# CAMEROON - RIO DEL REY "DATA TO LEADS" CASE STUDY

# Ranking Hydrocarbon Potential on a Proven Acreage

#### Abstract

Perenco provided two 3D surveys in a proven hydrocarbon province to run GeoInquest LLC's "Data to Leads" in order to catalog and rank hydrocarbon potential.

#### Conclusions

The "Data to Leads" (D2L) study detected all proven layers and identified new leads based solely from seismic data. Perenco was able to validate, rank, and prioritize a prospect inventory using the D2L results listing all relevant geological objects in terms of rock properties, fluid signatures, and hydrocarbon volumes in place.

#### Main take outs

- Perenco validated the study results
- D2L brings a significant competitive advantage and accelerates data evaluation
- Study highlighted known resources and found promising new plays
- Final deliverables merged into one pseudo 3D

### Area of Interest and Scope

Cameroon Rio del Rey basin is a well-proven play area with hundreds of wells targeting the Mio-Pliocene fluvio-deltaic Agbada formation in the eastern extension of the Niger delta. Two 3D seismic surveys (-200 km2) were selected as the study area where more than 30 wells have been drilled since the 1970s. Perenco's goal is to evaluate if "Data to Leads" can:

I) Find the main hydrocarbon fields

2) Shortlist prospects without any guidance or prior knowledge3) Significantly improve business competitiveness and accelerate resource evaluation procedures.

D2L deliverables contributed to the development plan for remaining gas prospects and field extensions. This paper shows key findings and an example of the D2L results near a proven oil and gas field.

#### Data to Leads Overview

GeoInquest LLC's D2L workflow consists of several seismic data enhancement steps to produce a ranked list of objects of interest (OOI) listing exhaustively and objectively all resource potential. The D2L technique provides a unique way to convert multiple seismic surveys into consistently conditioned seismic derivatives and valuable intelligence for appraising in situ resources. Deliverables are both new seismic volumes (data) and intelligence (ranked list of OOI prospects, horizons) that clients leverage to focus and accelerate / validate acreage evaluations. Figures 1 and 2 show a schematic view of the D2L process, from input data to key deliverables, highlighting benefits for every stage of an asset development life cycle. Running the D2L data preparation process across surveys / basins is key, to harmonize incompatible datasets and for robust model calibration for Artificial Intelligence (AI) applications.

#### Perenco

Oil exploration and production group established in 1992, with currently 6,000 employees in 16 countries and producing 500,000 boepd.

#### **GeoInquest LLC**

Geophysical consulting company founded in 2022 in Texas by Vincent Favreau, industry expert geophysicist, to enable oil and gas, mineral, and geothermal acreage owners, developers and investors to extract the most valuable information from seismic data and make sound business decisions.

#### **Data to Leads**

GeoInguest LLC's "Data to Leads" (D2L) service is a unique subsurface potential evaluation method, turning heterogeneous seismic surveys into consistently conditioned seismic derivatives and valuable intelligence for appraising in situ resources. This fast and affordable data mining tool is designed to predict the presence or absence of desired resources in the subsurface and speed up data evaluation by an order of magnitude. Primarily developed for the oil and gas industry, deliverables from the D2L process (porosity, net to gross volumes) also add value to other industries such as geothermal and mining.

## Case Study Findings

Figure 3 shows a shortlist of 46 OOIs, including proven fields and prospects, flagged and ranked by the D2L process. All proven fields are labeled DRILLED in the table. A large remaining potential of smaller satellite objects to proven fields is labelled UNDRILLED in the table, previously evaluated prospects are labelled PROSPECT. The study identified significant additional potential not previously considered, some corresponding to new plays not drilled by wells. Figure 4 shows the intercept-gradient (aka. AB) cross plot highlighting objects with the best hydrocarbon-bearing potential located away from the wet trend line. Figures 5 and 6 show the example OOI ID #564 as an extension of a main reservoir (OOI ID #566). The AVO Strength (AS) in Figure 6 section and map views highlights best the potential hydrocarbon-bearing layers, leaving wet layers in the background. Figure 7 shows all shortlisted OOI as time horizons representing the remaining resource density. All deliverable volumes are both SEGY and ZGY format; OOI top and base horizons are ASCII format.

#### Conclusions

**Technical Goals Achieved:** The D2L study used two 3D surveys to successfully detect all major fields, their satellites as well as new objectives, from seismic data alone. This study was carried out without prior knowledge or well data, in two weeks.

**Minimizing Missed Business Opportunities:** Perenco leveraged the D2L deliverables to finalize a ranked prospect inventory being carried towards resources and reserves assessment.

**Improve Competitiveness:** This D2L study demonstrates that hydrocarbon-bearing reservoirs can be detected quickly with sufficient precision and speed; generating a significant competitive advantage. Study results saved both time and money to contribute to a development plan for the study area.

**3D Data Merge:** Deliverables post D2L were seamlessly merged into newly created pseudo 3D volumes to facilitate interpretation and amplitude mapping across multiple surveys.

GeoInquest LLC would like to thank Perenco for the opportunity to demonstrate D2L techniques in this study.



**Figure 1:** "Data to Leads" (D2L) schematic, inputs, deliverables and benefits. The D2L is a seismic based technique designed to extract valuable intelligence about the presence of hydrocarbon-bearing layers in the subsurface. The process is thorough, unbiased, and allows clients to refine and prioritize their prospects list.



**Figure 2:** "Data to Leads" deliverables such as AVO Strength (AS), Objects of Interest (OOI) volumes, and the Objects of Interest (OOI) shortlist can impact the acreage evaluation at every development stage. Perenco used the D2L results to finalize the development plan for the unproduced gas fields and prospects, oil production being the main historical focus.

Object ID	Area (bins)	Vol (samples)	X (m)	Y (m)	IL	XL	TWT ms	REF twt ms	TWT ms BML	Intercept Average	Gradient Average	AVO Strength	AVO class Average	Intercept Sweetspot	Gradient Sweetspot	AVO Strength	AVO class Sweetspot	GRV bbl	Perenco validation
			_	_								Average				Sweetspot			
566	164,537	2,650,124			2,840	1,571	1,226	90	1,136	-64,053	-44,258	-100,210	2.85	-98,150	-77,755	-134,776	2.75	4.68E+09	DRILLED
175	90,409	1,291,385			2,486	1,559	842	90	752	-76,161	-51,683	-122,822	2.79	-137,942	-96,301	-171,453	2.78	2.15E+09	DRILLED
527	89,434	1,284,192			2,791	1,389	758	90	668	-105,898	-37,042	-133,656	3.13	-201,196	-75,363	-193,802	3.20	2.11E+09	DRILLED
974	49,296	551,145			3,040	1,814	1,412	90	1,322	-39,116	-38,078	-70,824	2.35	-60,753	-59,038	-88,234	2.59	1.00E+09	DRILLED
769	40,312	390,354			2,923	1,673	748	90	658	-45,066	-36,283	-69,887	2.51	-66,683	-62,855	-89,169	2.56	6.39E+08	DRILLED
260	21,733	189,124			2,438	1,538	1,078	90	988	-74,403	-23,635	-84,966	3.24	-115,240	-48,025	-112,886	3.21	3.26E+08	DRILLED
408	8,119	117,362			2,558	1,869	798	90	708	-62,279	-41,992	-100,080	2.66	-97,968	-84,533	-139,458	2.61	1.94E+08	PROSPECT
874	13,771	109,833			2,995	1,367	706	90	616	-32,801	-41,384	-69,806	2.26	-45,684	-72,121	-87,935	2.30	1.79E+08	DRILLED
1,080	8,242	96,550			3,079	1,778	1,342	90	1,252	-72,765	-12,066	-76,040	3.28	-113,210	-18,213	-98,188	3.46	1.74E+08	DRILLED
485	11,389	98,235			2,707	2,003	422	90	332	-16,304	-82,104	-96,340	1.68	-32,615	-160,104	-129,541	1.59	1.53E+08	UNDRILLED
565	7,707	81,302			2,706	1,971	1,458	90	1,368	-24,687	-52,470	-71,133	1.92	-23,352	-86,721	-91,211	1.74	1.49E+08	PROSPECT
1,068	7,937	85,812			3,070	1,771	1,036	90	946	-83,951	-1,336	-79,946	3.47	-124,004	-4,288	-104,057	3.46	1.47E+08	DRILLED
1,078	10,771	89,769			3,112	1,664	676	90	586	-50,605	-25,588	-70,583	2.79	-81,718	-31,459	-88,653	2.95	1.45E+08	UNDRILLED
572	6,350	94,324			2,705	2,007	310	90	220	-2,708	-72,102	-74,136	1.09	-11,076	-112,355	-95,602	1.65	1.44E+08	UNDRILLED
1,170	8,996	84,303			3,174	1,688	616	90	526	-40,513	-33,426	-70,306	2.49	-61,597	-57,658	-86,011	2.63	1.35E+08	UNDRILLED
462	8,894	80,432			2,683	2,010	714	90	624	-41,459	-47,003	-79,253	2.34	-73,512	-77,320	-104,597	2.56	1.31E+08	UNDRILLED
514	9,190	70,111			2,687	1,999	782	90	692	-28,746	-50,278	-75,060	2.07	-51,940	-91,913	-100,489	2.18	1.15E+08	UNDRILLED
590	6,067	74,104			2,740	1,982	220	90	130	11,283	-87,259	-76,706	1.05	15,030	-141,143	-99,709	1.01	1.12E+08	UNDRILLED
812	6,149	62,600			2,881	1,716	504	90	414	-58,104	-22,140	-71,948	2.90	-79,277	-49,709	-88,729	2.86	9.86E+07	UNDRILLED
456	6,015	56,149			2,672	2,006	496	90	406	-61,794	-26,703	-76,466	2.70	-99,505	-55,097	-98,039	2.87	8.83E+07	UNDRILLED
851	4,477	55,102			2,905	1,709	404	90	314	-22,176	-55,663	-72,369	1.97	-35,254	-89,101	-93,215	1.88	8.54E+07	UNDRILLED
1,188	4,195	48,563			3,168	1,704	368	90	278	-28,650	-46,932	-69,708	2.10	-41,675	-81,594	-88,060	2.24	7.48E+07	UNDRILLED
543	4,684	44,823			2,690	2,010	600	90	510	-44,008	-43,445	-78,440	2.41	-63,358	-82,405	-100,228	2.35	7.17E+07	UNDRILLED
1,113	3,684	41,235			3,080	1,773	900	90	810	-95,137	15,847	-78,535	3.51	-161,018	31,034	-108,865	4.00	6.92E+07	DRILLED
564	2,808	38,038			2,652	1,882	1,268	90	1,178	-50,089	-43,347	-88,032	2.65	-68,716	-76,269	-121,621	2.51	6.77E+07	PROSPECT
635	4,150	39,687			2,738	2,015	936	90	846	-45,605	-37,451	-74,251	2.38	-46,708	-97,387	-98,410	2.11	6.70E+07	UNDRILLED
861	2,987	34,491			2,918	1,715	676	90	586	-63,713	-19,266	-77,637	3.09	-111,374	-34,426	-91,661	3.22	5.58E+07	UNDRILLED
664	3,446	26,956			2,750	2,014	842	90	752	-25,951	-50,516	-69,378	2.05	-36,759	-81,980	-86,891	2.09	4.48E+07	UNDRILLED
618	2,154	21,763			2,686	1,972	2,060	90	1,970	-32,526	-60,981	-76,149	2.16	-38,392	-83,014	-96,322	1.95	4.40E+07	PROSPECT
273	1,905	23,258			2,406	1,239	1,540	90	1,450	-31,201	-48,357	-73,003	2.13	-49,558	-79,342	-95,600	2.26	4.32E+07	DRILLED
60	3,284	24,410			2,327	1,404	966	90	876	-52,920	-14,592	-63,884	3.07	-73,091	-40,496	-86,628	3.11	4.14E+07	UNDRILLED
2	2,285	21,010			2,221	1,384	1,178	90	1,088	-46,224	-30,623	-67,999	2.56	-56,867	-74,199	-87,249	2.40	3.69E+07	PROSPECT
451	2,011	20,751			2,582	1,563	1,086	90	996	-41,580	-45,491	-77,228	2.58	-20,065	-99,926	-103,293	2.23	3.59E+07	PROSPECT
176	1,872	18,680			2,371	1,260	1,148	90	1,058	-72,310	-26,130	-91,054	2.92	-114,182	-96,245	-135,124	2.74	3.26E+07	DRILLED
1,181	1,592	21,268			3,168	1,723	252	90	162	8,214	-91,638	-84,263	1.05	7,799	-160,647	-110,480	1.26	3.22E+07	UNDRILLED
245	1,481	17,260			2,388	1,261	1,306	90	1,216	-72,400	-24,077	-82,425	3.02	-118,773	-49,720	-119,321	3.26	3.09E+07	PROSPECT
1,116	1,655	20,289			3,089	1,799	246	90	156	10,543	-83,332	-73,178	1.00	11,745	-129,771	-91,730	1.00	3.07E+07	UNDRILLED
595	3,141	18,074			2,719	2,012	864	90	774	-21,917	-57,466	-73,851	2.12	-34,215	-72,933	-87,839	2.12	3.02E+07	UNDRILLED
622	2.729	17.523			2.713	2.005	548	90	458	-44.836	-33,560	-73.655	2.31	-80.883	-46.324	-95.719	2.68	2.78E+07	
173	1,553	15,230			2,373	1,328	1,148	90	1,058	-8,802	-70,113	-78,691	2.00	-3,724	-147,345	-103,183	2.00	2.66E+07	PROSPECT
1.225	1.429	15.654			3.201	1.653	266	90	176	9.072	-77,465	-69.134	1.00	6.433	-111.850	-86,570	1.10	2.37E+07	
20	2,208	12,998			2,250	1,197	1.288	90	1,198	-36 353	-49,513	-73,225	2.09	-32,517	-93,730	-97,820	2.00	2.32F+07	
1.263	1.876	13,480			3,214	1,664	736	90	646	-69,434	-8,309	-70,198	3.34	-86,410	-19,647	-85,699	3,42	2.20E+07	
1	1 390	10 002			2 205	1 395	948	90	858	-52 892	-21 558	-67 576	2.68	-57 505	-64 652	-88 277	2 55	1.69F+07	
122	1 376	9.055			2 324	1 240	1 032	90	942	-65 014	1 319	-66 206	3 58	-92 131	-5 464	-90 376	3.69	1 55F+07	
521	1,136	7,959			2.636	2.014	458	90	368	-26.060	-54.728	-74,235	2.03	-50.052	-79.661	-91.182	2.20	1.24E+07	

**Figure 3:** Extract of a sorted list of Objects of Interest (OOI) and associated statistics with Perenco validation: UNDRILLED, DRILLED, and PROSPECT carried for assessment. Objects are sorted by size with a cutoff on the <u>AVO Strength Sweet Spot</u> values. The D2L results helped Perenco complete the inventory of oil and gas assets, confirming already known prospects and discovering news ones, including new plays not yet proven by wells.



**Figure 4:** Intercept-Gradient (AB) cross plot showing shortlisted Objects of Interest (OOI). Biggest and sweetest objects are labeled. Large gas fields are OOI ID #527, #175, #566, and #974. The best overall OOI are located "south-west" of the wet trend in both cross plots.



**Figure 5:** Band Limited Impedance (BLIMP, quadrature phase) volume for the near stack, well A, and Object ID #564. Low impedance are negative numbers shown as blue colors. A special wavelet used to generate a synthetic on the BLIMP data, tailored for the Well A location, was provided by GeoInquest LLC.





**Figure 6:** AVO Strength volume (AS, quadrature phase), well A (OOI ID #566), and prospect OOI ID #564. High probability of hydrocarbon presence is represented as large negative numbers. Note the bottom of the section is in the wet background compared to the BLIMP volume on Figure 5.



Map expression of the AVO Strength extracted within the main reservoir horizon below:

GeoInquest LLC

https://geoiq.us



**Figure 7:** Map view of OOI shortlist to illustrate prospect / field density. Time maps of horizons show the size and location of shortlisted objects. Red, green, blue, and yellow outlines correspond to proven oil and gas fields, with horizon time maps of proven fields removed for clarity.