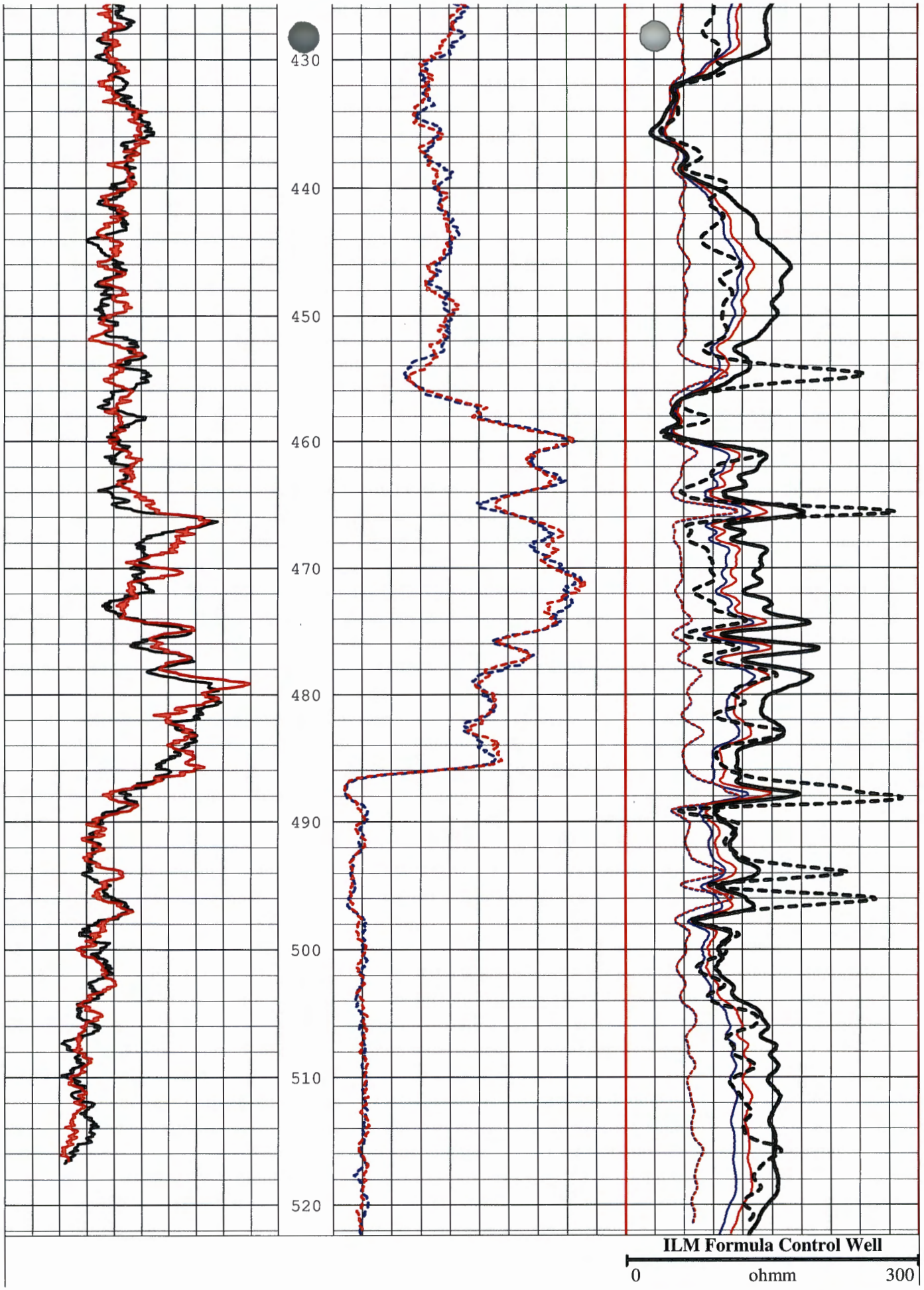
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ILM Formula Control Well
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						0	ohmm	300
							Medium Induction Repeat	
						0	Ohmm	50
							Deep Induction Repeat	
						0	Ohmm	50
	Gamma Ray Repeat (I)			Neutron Repeat			Medium Induction	
0	API	200		0	API	2000	0 Ohmm	50
	Gamma Ray (I)		Depth	Neutron			Deep Induction	
0	API	200	1:120	0	API	2000	0 Ohmm	50

JET WEST
GEOPHYSICAL SERVICES, LLC.

State Plane 1927
Northing: 1474076.871
Easting: 1542190.575

COMPANY	SHAW ENVIRONMENTAL/KAFB-BFF, PROJECT #140705
WELL ID	KAFB-106081
FIELD	KAFB-BFF
COUNTY	Bernalillo STATE New Mexico
TYPE OF LOG:	**Dual Induction, Gamma Ray Neutron**
OTHER SERVICES	
LOCATION	
SEC TWP RGE	API No.

ERMANENT DATUM	Ground Level	ELEVATION	5349.47	K.B.
OG MEAS. FROM	Ground Level	ABOVE PERM. DATUM		T.O.C
RILLING MEAS. FROM	Ground Level			G.L.

ATE	April 28, 2011	TYPE FLUID IN HOLE	Formation water
UN No.	one	SALINITY	
YPE LOG	DIL-45, QL-Neutron	DENSITY	
EPTH DRILLER	595 ft.	LEVEL	490 ft.
EPTH LOGGER	594.33 ft.	MAX. REG. TEMP	
TM LOGGED INTERVAL	594.33 ft.	DIGITIZE INTERVAL	0.1 ft.
OP LOGGED INTERVAL	Surface	DEPTH ERROR INDUCTION	0.35 ft.
PERATING RIG TIME		DEPTH ERROR NEUTRON	0.40 ft.
ECORDED BY	D. Walker		
ITNESSED BY	D. Castaneda		

UN	BOREHOLE RECORD			CASING RECORD			
O.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
	11 3/4 in.	0 ft.	200 ft.	in.		0 ft.	ft.
	9 5/8 in.	200 ft.	595 ft.	5 in.	PVC	-2.96 ft.	594.33 ft.

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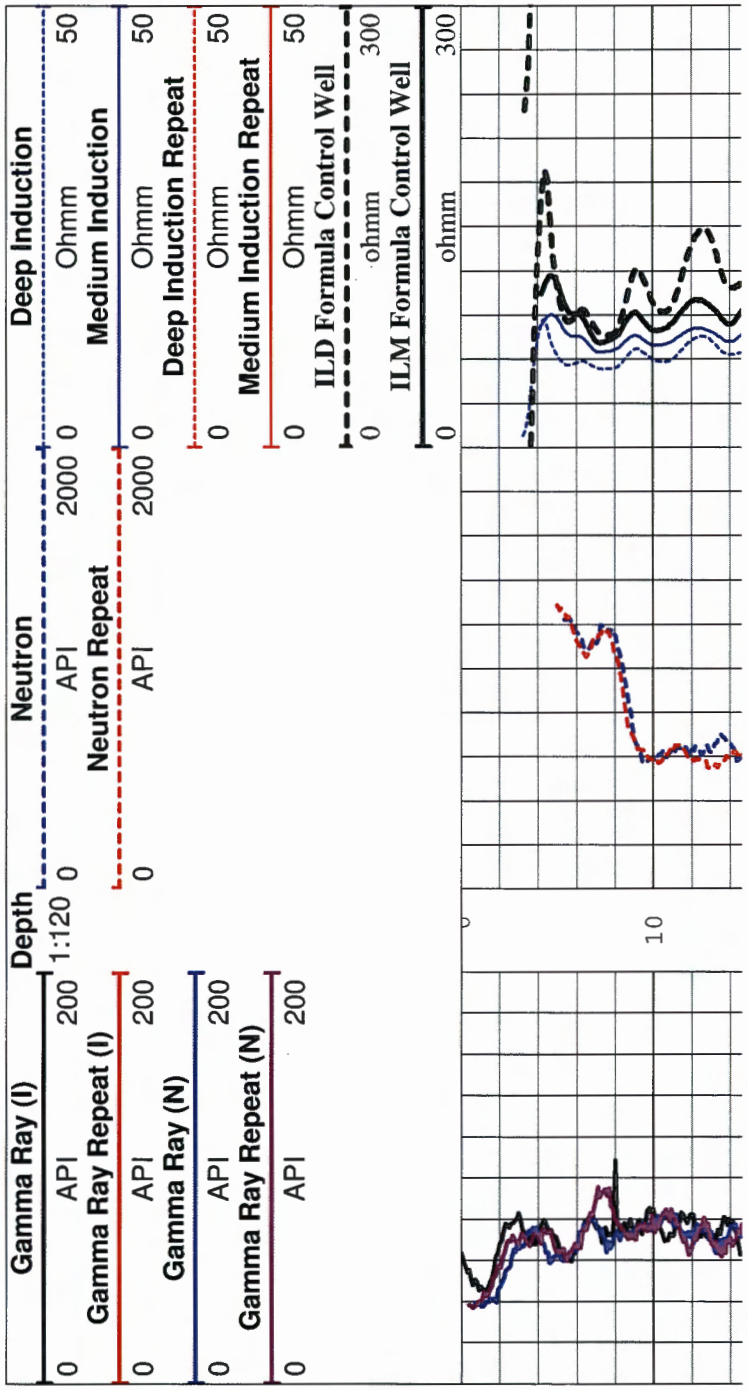

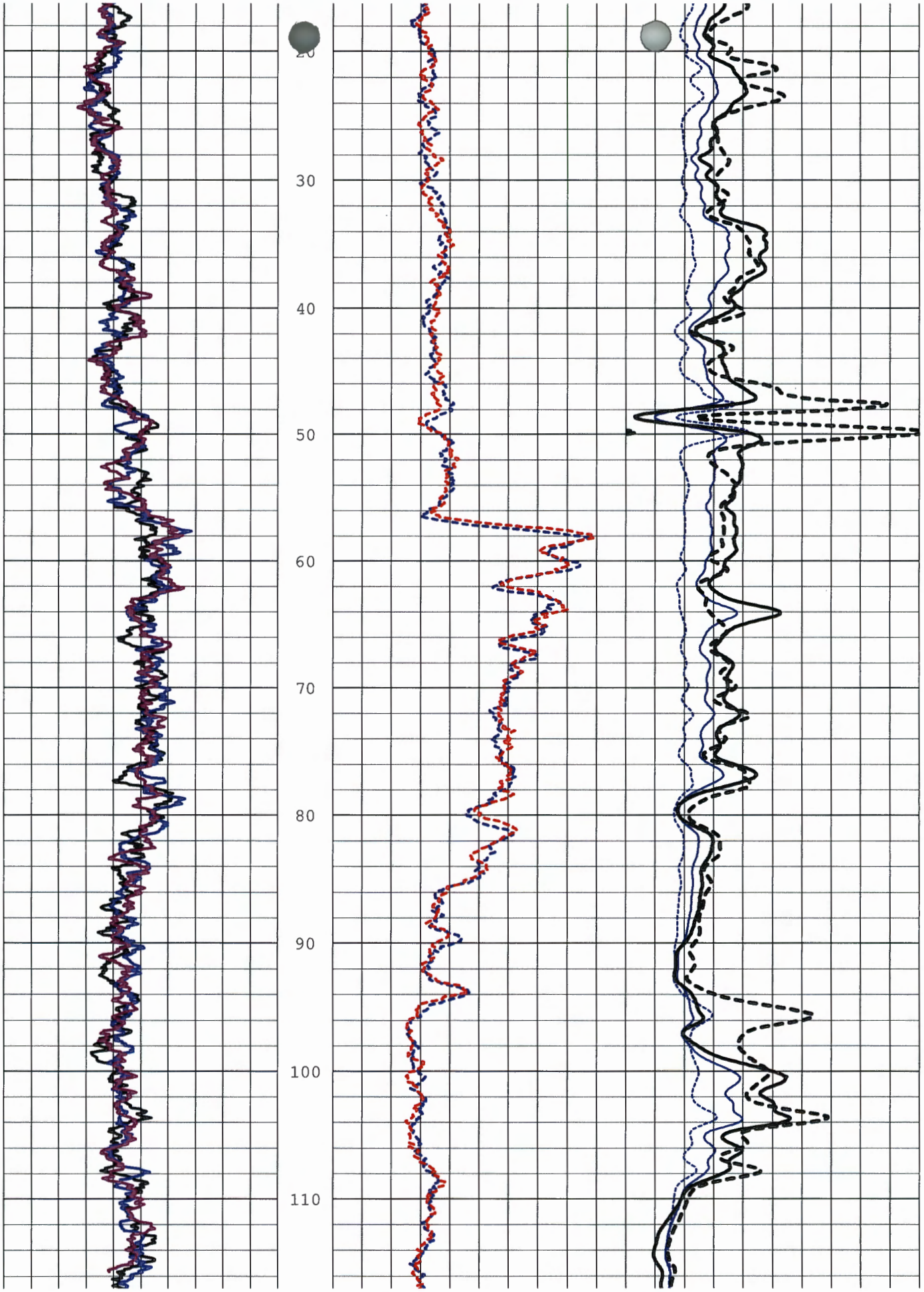
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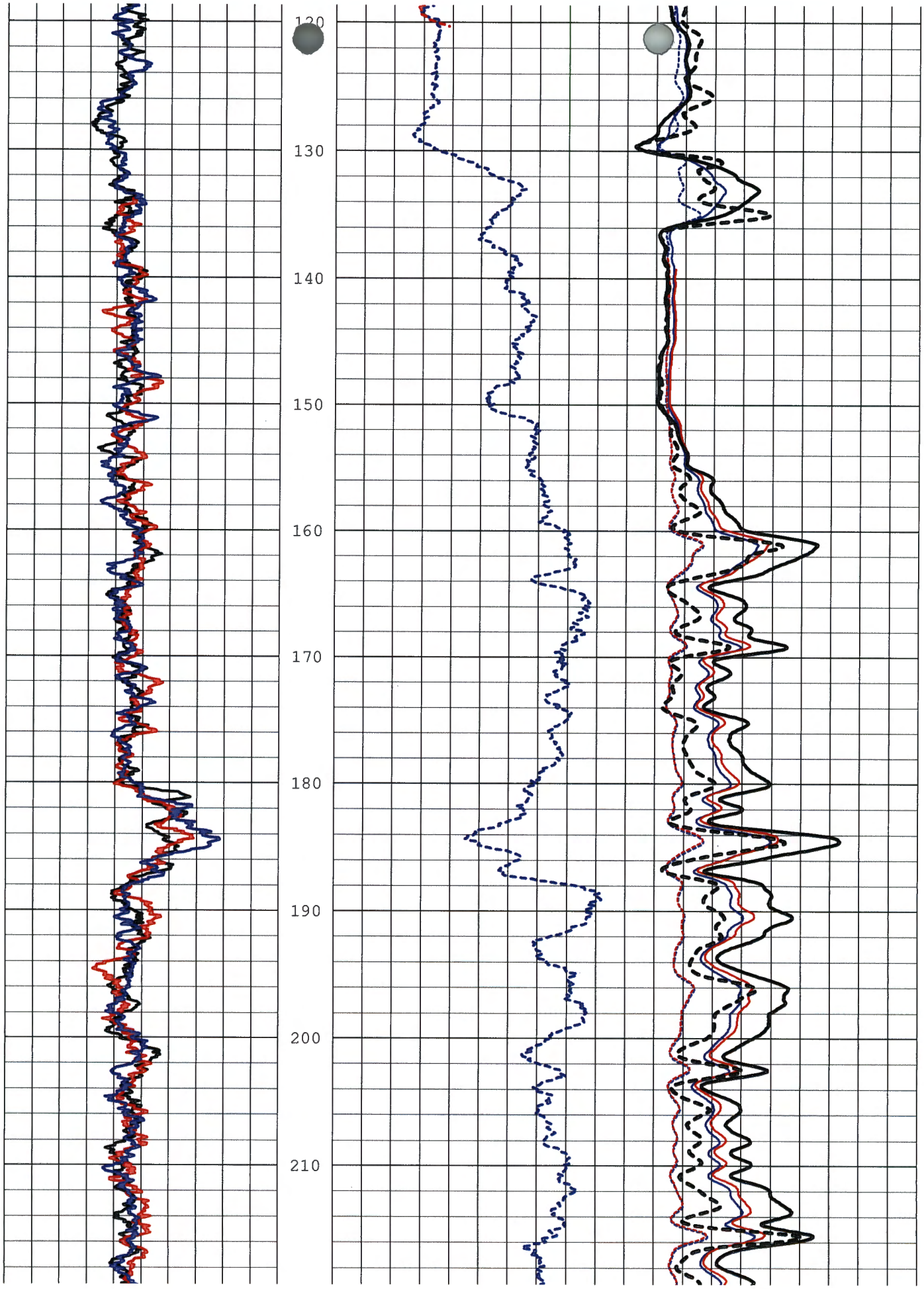
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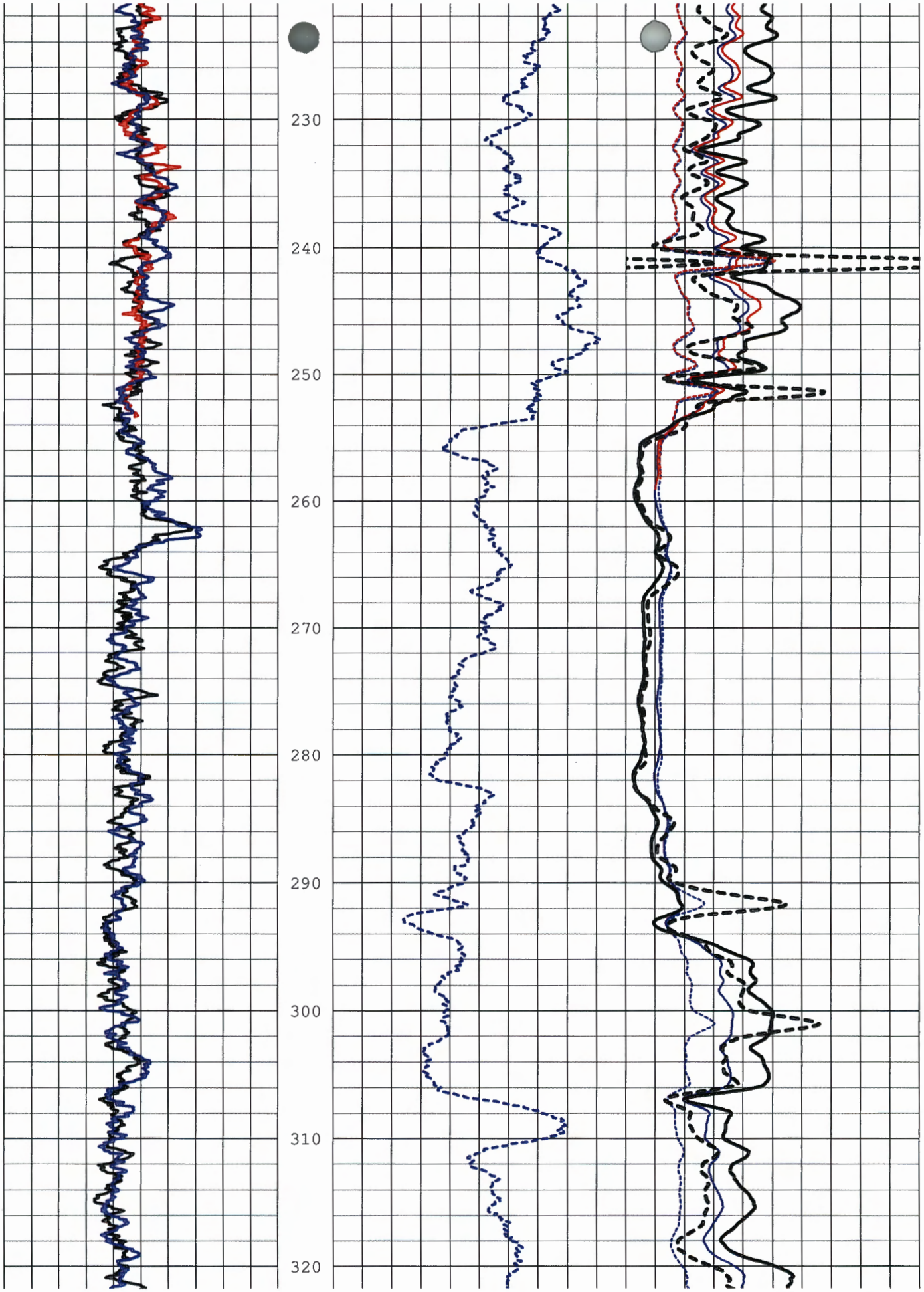
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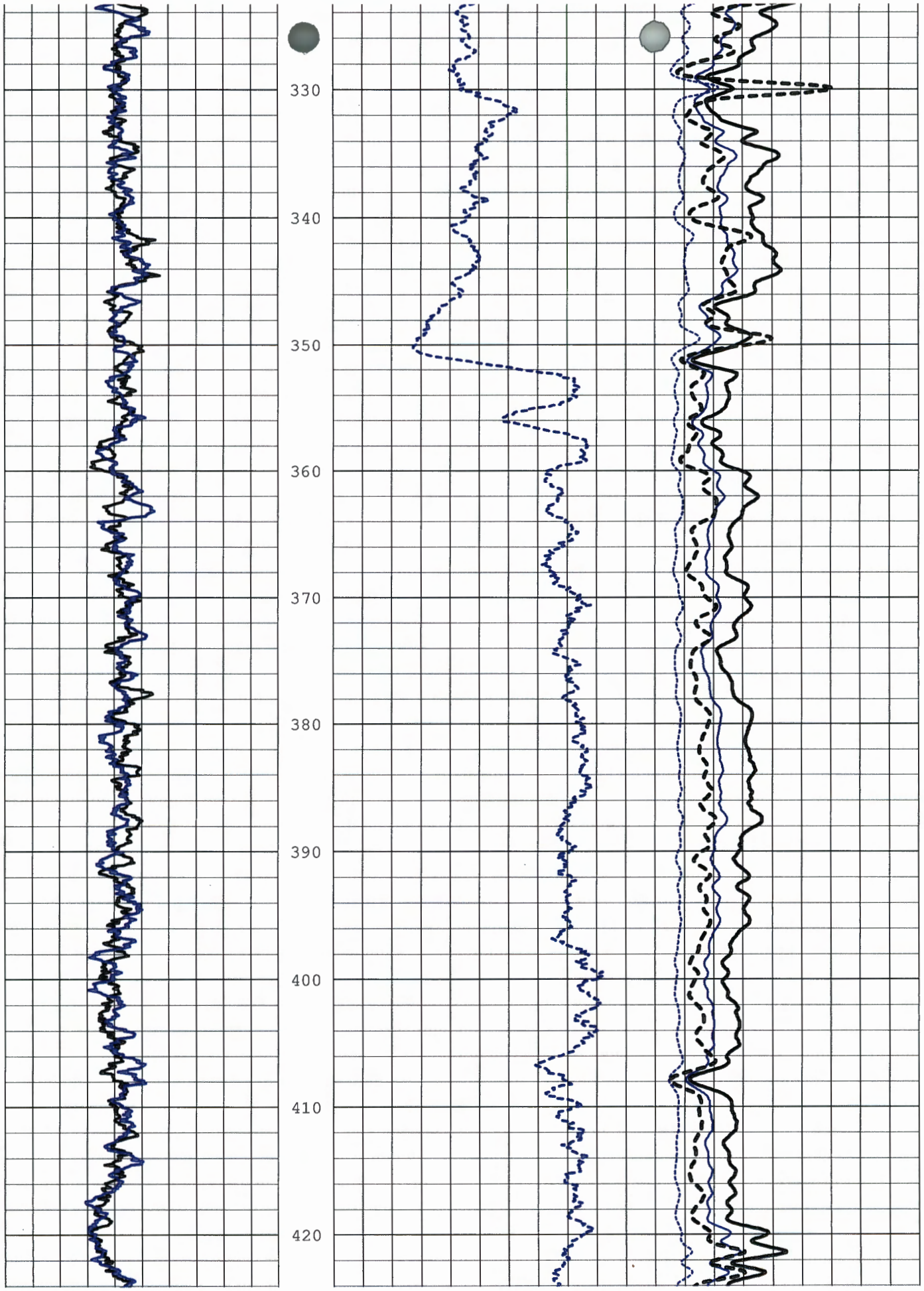
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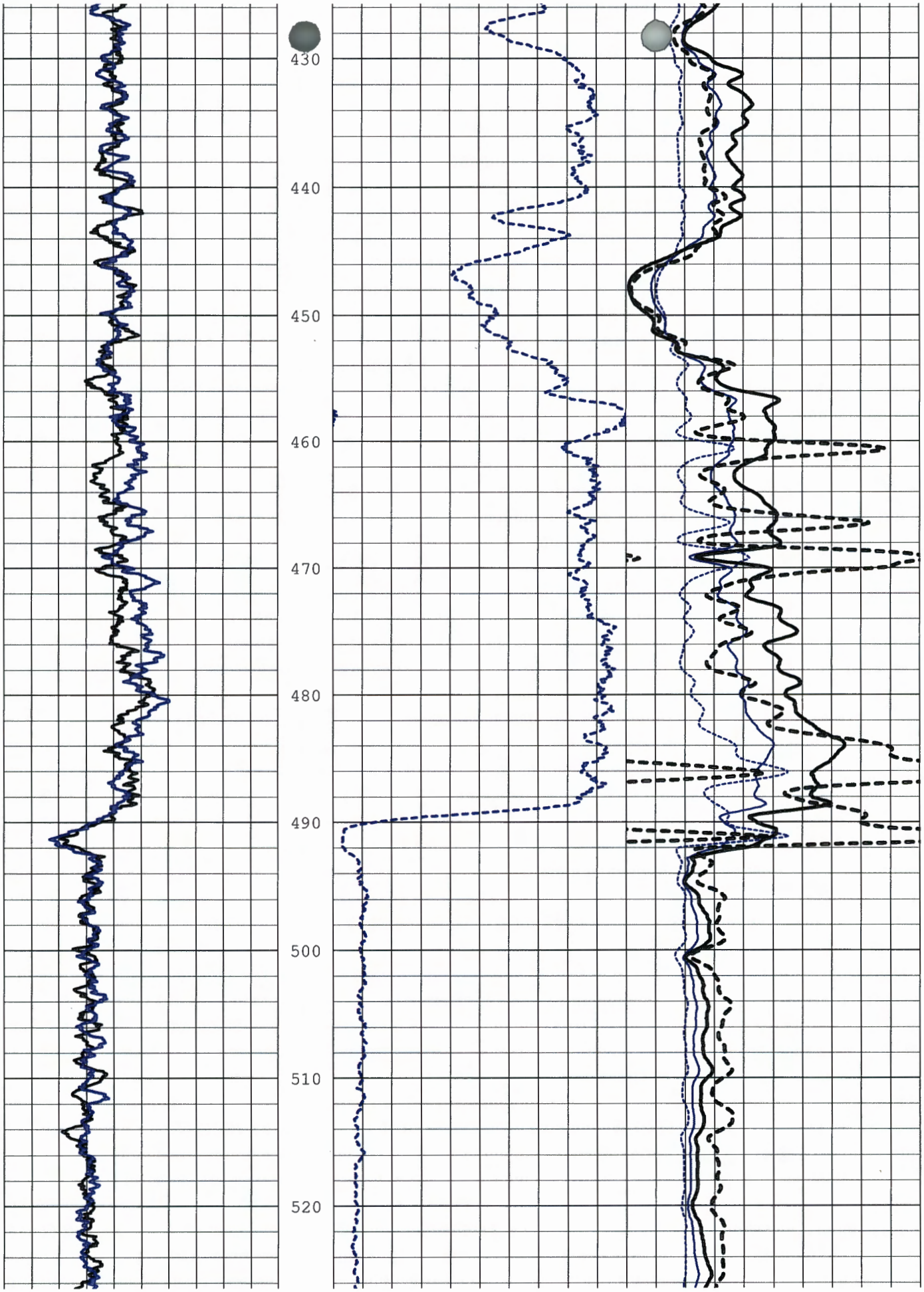
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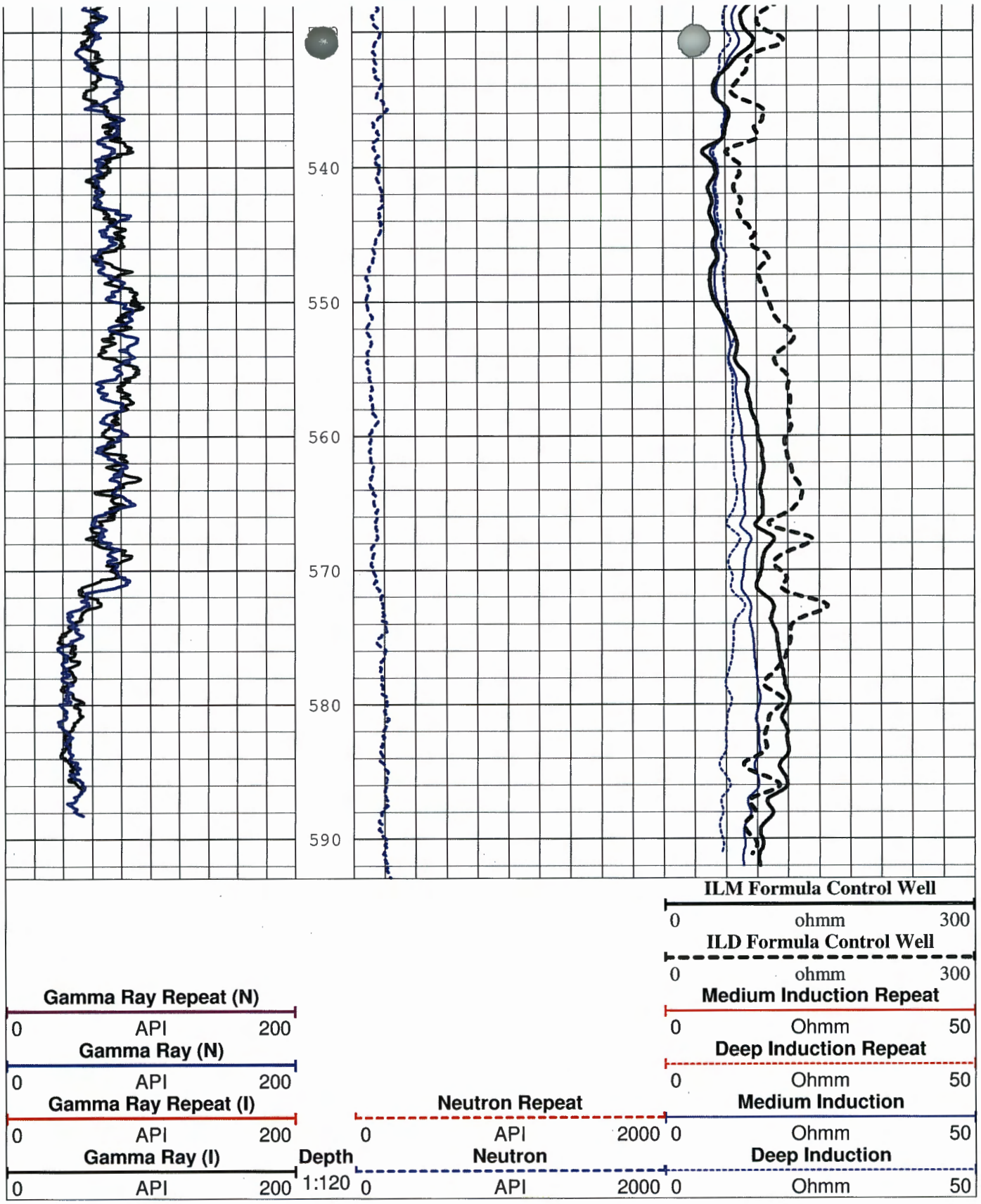
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0 API 200
Gamma Ray (I)
0 API 200
Neutron Repeat
0 API 2000
Neutron
0 API 2000
Depth
1:120

JET WEST
GEOPHYSICAL SERVICES, LLC.

State Plane 1927
Northing: 1473741.3354
Easting: 1541791.6408

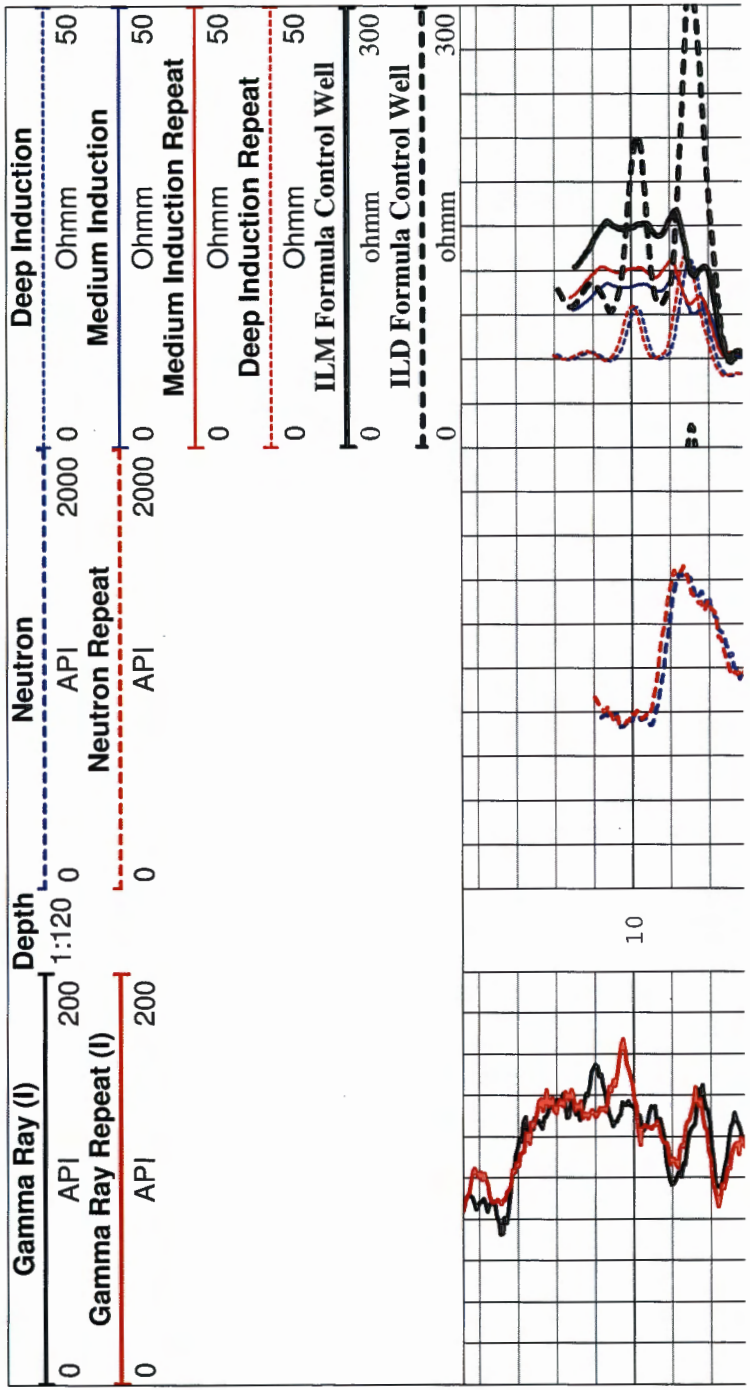
COMPANY	SHAW ENVIRONMENTAL/KAFB-BFF, PROJECT #140705
WELL ID	KAFB-106118
FIELD	KAFB-BFF
COUNTY	Bernalillo STATE New Mexico
TYPE OF LOG:	**Dual Induction, Gamma Ray Neutron**
OTHER SERVICES	
LOCATION	
SEC TWP RGE	API No.

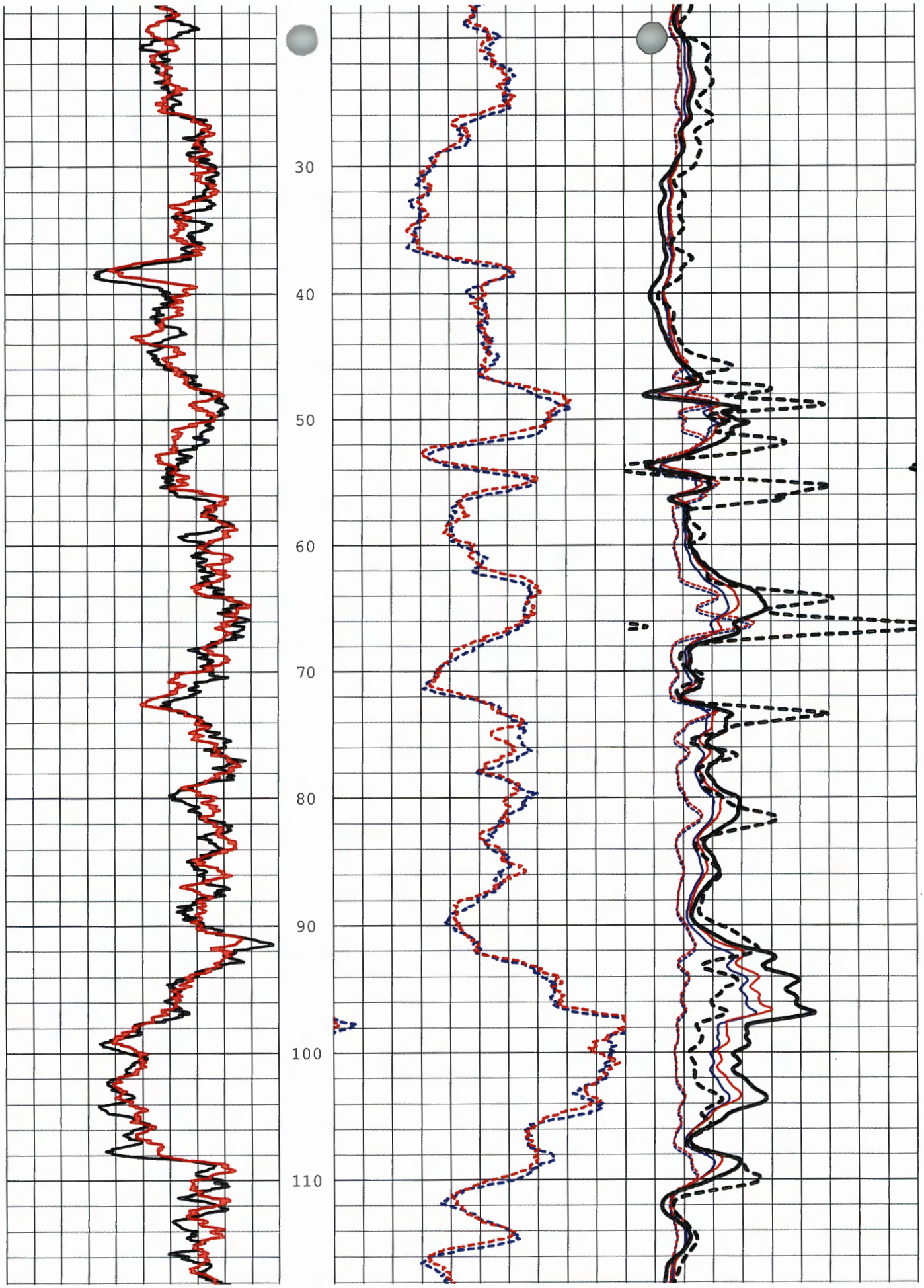
ERMANENT DATUM	Ground Level	ELEVATION	5345.89	K.B.
OG MEAS. FROM	Ground Level	ABOVE PERM. DATUM		T.O.C
RILLING MEAS. FROM	Ground Level			G.L.

ATE	March 25, 2011	TYPE FLUID IN HOLE	
UN No.	one	SALINITY	
YPE LOG	DIL-45, QL-Neutron	DENSITY	
EPTH DRILLER	459.1 ft.	LEVEL	
EPTH LOGGER	450.55 ft.	MAX. REG. TEMP	
TM LOGGED INTERVAL	450.55 ft.	DIGITIZE INTERVAL	0.1 ft.
OP LOGGED INTERVAL	Surface	DEPTH ERROR INDUCTION	0.34 ft.
PERATING RIG TIME		DEPTH ERROR NEUTRON	0.39 ft.
ECORDED BY	D. Walker		
ITNESSED BY	D. Castaneda		

UN	BOREHOLE RECORD			CASING RECORD			
O.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
	11 3/4 in.	0 ft.	120 ft.	in.		0 ft.	ft.
	9 5/8 in.	120 ft.	459.1 ft.	3 in.	PVC	0 ft.	450.55 ft.

EMARKS: FIELD COPY

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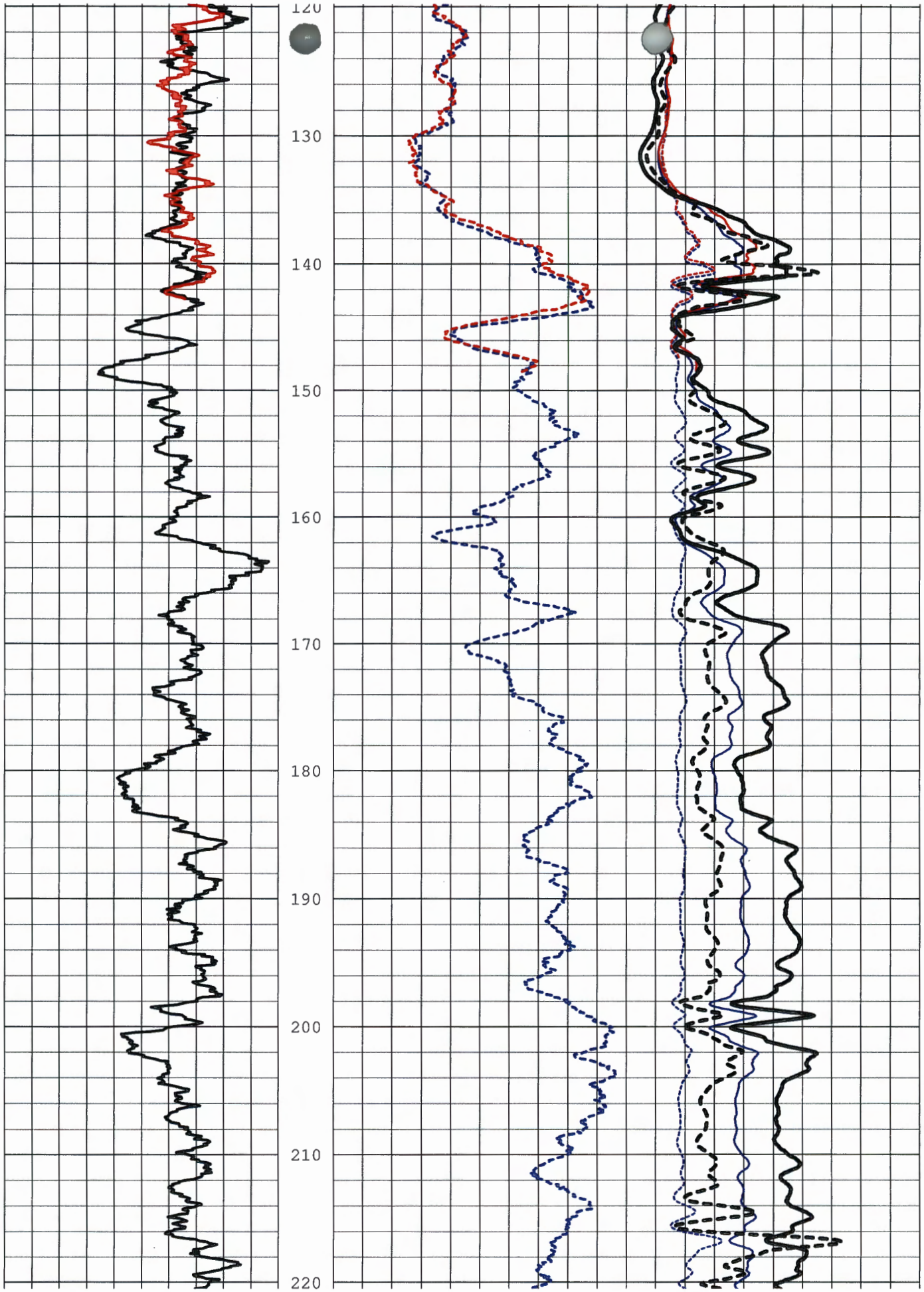
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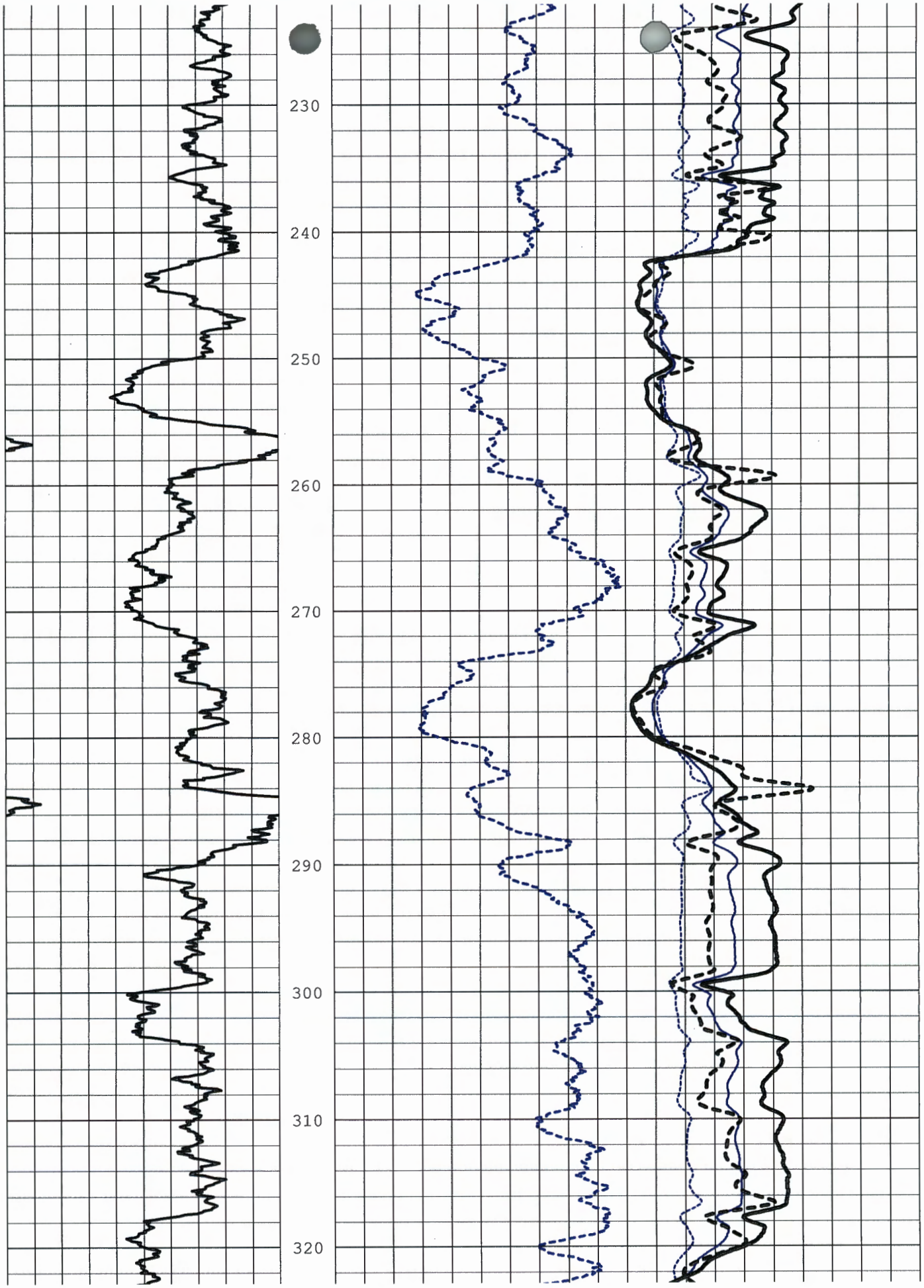
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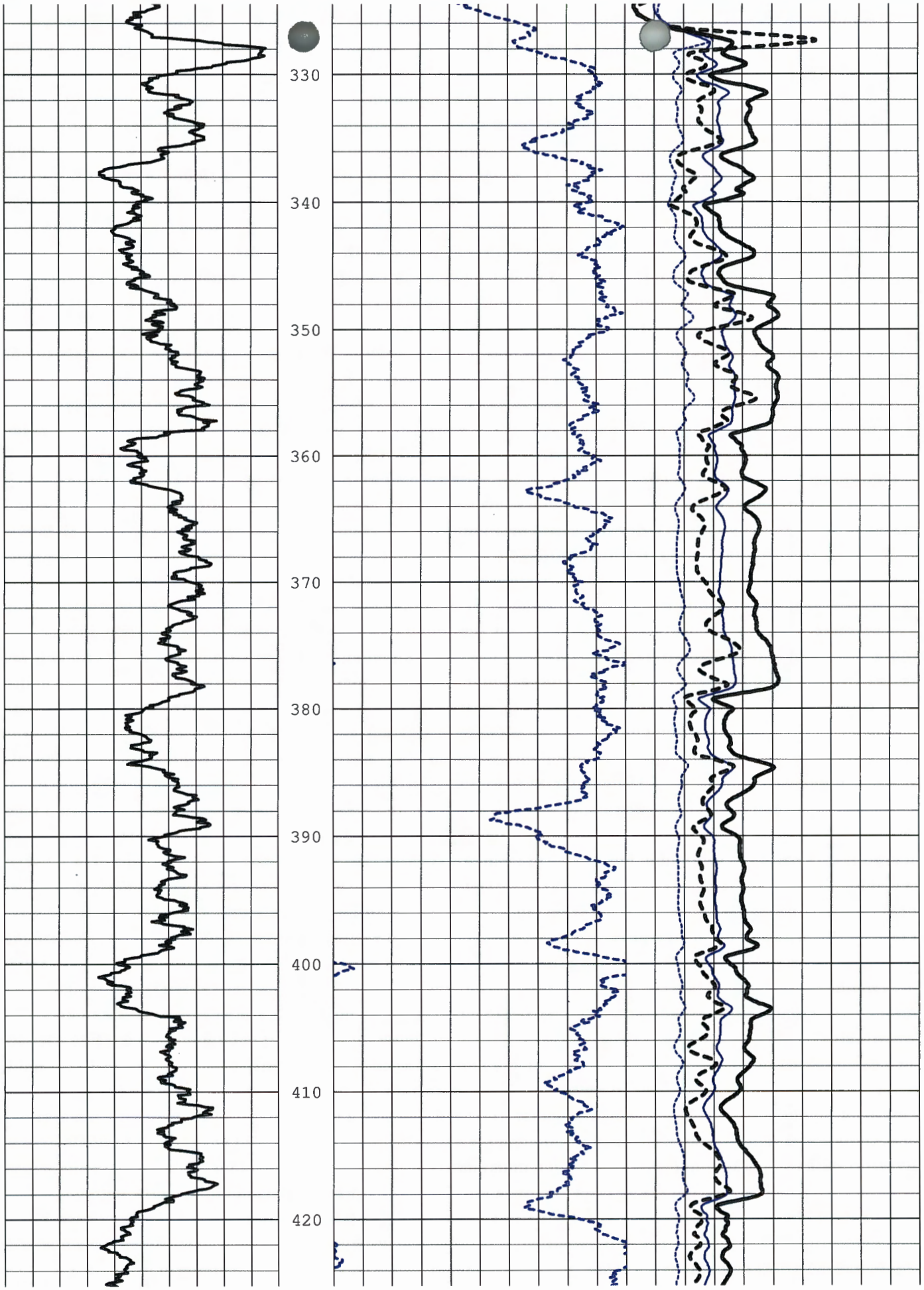
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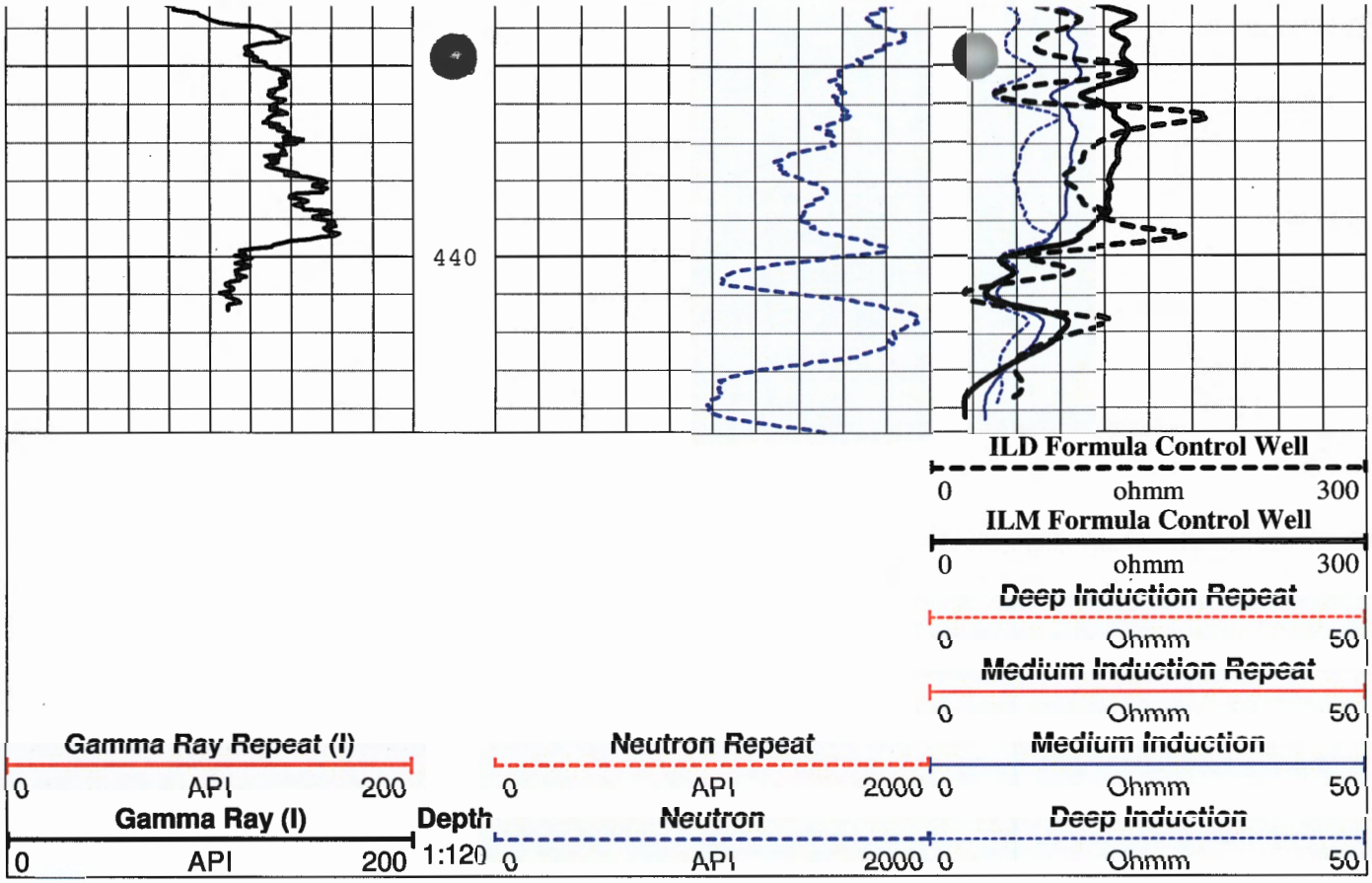

440
ILD Formula Control Well
0 ohmm 300
ILM Formula Control Well
0 ohmm 300
Deep Induction Repeat
0 Ohmm 50
Medium Induction Repeat
0 Ohmm 50
Gamma Ray Repeat (I)
0 API 200
Neutron Repeat
0 API 2000
Medium Induction
0 Ohmm 50
Gamma Ray (I)
0 API 200
Depth
1:120
Neutron
0 API 2000
Deep Induction
0 Ohmm 50

ATTACHMENT D

JET WEST
GEOPHYSICAL SERVICES, LLC.

COMPANY	CH2M Hill
WELL ID	Borehole 106-C
FIELD	KAFB-Bulk Fuels Facility
COUNTY	Bernalillo STATE New Mexico

State Plane 1927
Northing:
Easting:

TYPE OF LOG: **Electric Log/Gamma Ray**
3 Arm Caliper

OTHER SERVICES
Neutron

LOCATION
SEC TWP RGE

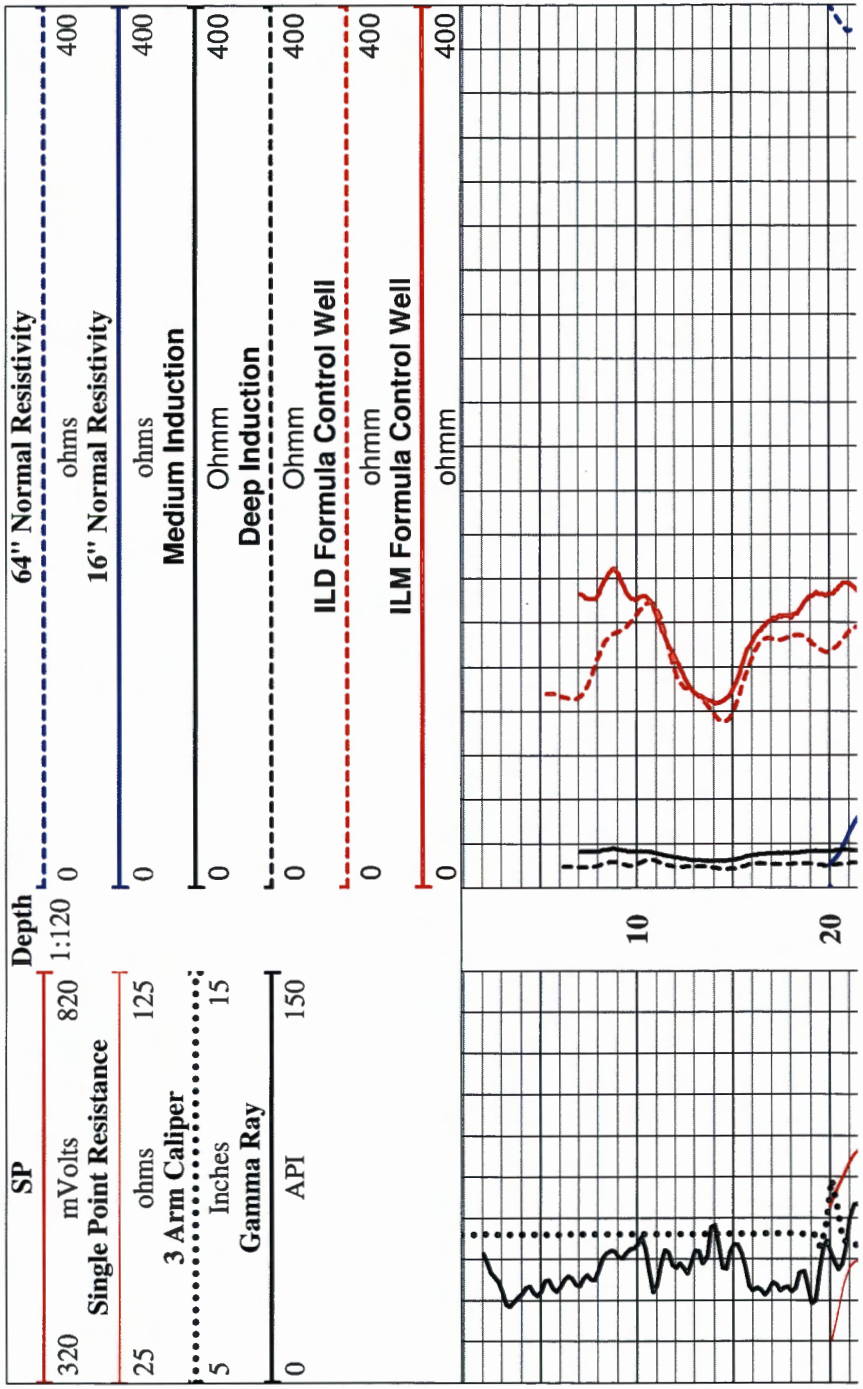
API No.

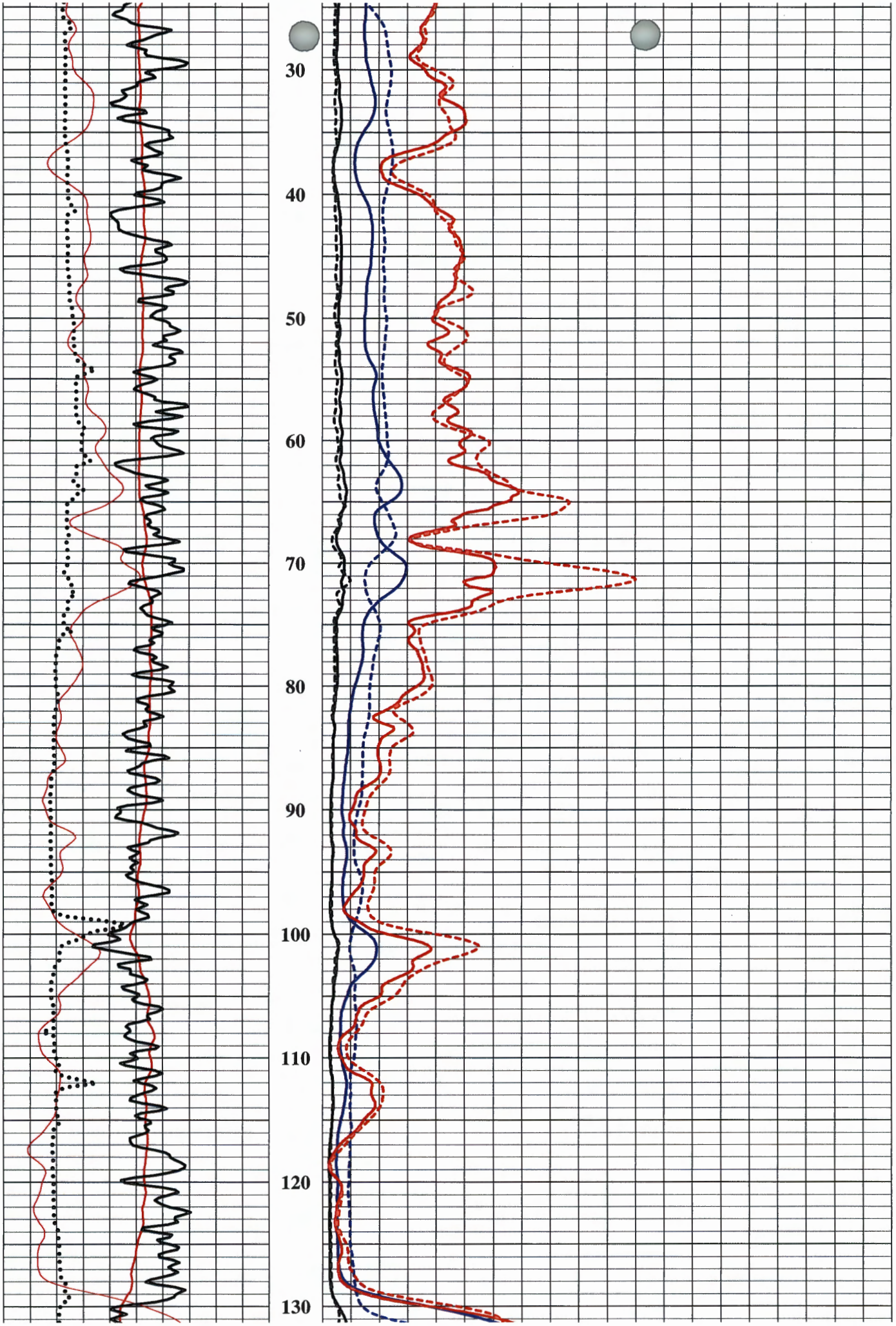
ERMANENT DATUM	Ground Level	ELEVATION	K.B.
OG MEAS. FROM	Ground Level	ABOVE PERM. DATUM	T.O.C
RILLING MEAS. FROM	Ground Level		G.L.

ATE	July 21,2009	TYPE FLUID IN HOLE	Drill Mud
UN No.	one	SALINITY	
YPE LOG	Poly4294	DENSITY	
EP[illegible]RILLER	515 ft.	LEVEL	full
EPTH-LOGGER	515 ft.	MAX. REG. TEMP	
TM LOGGED INTERVAL	515 ft.	DIGITIZE INTERVAL	0.2 ft.
OP LOGGED INTERVAL	Surface		
PERATING RIG TIME			
ECORDED BY	A.Henderson		
ITNESSED BY	CH2M Hill		

UN	BOREHOLE RECORD			CASING RECORD			
O.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
	6-1/4 in.	0 ft.	515 ft.	9 in.	steel	+ 1 ft.	20 ft.

EMARKS:

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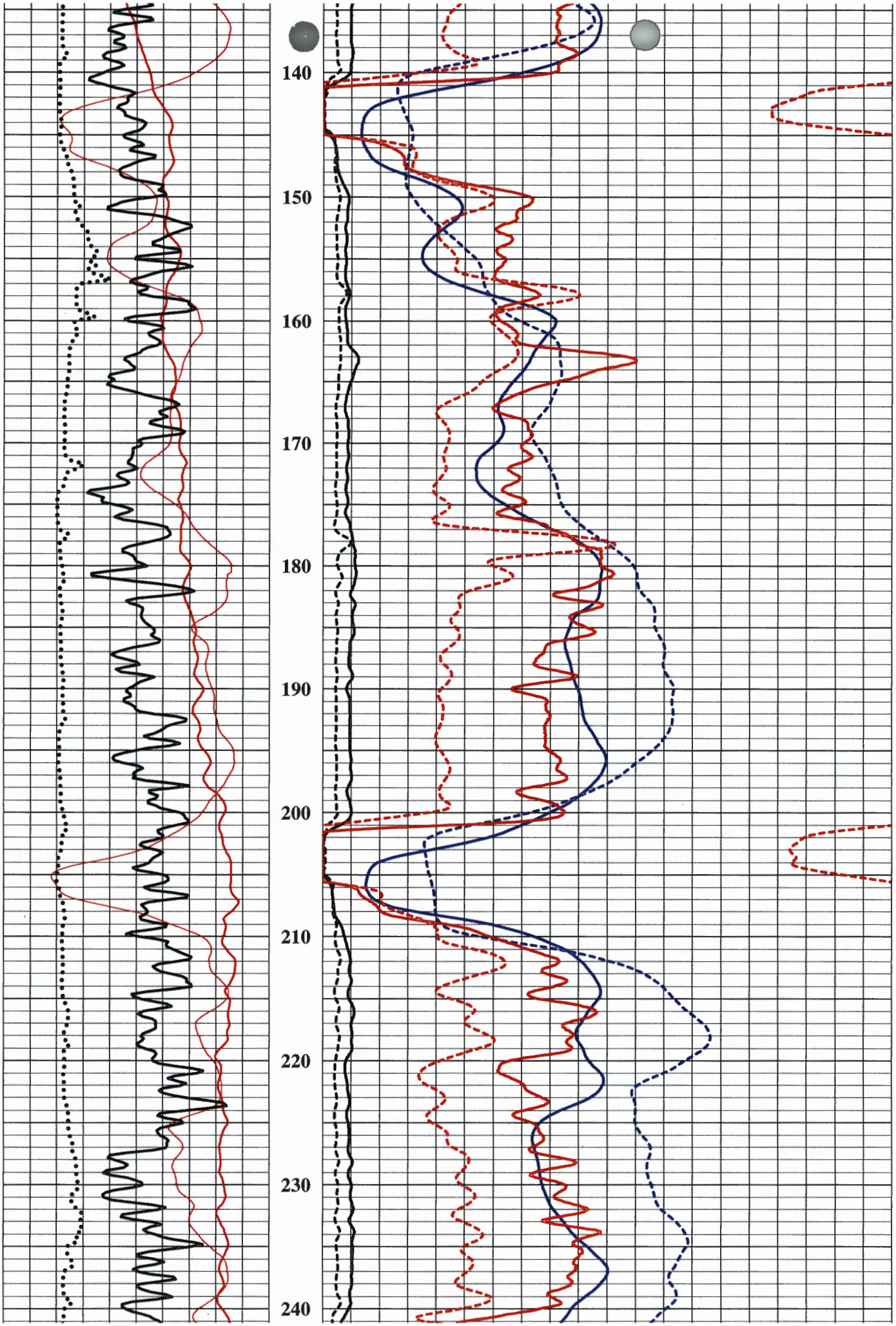
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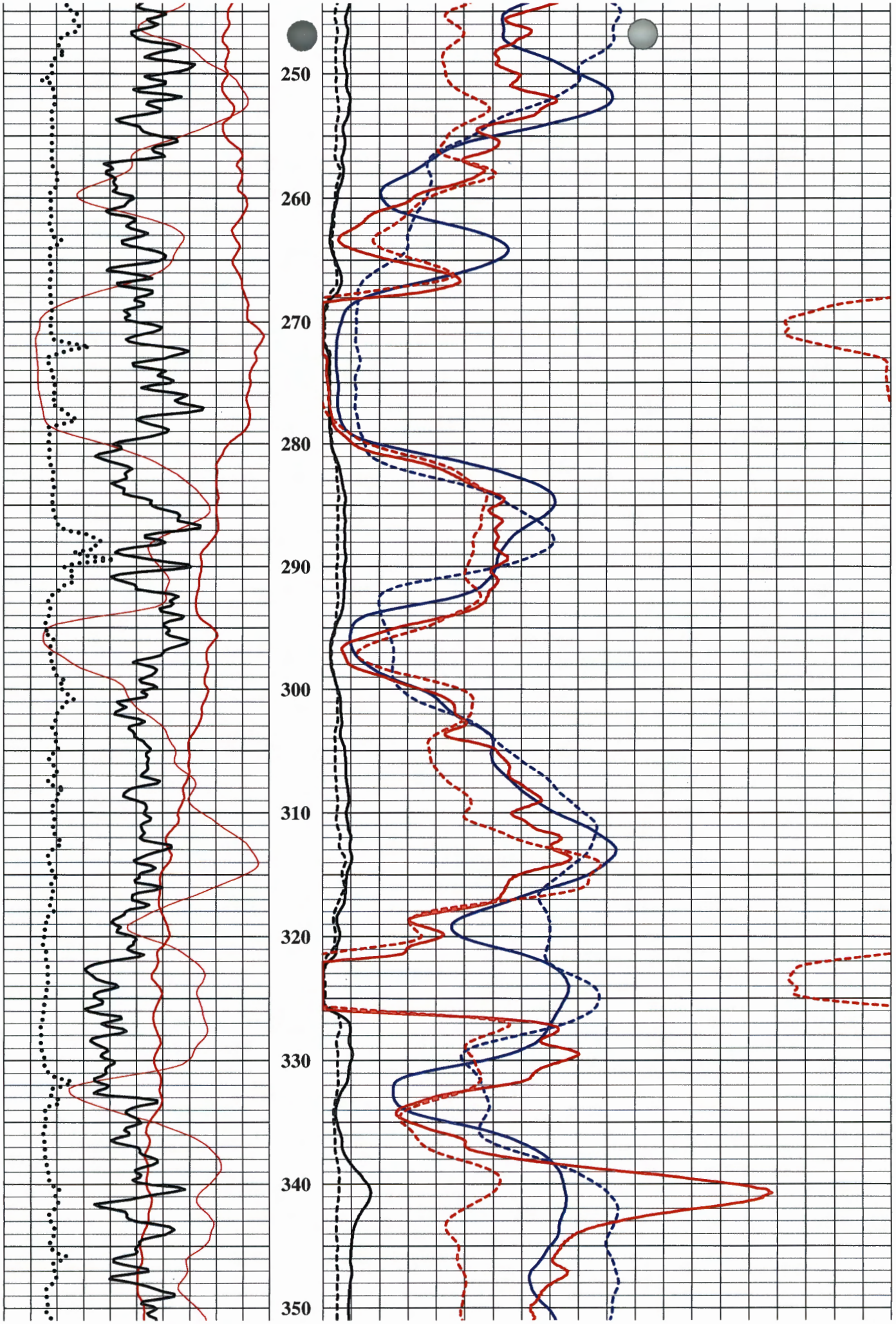
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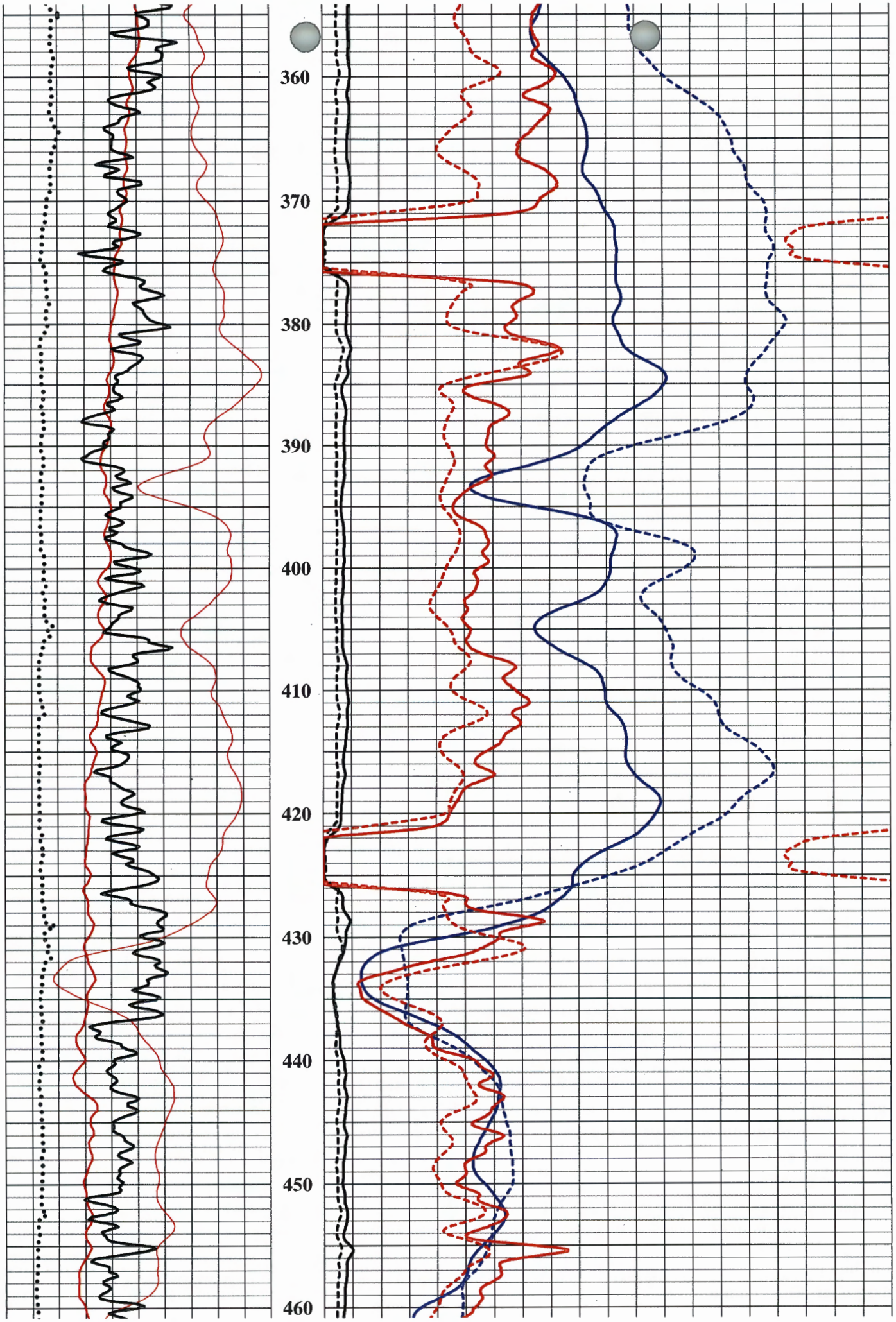
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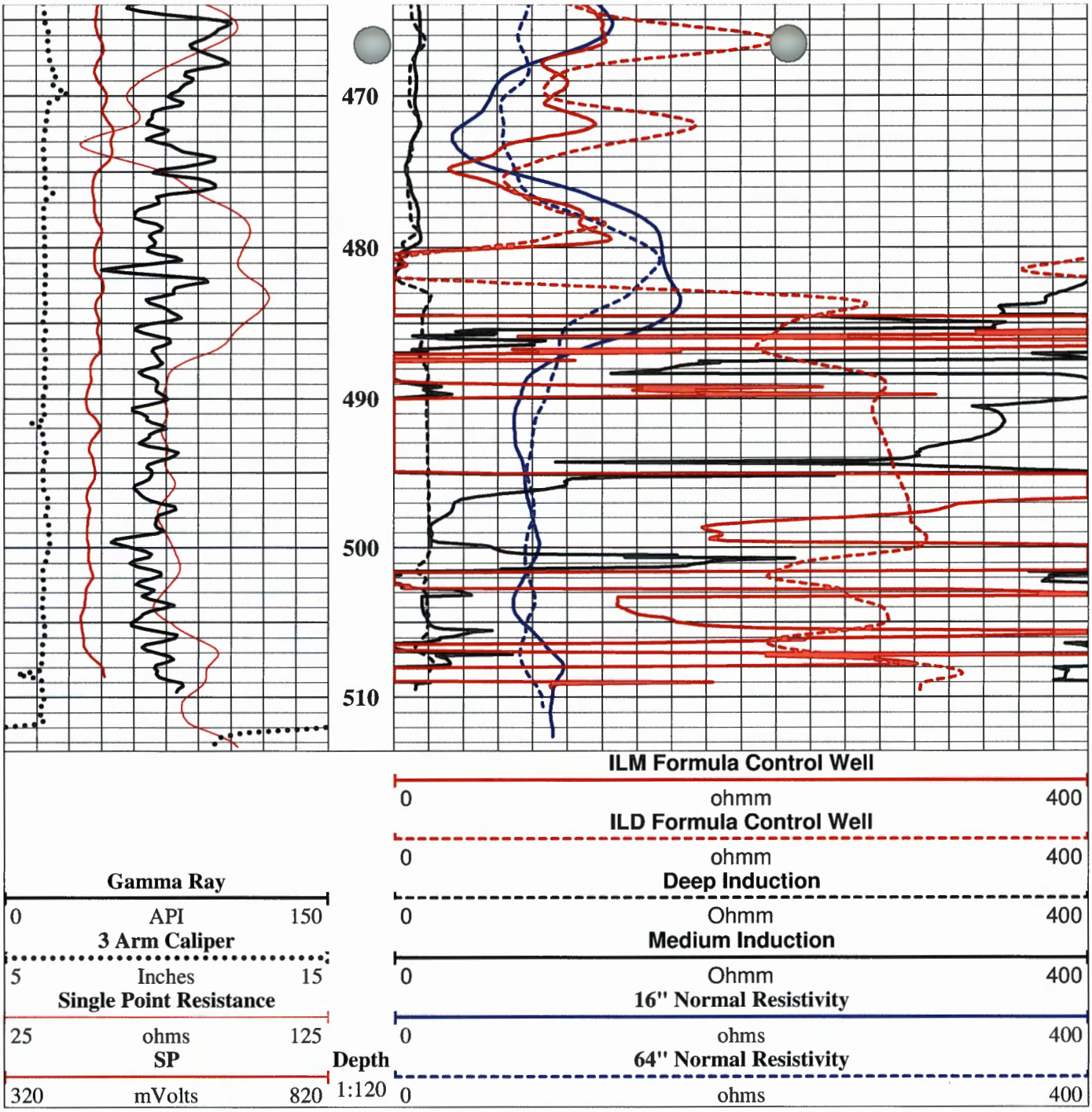
470
480
490
500
510
ILM Formula Control Well
0 ohmm 400
ILD Formula Control Well
0 ohmm 400
Gamma Ray
0 API 150
Deep Induction
0 Ohmm 400
3 Arm Caliper
5 Inches 15
Medium Induction
0 Ohmm 400
Single Point Resistance
25 ohms 125
16" Normal Resistivity
0 ohms 400
SP
320 mVolts 820
Depth
1:120
64" Normal Resistivity
0 ohms 400