Calima Shows Strong

Tommy Lakes, BC

Chris Podetz, P.Geol., Allison Gibbs, P.Geol. | November 30, 2020

Additional test results from Calima's Montney wells at Tommy Lakes show that the potential for further development at the northern end of the Montney play remains high.

Canadian Discovery Ltd.

When CDL first reported on Calima's foray into the Northern Montney with a vertical and two horizontal wells at Tommy Lakes *(figures 1 and 2)*, little public data were available (Podetz, 2019). All three wells have since come off confidential status, and detailed flow and pressure test results from both horizontal wells are now in the public domain. The new data provide strong evidence, especially when compared to producing analogue wells, that the Upper Montney (UM) and Upper Middle Montney (UMM) productive fairways are poised for expansion into Calima's land base.

Image Overleaf
Calima-3
From Calima Energy website, November 2020

Basic Well Summaries

Calima-1 (a-54-C 94-G-9) is a vertical strat test well drilled in January 2019 through the Montney into the Paleozoic. A full log suite was run in the well. A 230m core was taken, covering nearly the entire Montney succession, leaving out just the very top and base of the formation *(figure 3)*. Calima-2 (d-21-C 94-G-9/2) is a horizontal well targeting the base of CDL's UMM (deemed the "Claraia Zone" based on Davies et al., 2018), with a lateral length of approximately 2,650m. Calima-3 (c-76-C 94-G-9), with a similar lateral length, targets a horizon in the lower portion of the UM, near the contact with the UMM.

Both Calima horizontals used the same relatively intense completion design: 92 frac stages at 25–30m spacing, with approximately 300 m^3 fluid and 45t of proppant per stage, for total volumes of roughly 27,600 m^3 fluid and 4,140t proppant per well.

Calima-2 Results and Target Description

The Calima-2 UMM well was flow tested in March 2019, measured a maximum gas rate of 10.2 mmcf/d and reached a condensate/gas ratio (CGR) exceeding 40 bbls/mmcf at the end of the test (Podetz, 2019). The well was shut-in until August 2020, when a bottom hole pressure test yielded a value of 19,400 kPa, equating to an overpressured gradient of 11.5 kPa/m *(figure 4)*. These test results compare favourably to nearby established producers targeting the same lower UMM zone such as Polar Star's c-16-K 94-H-5 at

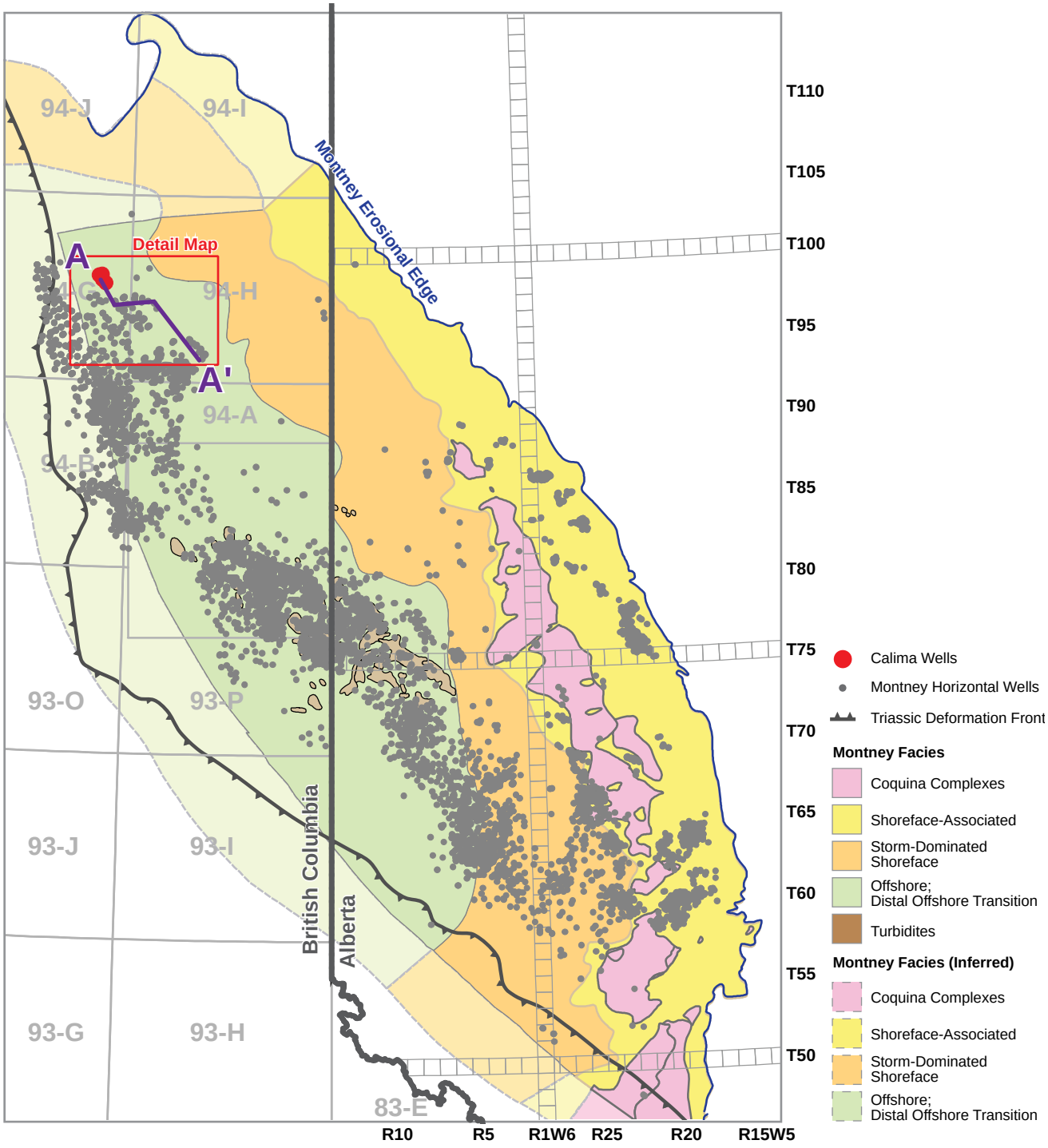
Table 1. Montney Target Zone Summaries from Calima-1 Core Analysis

	From (mKB)	To (mKB)	Samples (#)	Porosity (%)		Permeability (microDarcies)*		Avg Saturation (%)		
				Avg	Range	Avg	Range	Water	Oil	Gas
Calima-2 Target (UMM)	1,675	1,696	9	5.25	3.99–5.91	0.05	0.014–0.15	6	33	61
Calima-3 Target (UM)	1,596	1,610	9	3.91	2.35–6.02	0.04	0.007–0.11	4	43	53
Potential Lower Montney (LMZ)	1,752	1,770	7	5.11	4.52–6.05	0.07	0.003–0.13	28	27	44

*measured from crushed sample

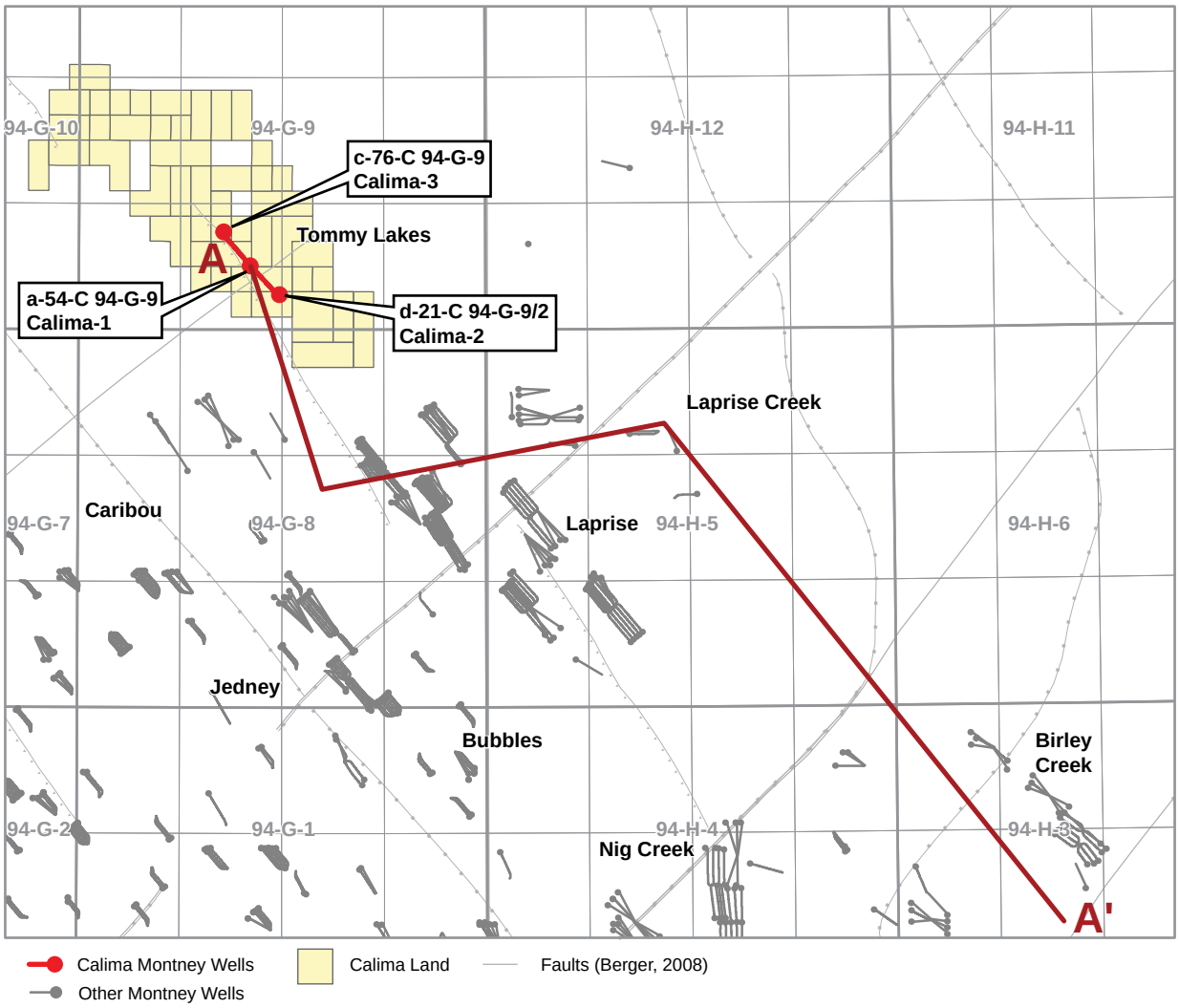
Data from AGAT Laboratories

1 Calima Montney Location



Data supplied by geoLOGIC

2 Detailed Calima Well and Land Map

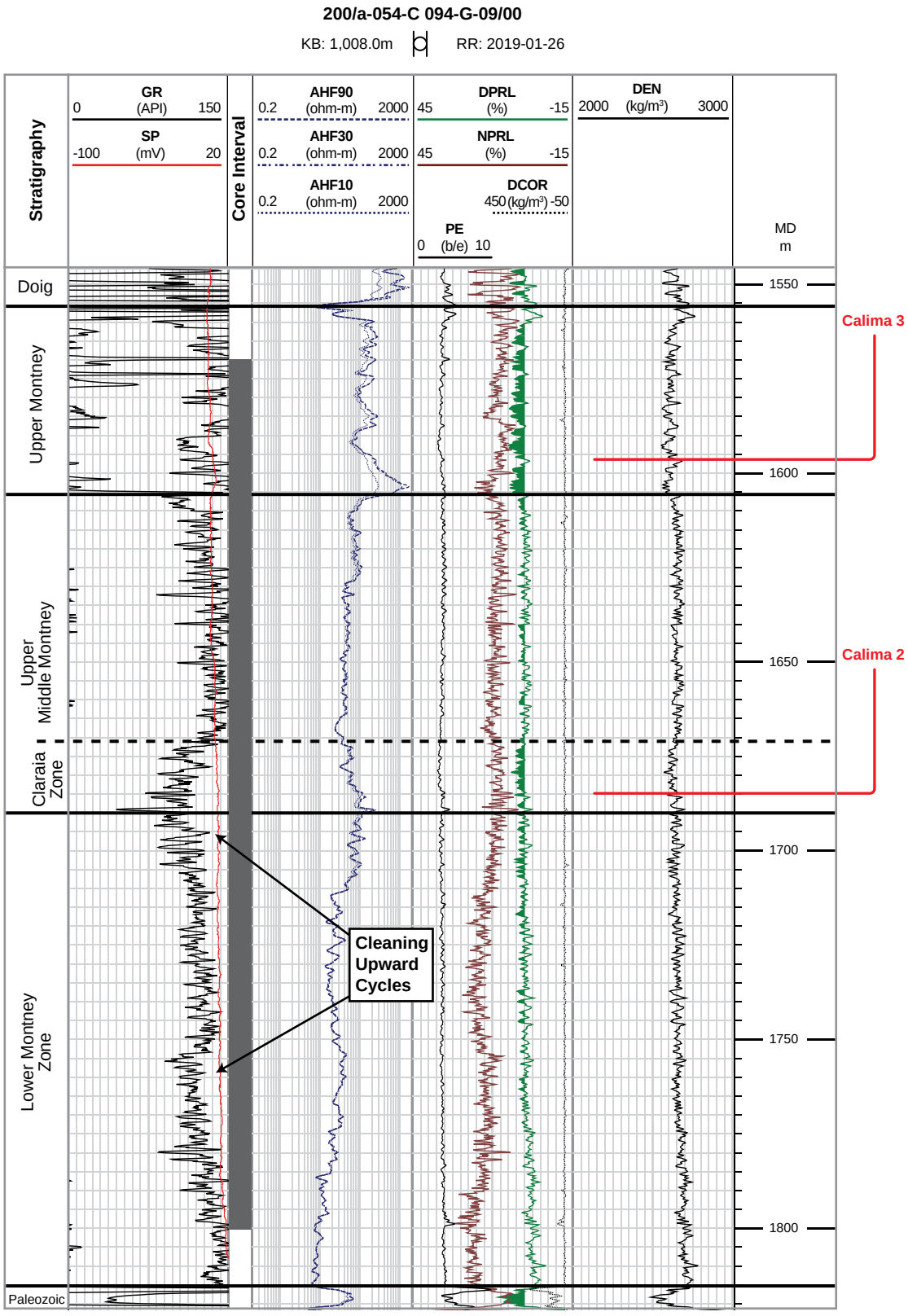


Data supplied by geoLOGIC

Laprise Creek *(figures 4 and 5)*, which had an IP90 liquids rate of 223 bbls/d and a CGR of more than 50 bbls/mmcf (Calima, 2020a). Wet Gas Index (WGI) mapping, which uses the proportion of C_2+ hydrocarbons to total hydrocarbon volume from a gas test as a proxy for the likelihood of liquids production (given the overall lack of liquids data in the public domain), also indicates that the UMM in Calima-2 is a likely condensate-rich target with a C_2+ WGI value of 18.2% *(figures 6 and 7)*.

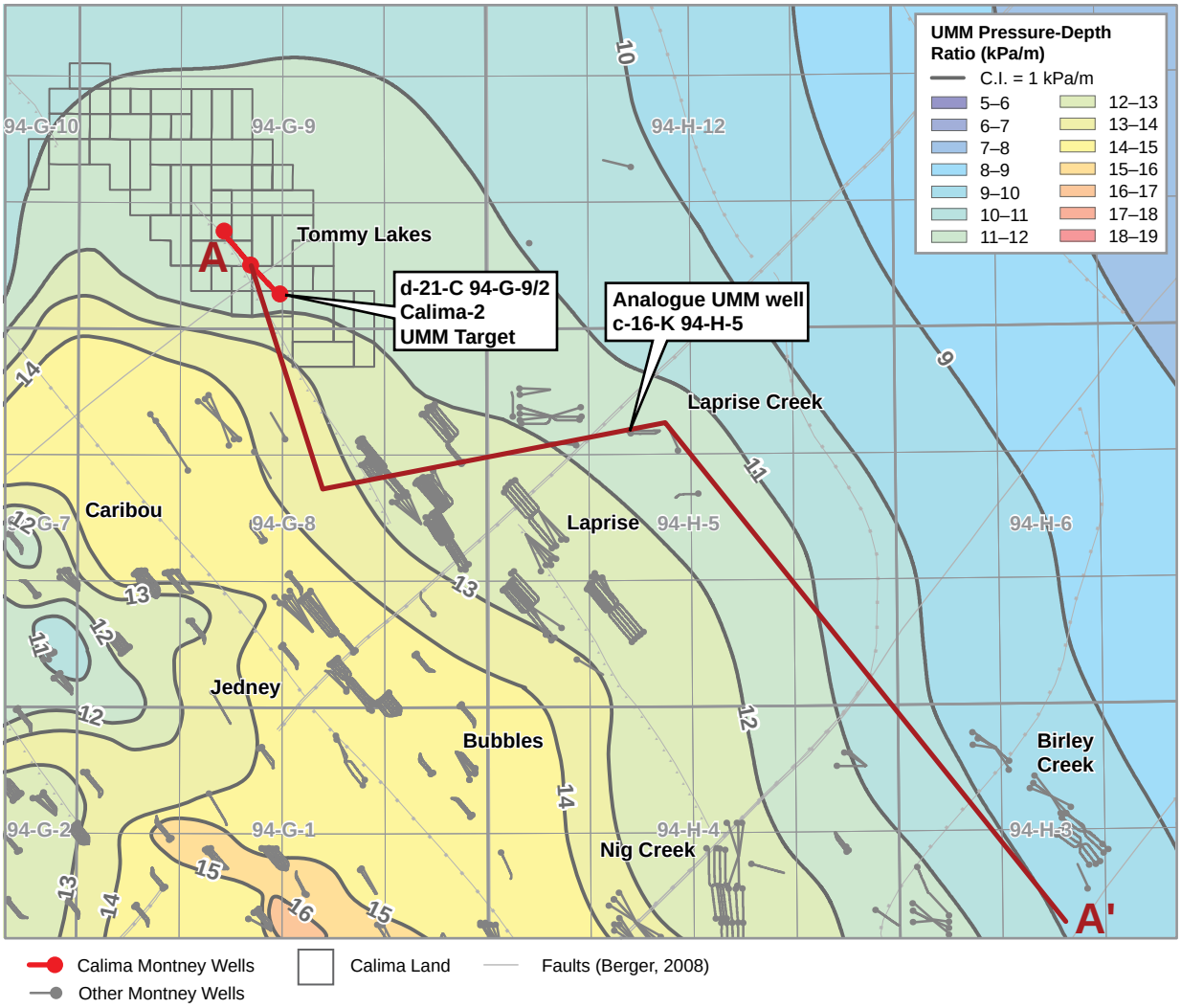
Calima-2 targeted the Claraia zone, near the base of the UMM *(figure 3)*. This interval is marked by a concentration of Claraia bivalve fossils, as described by G. Davies in his recent core study of Calima-1. These fossils usually occur at the top of repeating, metre-scale shallowing-upward sequences, with varying levels of bioturbation. Analyses performed by AGAT Laboratories on the Calima-1 core indicate that the Calima-2 target interval has relatively consistent porosity averaging 5.3%, and an average matrix permeability of 0.05 µD *(table 1)*.

3 Calima-1 Montney Log Suite



Data supplied by geoLOGIC. Built in geoSCOUT

4 Upper Middle Montney Pressure-Depth Ratio (kPa/m) Map

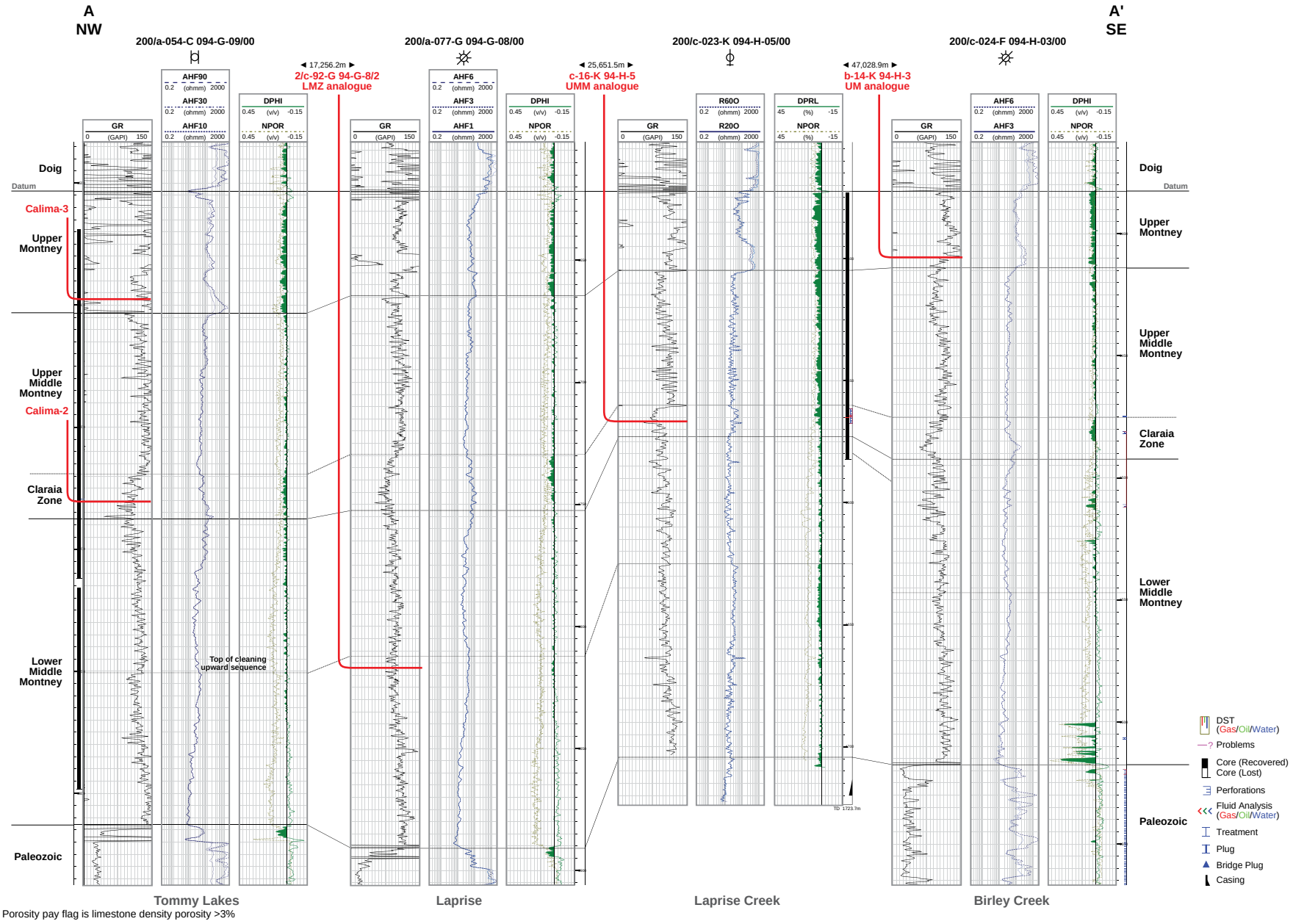


Data supplied by CDL's Fluids Database

Calima-3 Results and Target Description

The flow test for Calima-3, which targeted the lower portion of the UM *(figure 3)* and was stopped early due to deteriorating road conditions, achieved a rate of 4.0 mmcf/d, with no produced condensate. Similar to Calima-2, the well was then shut-in for 544 days (until September 2020). Calima-3's final bottom hole pressure was measured at 12,980 kPa, which represents a normally pressured reservoir *(figure 8)*. This pressure was lower than expected, especially compared to Calima-2, but similar to analogous UM wells to the south at Nig and Birley Creek, BC. Chinook's Birley Creek well b-14-K 94-H-3 has an IP90 liquids rate of 150 bbls/d and a CGR of 45 bbls/mmcf (BCOGC, 2020) *(figures 5 and 8)*. The UM target zone in b-14-K has a similar measured pressure gradient of approximately 9 kPa/m. WGI mapping for the UM in the vicinity of Calima-3 suggests that the target should also be a robust liquids producer *(figure 9)*.

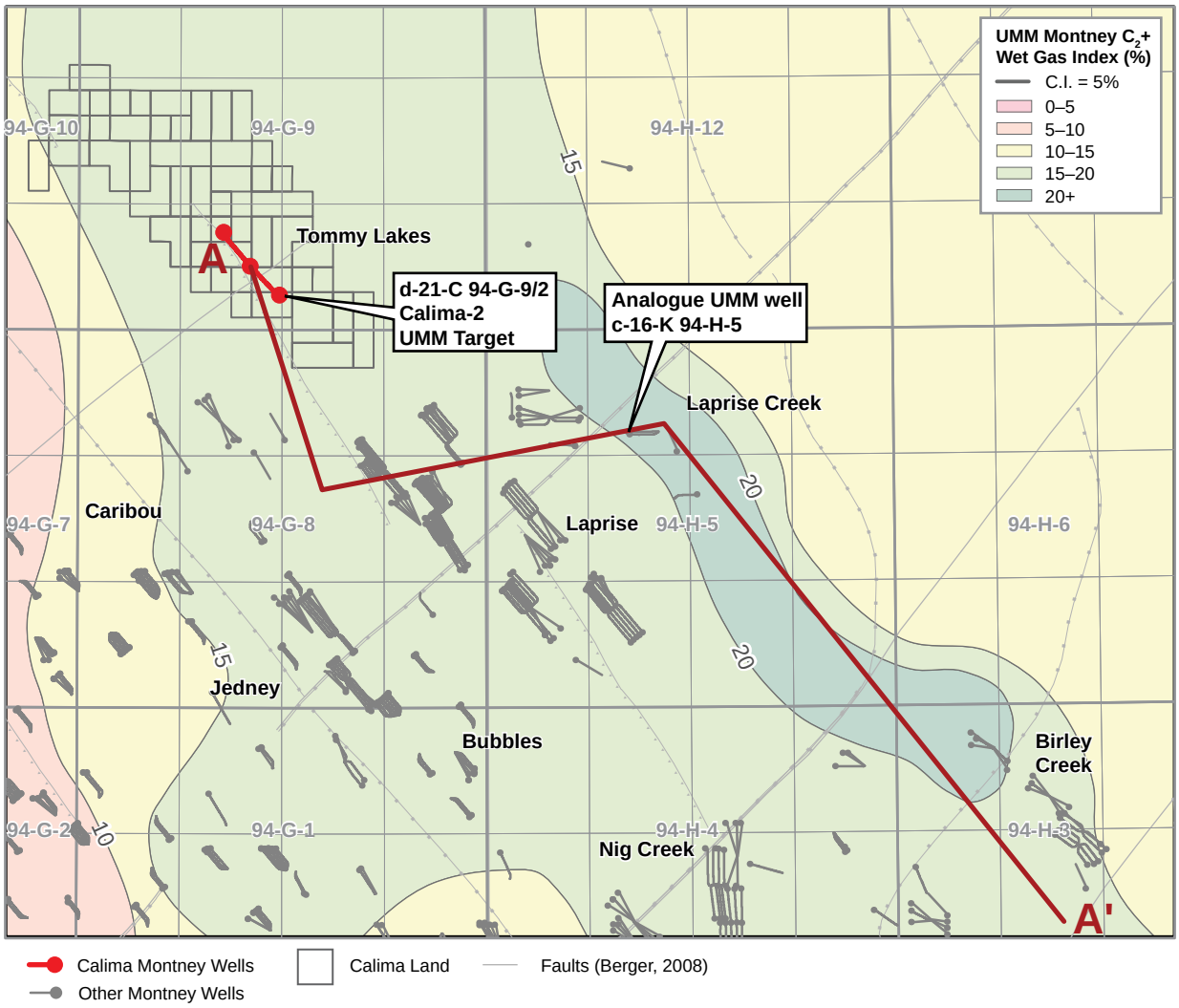
5 Tommy Lakes–Birley Creek Montney Stratigraphic Cross-Section A-A'



Porosity pay flag is limestone density porosity >3%

Data supplied by geoLOGIC. Built in geoSCOUT

6 Upper Middle Montney Wet Gas Index Map

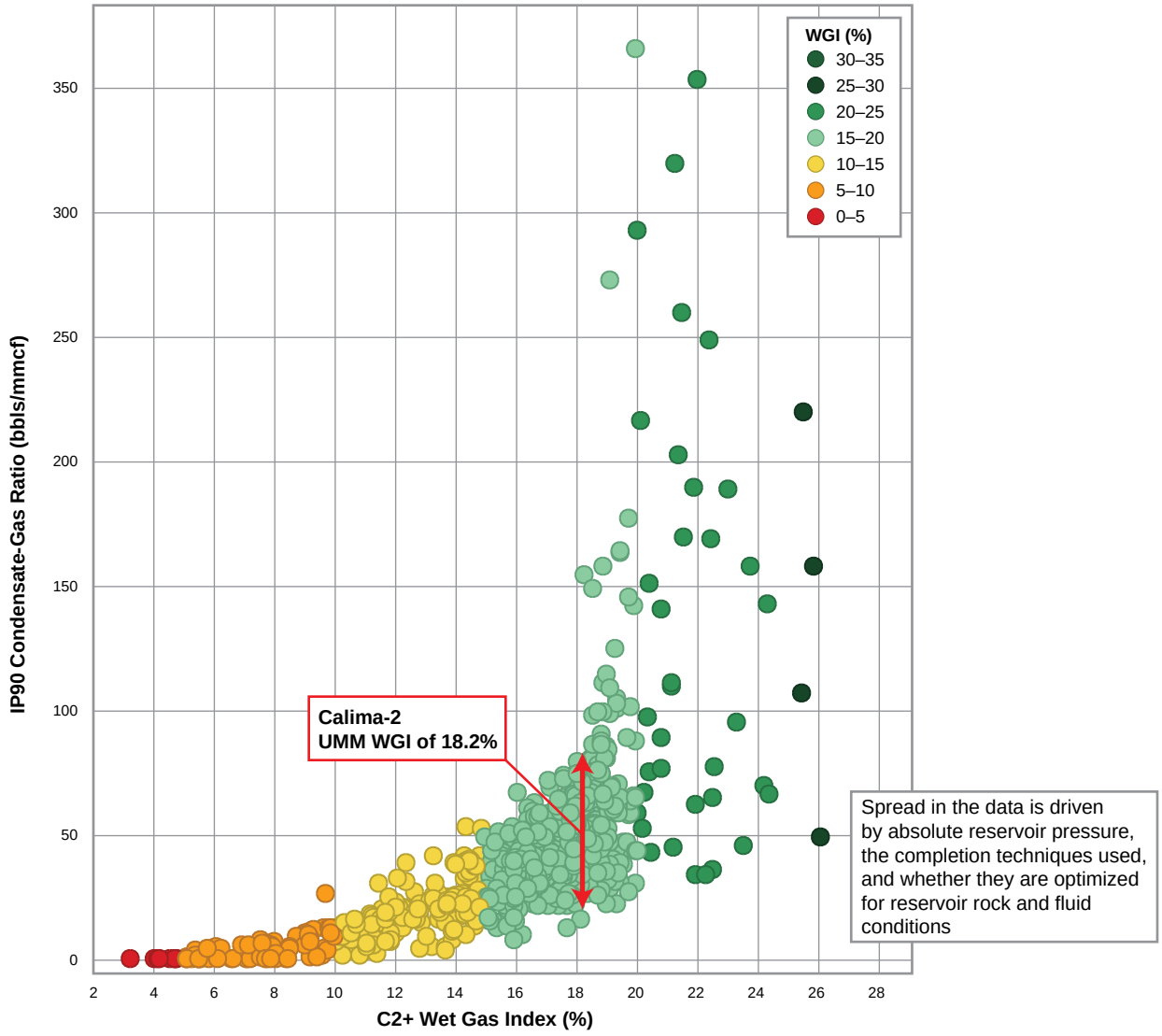


Data supplied by CDL's Fluids Database

The absence of any liquids production in the abbreviated Calima-3 flow test may be due to the high intensity (specifically the large injected fluid volume) of the completion used in the lower-pressured UM. The completions fluid pumped under high pressure essentially blocked off any immediate liquid flow from the UM into the welbore, and then slowly bled off into the formation, as evidenced by the gradual drop in wellbore pressure over the course of the shut-in period *(figure 10)* (Hawkes, 2020). The good news is that the wellbore pressure should now be in equilibrium with the UM, and a new, full duration flow test would provide a truer picture of the well's productivity. Going forward, the low pressure UM data, and aforementioned analogue well completion programs, suggest that lower intensity (and more capital-efficient) completions, using significantly less fluid volume than what was used in Calima-3, would be sufficient to successfully develop the UM in Calima's operating area.

Calima-3's target zone in the lower UM, based on examination of the equivalent core interval in

7 WGI vs CGR in the NE BC Montney (All Zones)

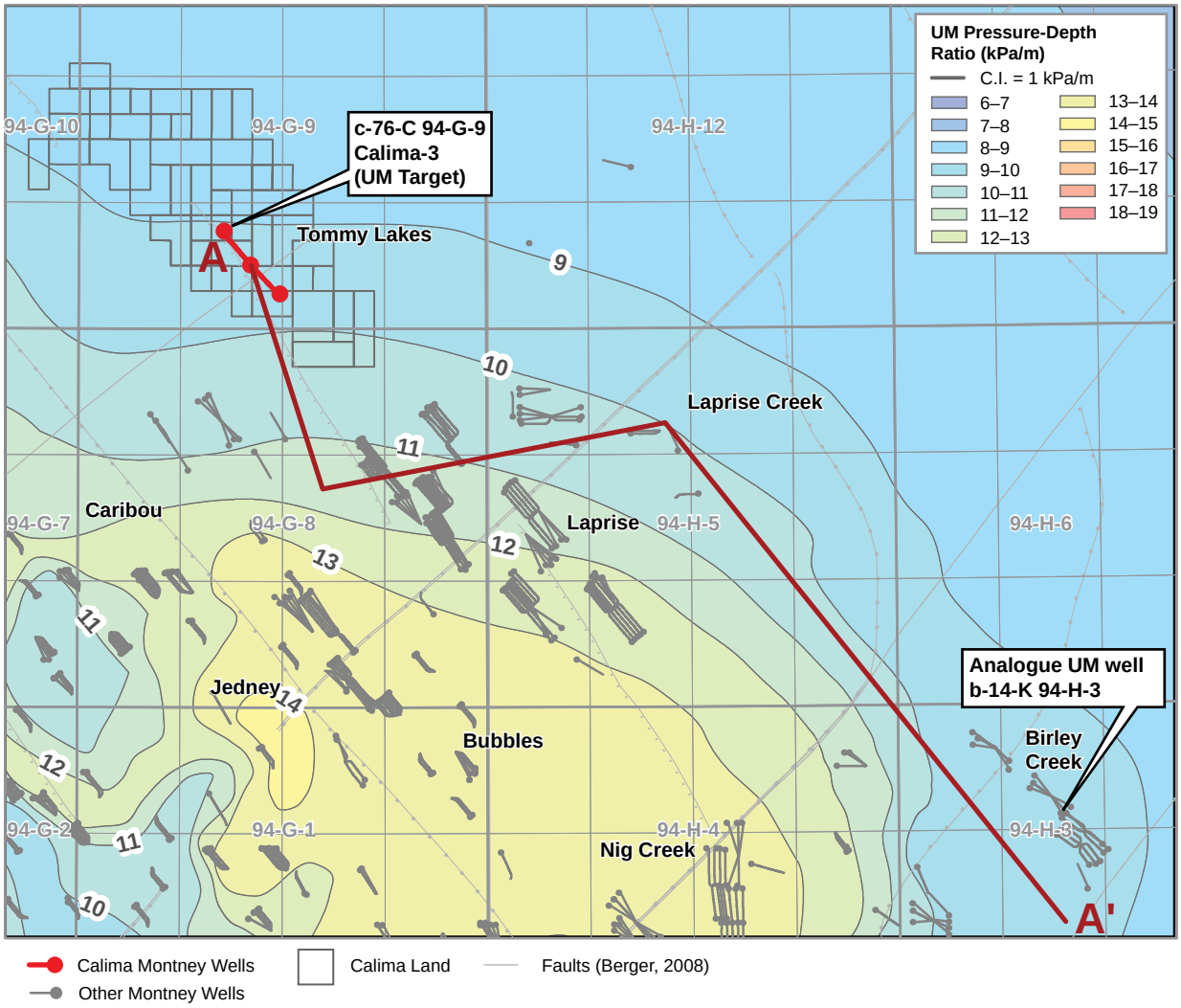


Data supplied by CDL's Fluids Database

Calima-1, consists of highly bioturbated, medium- to coarse-grained dolosiltstone with bituminous laminated interbeds and cm-scale coarser-grained "tempestite" beds, which resemble thin turbidites but more likely represent storm deposits (G. Davies, pers. comm.). These latter layers may serve as high permeability preferred pathways for hydrocarbon migration.

Calima-3 landed close to the UM/UMM contact, upon which sits an 8 cm thick conglomeratic lag. The interval immediately above the contact, in the Calima-1 core, shows signs of previous shear activity, with fibrous calcite veins and slickensided surfaces. It is unclear what, if any, effect such features have on well productivity if intersected by hydraulic fractures. Thin beds comprising bivalve fragments within a finer-grained matrix were also observed in core immediately below the UM/UMM contact, and are another example of discrete high-permeability zones that may have been accessed in Calima-3.

8 Upper Montney Pressure-Depth Ratio (kPa/m) Map



Data supplied by CDL's Fluids Database

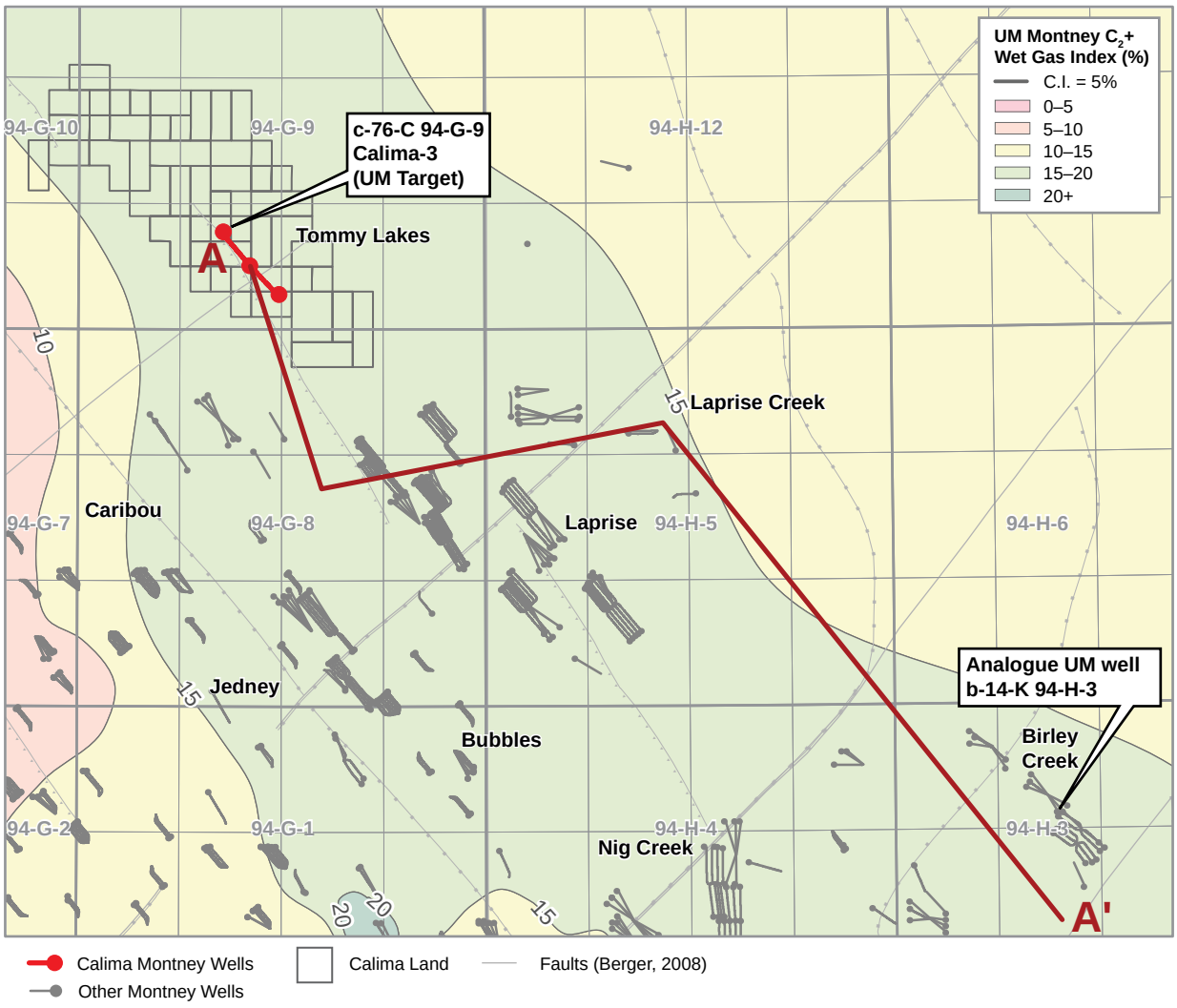
Porosity and permeability of the UM target zone, based on the Calima-1 core analysis, is similar to that of the UMM overall, with more variability between individual measurements. Samples range from 2 to 6% porosity and 0.007 to 0.11 µD permeability, averaging 3.9% and 0.04 µD respectively *(table 1)*.

Lower Montney Potential

Although not targeted by any of Calima's wells, the Lower Montney zone (comprising CDL's Lower Middle (LM) and Lower Middle Montney (LMM) units), or LMZ, represents approximately half the Montney section within Calima's land base *(figure 3)*. More representative of deeper water (and hence finer-grained) sediment deposition, the LMZ has, to date, seen far less development in northeast BC than UM/UMM targets. However, the LMZ intersected and sampled in Calima-1 (from 1,681 mKB to 1,813 mKB) presents some intriguing data.

A review of the Calima-1 gamma logs show that the lower Montney zones appear to comprise two major cleaning-upward sequences, with the

9 Upper Montney Wet Gas Index Map

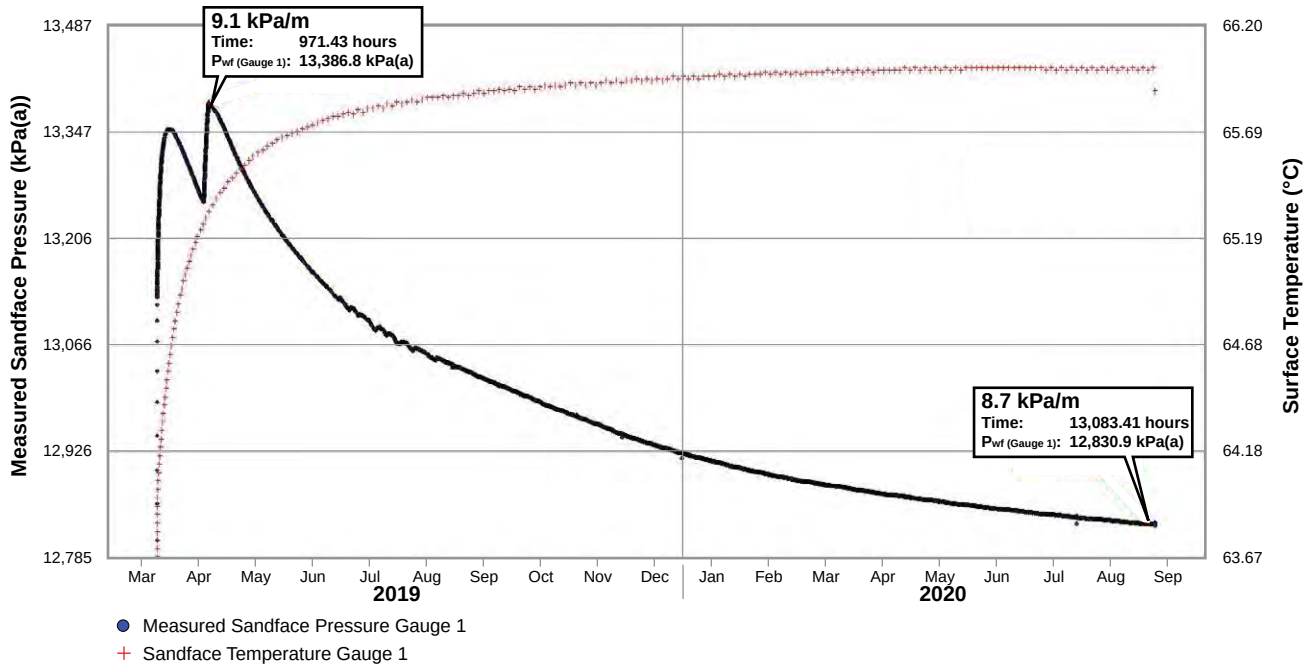


Data supplied by CDL's Fluids Database

boundary between the two at approximately 1,751 mKB MD *(figure 3)*. While the density porosity log does not reflect any appreciable changes near or at the sequence boundaries, neutron porosity readings gradually decrease upwards in each of the two intervals, possibly representing the presence of hydrocarbons. This is supported by a concurrent increase in resistivity readings *(figure 3)*, as well as higher mud log gas readings than the shallower target zones (600 vs. 300–400 units). The closest productive LMZ well to Calima is Saguaro's 2/c-92-G 94-G-8/2 *(figure 5)*, which targeted the top of the lower cleaning-upward sequence. It accumulated 398 mmcf gas, 12.5 mbbls condensate and 10.4 mbbls water between March 2014 and October 2017, based on public data. Mapping shows that the LMZ in Calima's lands may be slightly lower pressured (12–13 kPa/m vs 13–14 kPa/m) but has a similar WGI (15–20% C_2+) to the 2/c-92-G well *(figures 11 and 12)*.

Visual core analysis reveals that, compared to the UM and UMM, the LMZ is finer-grained overall, but contains numerous cm-scale, coarser-grained,

10 Calima-3 Shut-In Pressure and Temperature Plot



Modified from Hawkes, 2020

variably laminated and bioturbated "event beds" which include both tempestites and thin turbidites. The proportion of these event beds increases toward the top of each of the two cleaning-upward sequences. Porosity and permeability in the lower Montney as determined from core are similar to that measured in the Calima-2 and -3 target zones *(table 1)*, averaging 5% and 0.07 microdarcies, respectively, but water saturation is markedly higher.

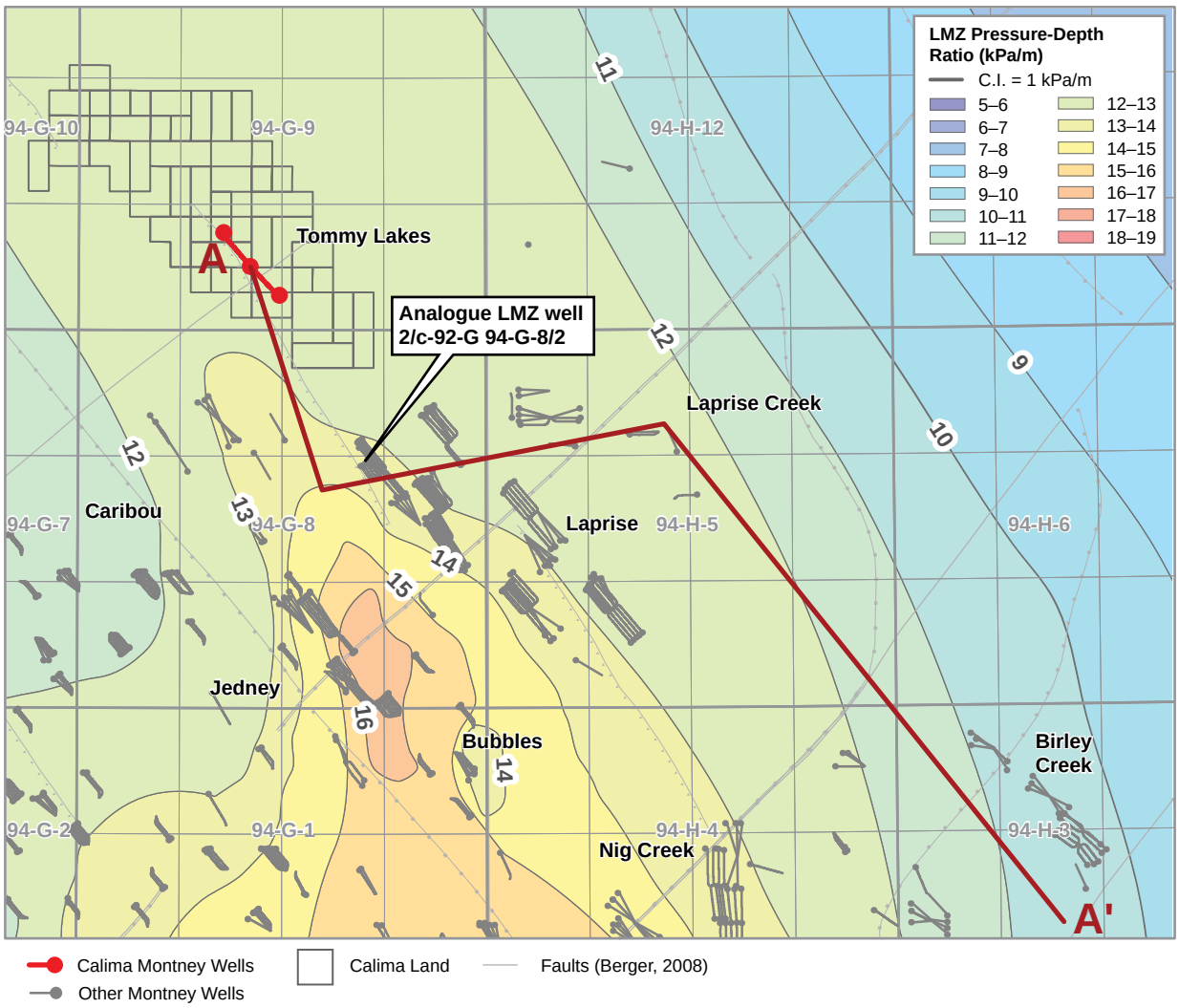
Looking Ahead

As of November 2020, Calima holds approximately 26,000 ha of Montney P&NG rights *(figure 2)*, over half of which have been converted to leases with expiry dates no earlier than June 2029. Combining this land base with the company's recent acquisition of infrastructure at Tommy Lakes, and receipt of approval to construct pipeline from its recent wells to that infrastructure (Calima, 2020b), Calima is well positioned to build significantly on its current Montney development.

Conclusions

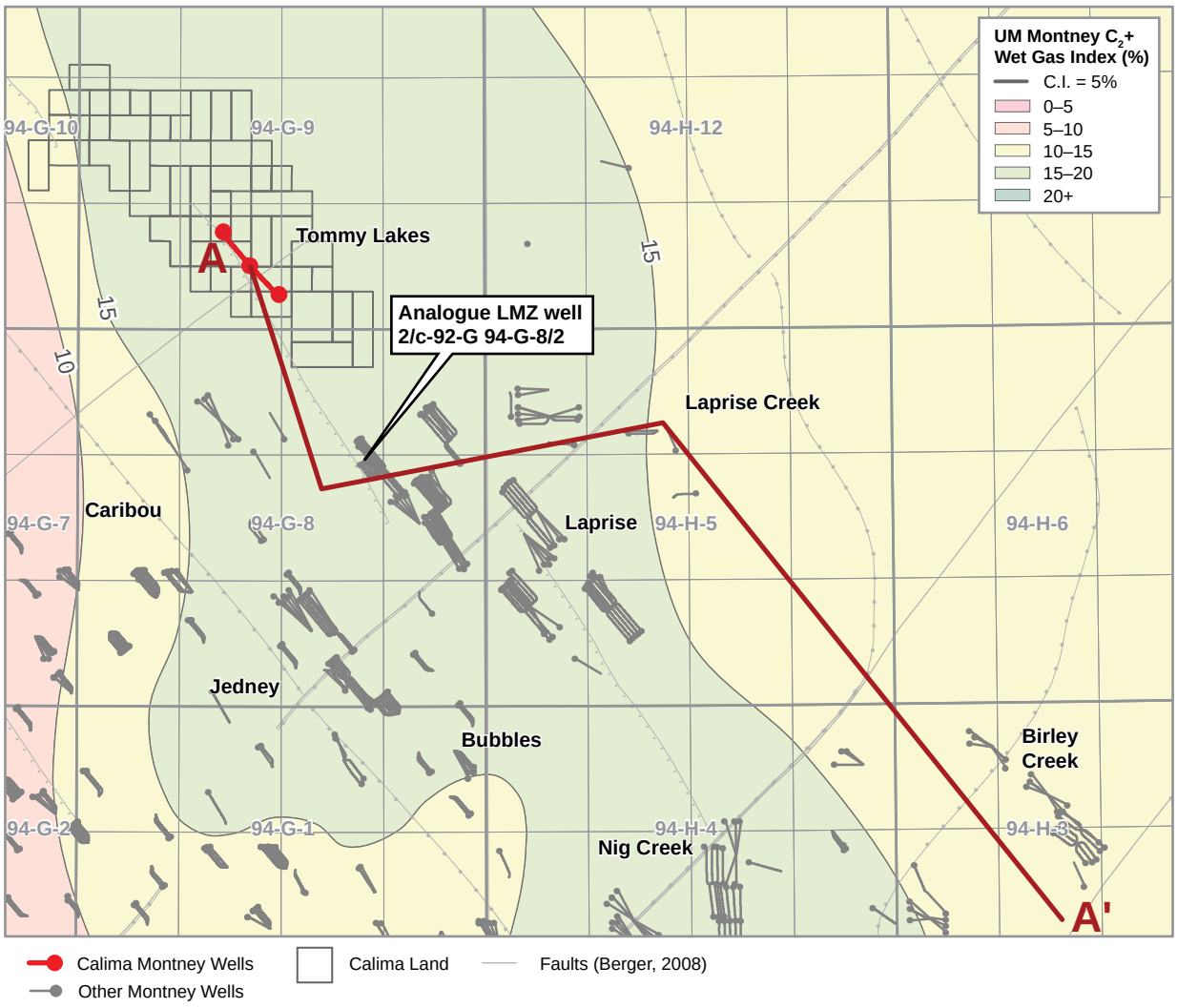
Pressure and flow test results from the Upper Middle Montney in Calima-2 and the Upper Montney in Calima-3, in addition to core analysis from Calima-1, indicate the presence of high-productivity Montney zones at the northern edge of the current Montney fairway. Regional mapping and the production history of analogue wells at Laprise and Birley Creek also point to Calima's wells becoming strong performers. While not tested, lower Montney intervals, based on core and log analysis from Calima-1, represent a potential resource that to date has been underdeveloped elsewhere in northeast BC.

11 Lower Montney Zone Pressure-Depth Ratio (kPa/m) Map



Data supplied by CDL's Fluids Database

12 Lower Montney Zone Wet Gas Index Map



Data supplied by CDL's Fluids Database

Canadian Discovery Related Technical Studies

- Lower Montney Project (LMP1), in progress.
- Full Montney Package (MNIR), 2020.
- Montney Hydrodynamics Project III (MRHS-III), 2019.

Selected References

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