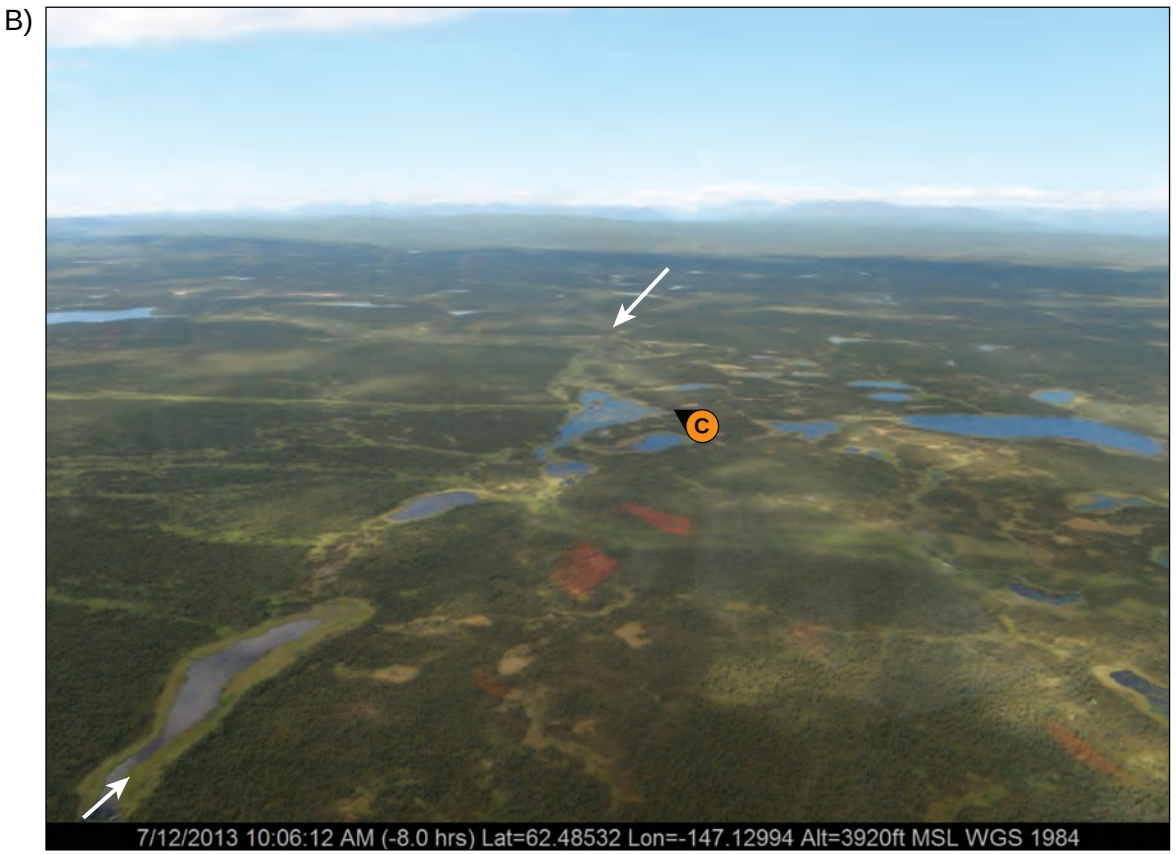




View looking west-southwest toward linear alignment of lakes. Arrows point along lineament. Note kettle lake terrain in the foreground.



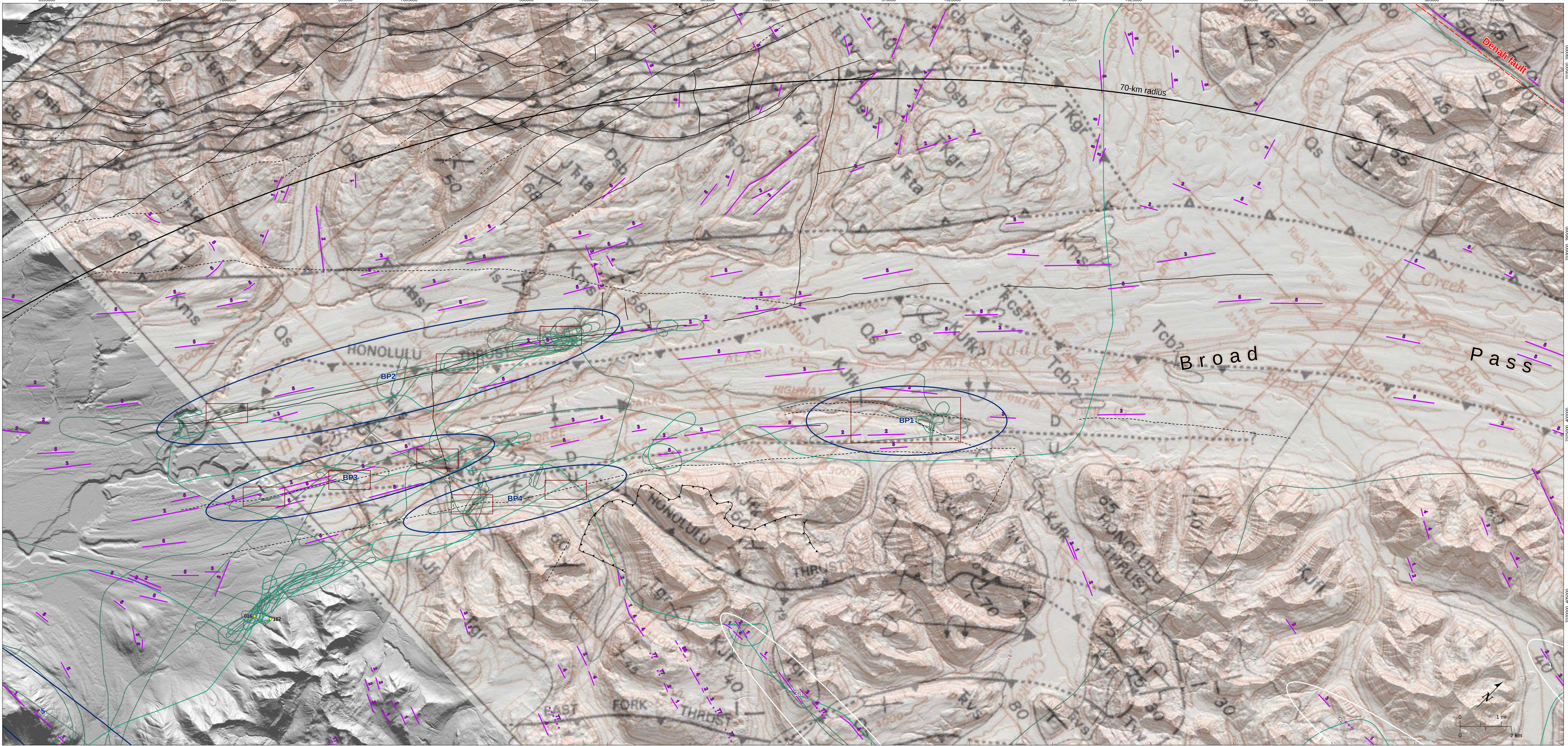
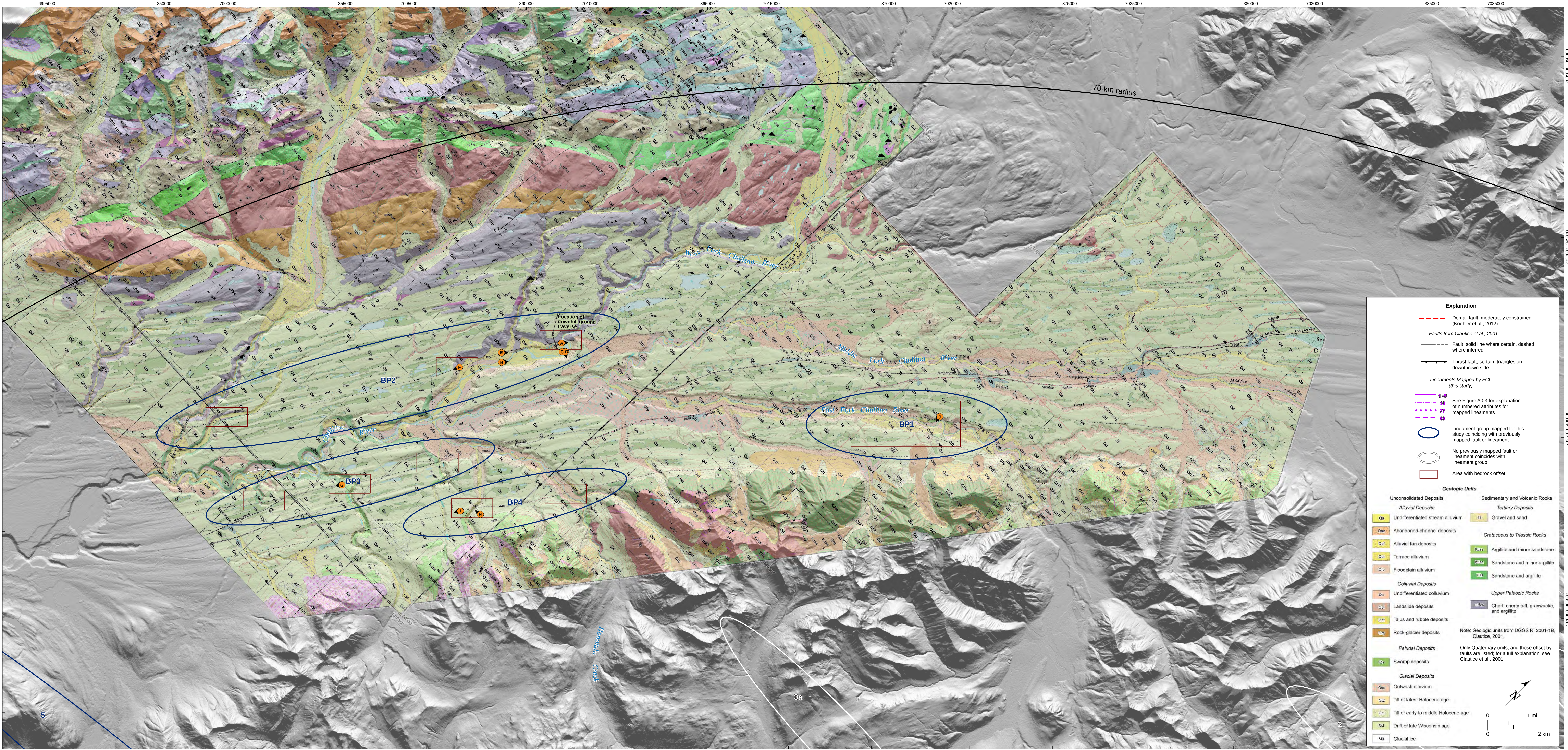
Close up view looking west-southwest along linear alignment of lakes in Photograph A. Arrows point along lineament.



View looking south across strong vegetation lineament associated with a ~2-meter-high linear ridge. Note that topographic expression of ridge abruptly dies out and does not continue to the west.



View looking northeast along south side of vegetation lineament and ~2-meter-high linear ridge shown in Photograph C. Positive feedback of vegetation growth and organic matter accumulation on the linear ridge may accentuate the apparent relief of the ridge.

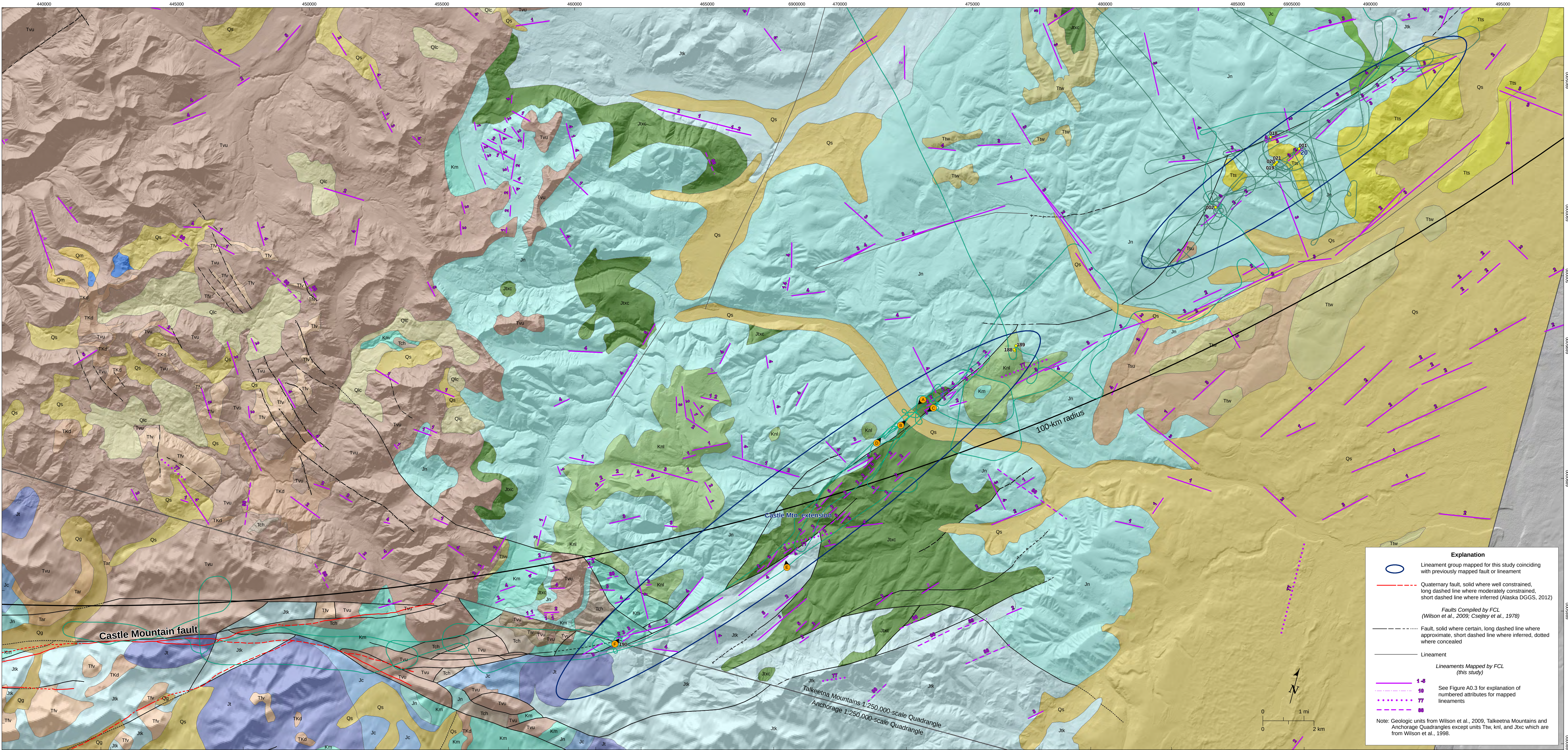


Notes: 1. See Figures A0.2, A0.3, A0.4, and A0.5 for explanation.
2. Data frames have been rotated 45° west of north.
3. Geologic map by Claustre et al., 2001 (top).
4. Coordinates on NAD83 UTM Zone 8 North meters.
5. Elevation from INSAR data.

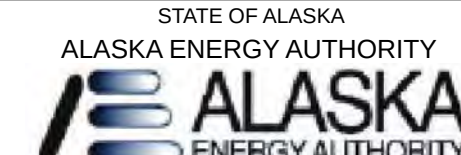


SUSTINA-WATANA HYDROELECTRIC PROJECT
Broad Pass Area

Plate A-BP

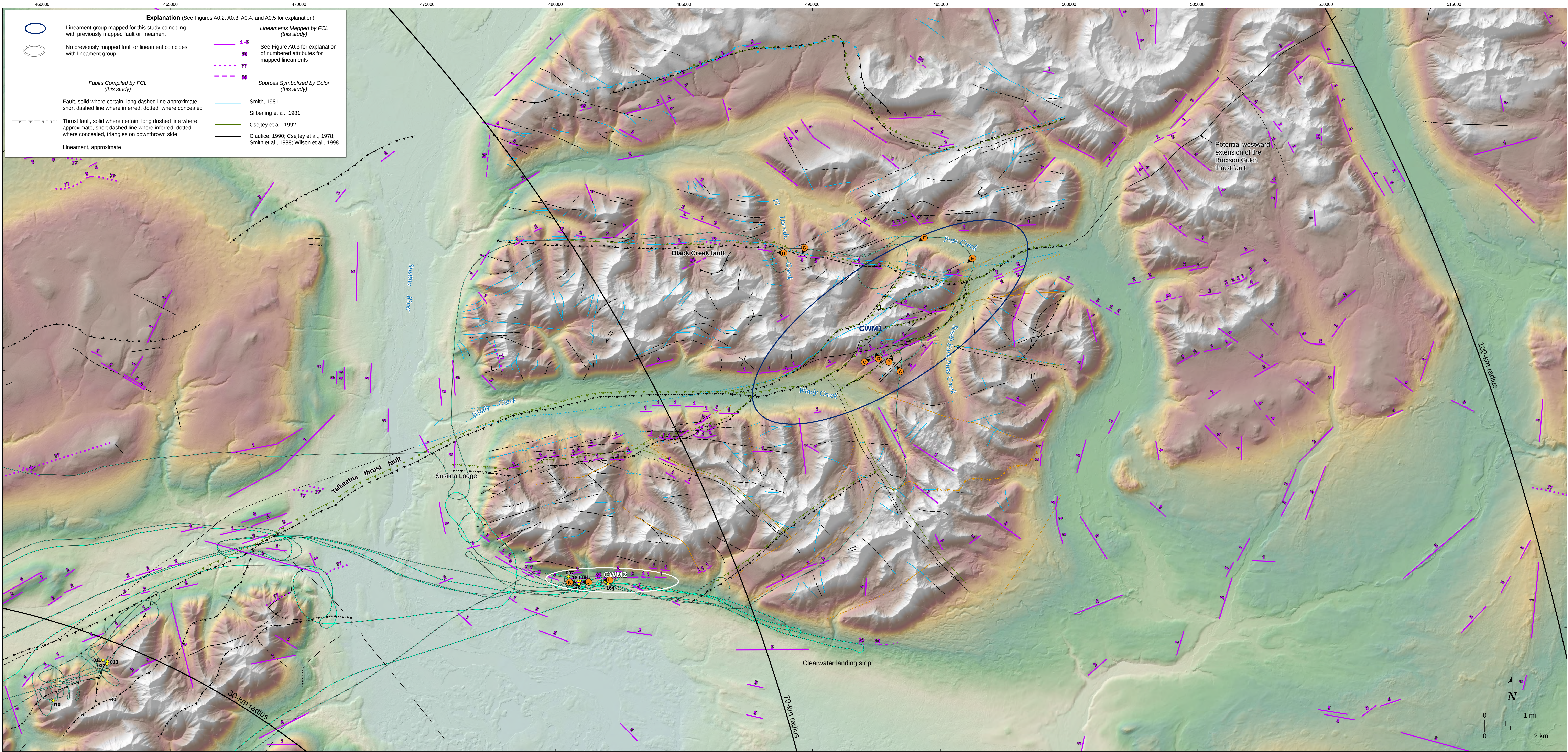


Notes: 1. See Figures A0.2, A0.3, A0.4, and A0.5 for explanation.
2. Data frames have been rotated 15° east of north.
3. Geology by Wilson et al., 2009
4. Coordinates on NAD83 UTM Zone 6 North meters.
5. Elevation from INSAR data and USGS SRTM data.



SUSTITNA-WATANA HYDROELECTRIC PROJECT
Castle Mountain Extension Area

Plate A-CME

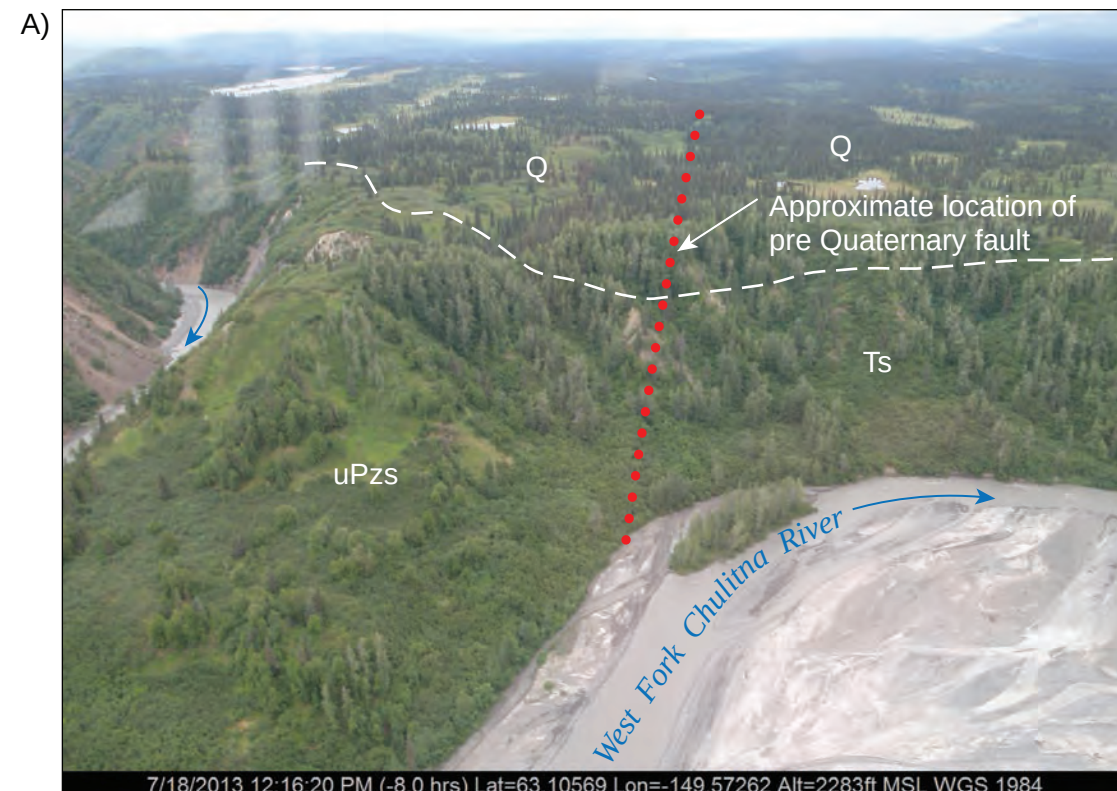


Notes: 1. See Figures A0.2, A0.3, A0.4, and A0.5 for explanation.
2. Coordinates in NAD83 UTM Zone 6 North meters.
3. Elevation from INSAR data



SUSITNA-WATANA HYDROELECTRIC PROJECT
Clearwater Mountains Area

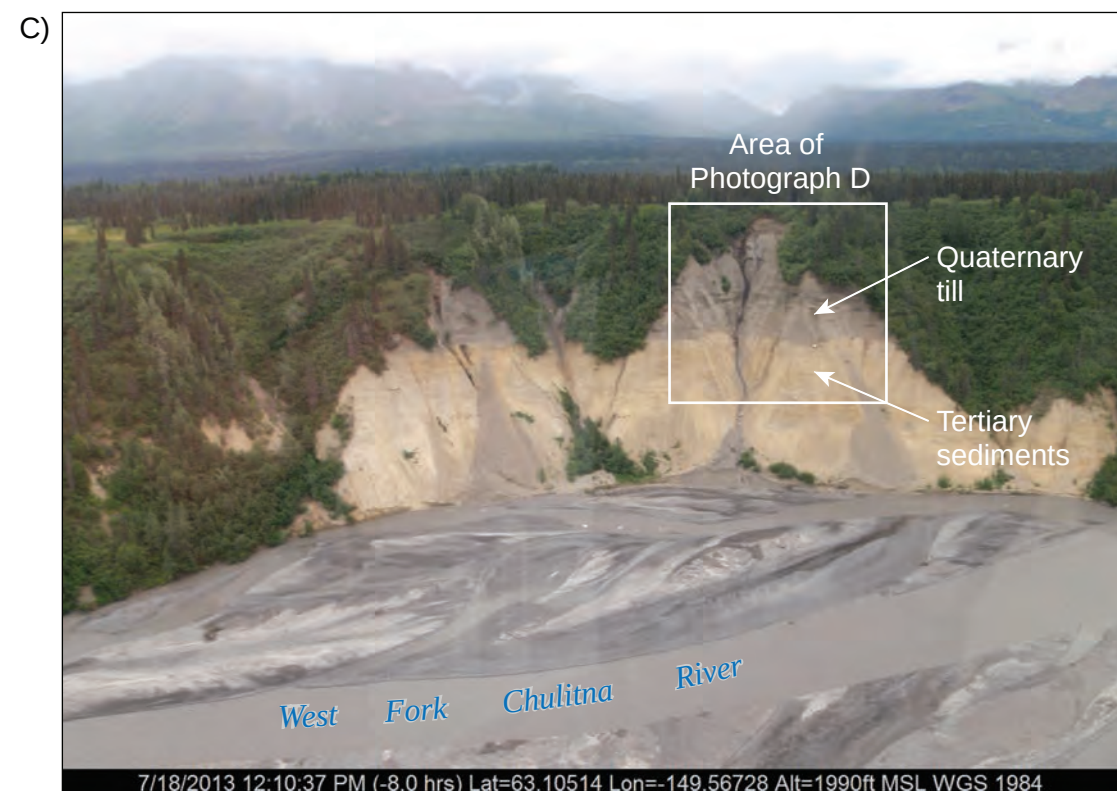
Plate A-CWM



View looking north at location where mapped fault would traverse across Quaternary sediments.



View looking north (upstream) along the West Fork Chulitna River valley at exposures described in text and photographs below.



View looking west at exposure along east bank of the West Fork Chulitna River demonstrating Quaternary till overlying Tertiary fluvial sediments.



Close up view of exposure shown in Photograph C. Basal contact between overlying till and underlying fluvial deposits appears to be sub-horizontal.



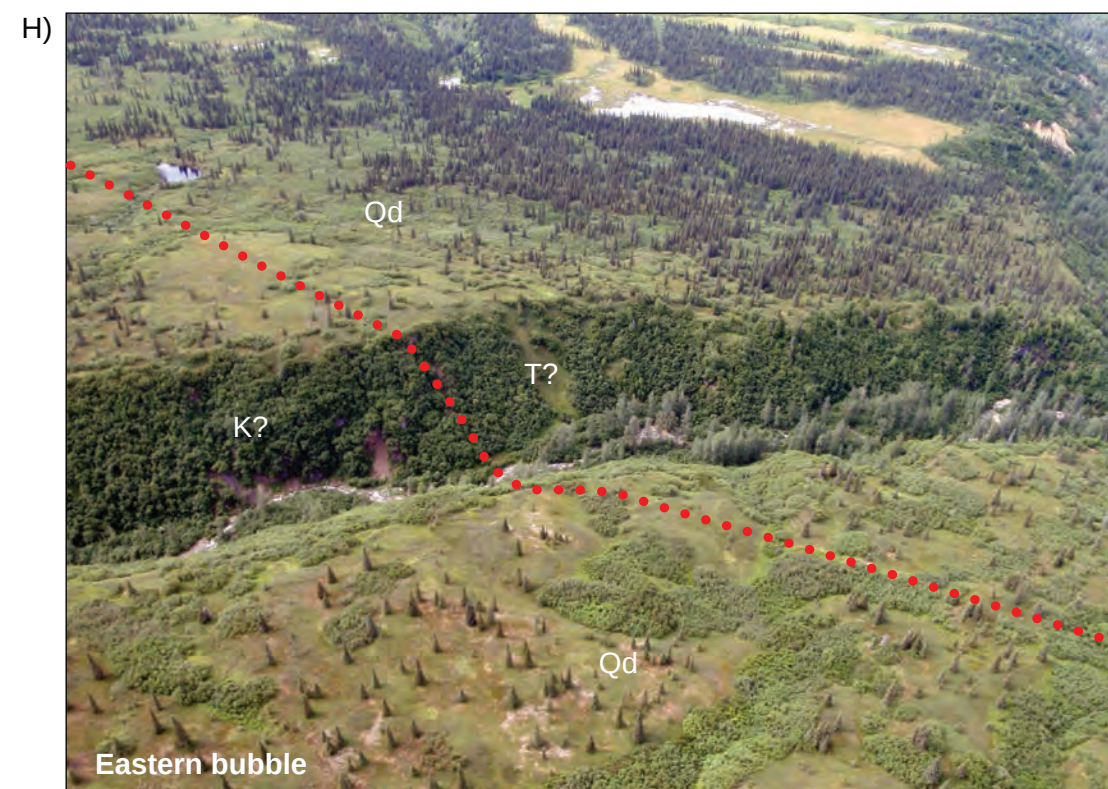
View looking northeast at subhorizontal contact between till and Tertiary sediments.



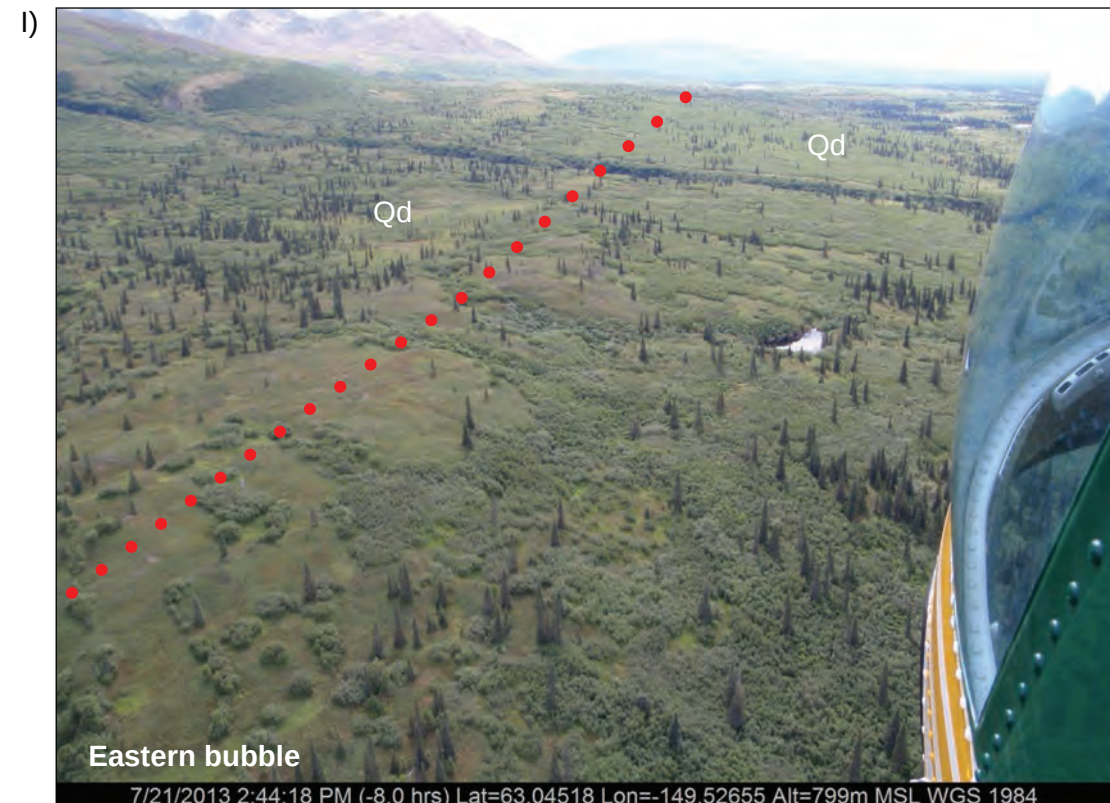
View looking south along Quaternary surface directly south of river valley. Marshy Quaternary sediments show no evidence of deformation or offset.



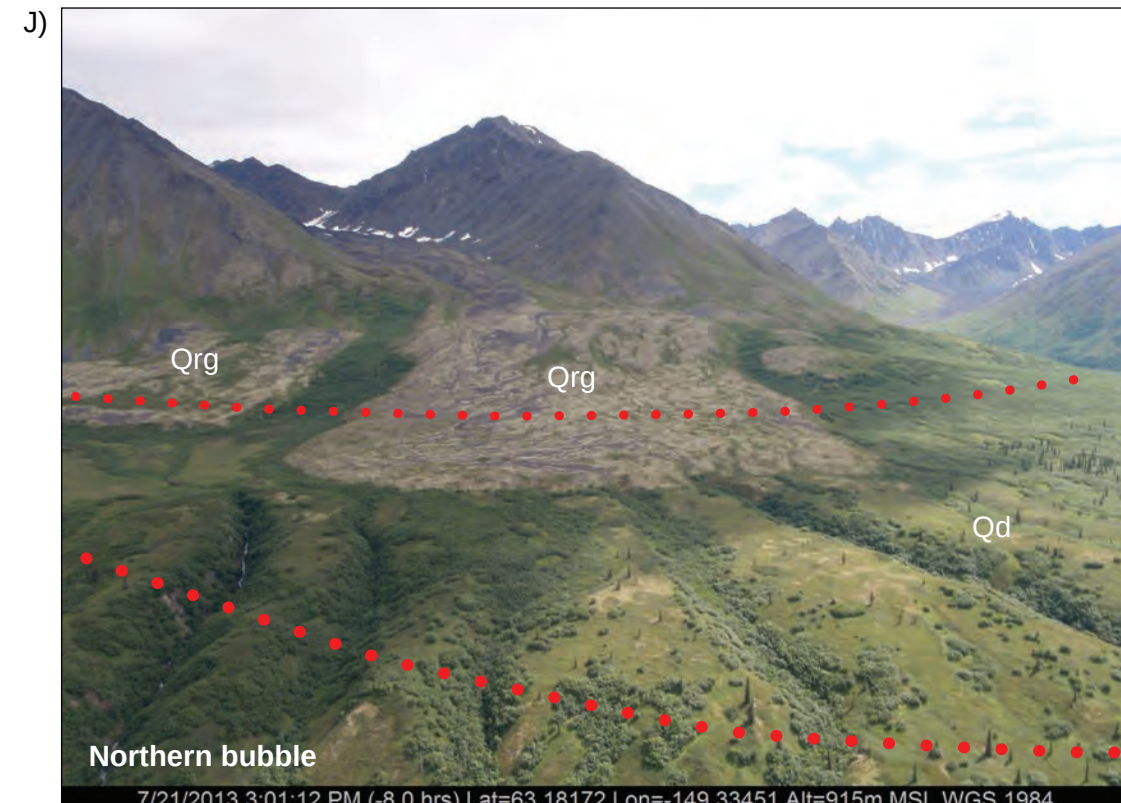
View looking south at location where inferred fault would traverse east of railroad tracks. Fault is mapped as juxtaposing Triassic and Cretaceous rocks outcropping in creek behind photograph. No evidence of faulting in Quaternary deposits.



View looking west at creek exposure along projection of mapped fault that depicts Cretaceous/Tertiary juxtaposition. Undisturbed surfaces support absence of Quaternary faulting.



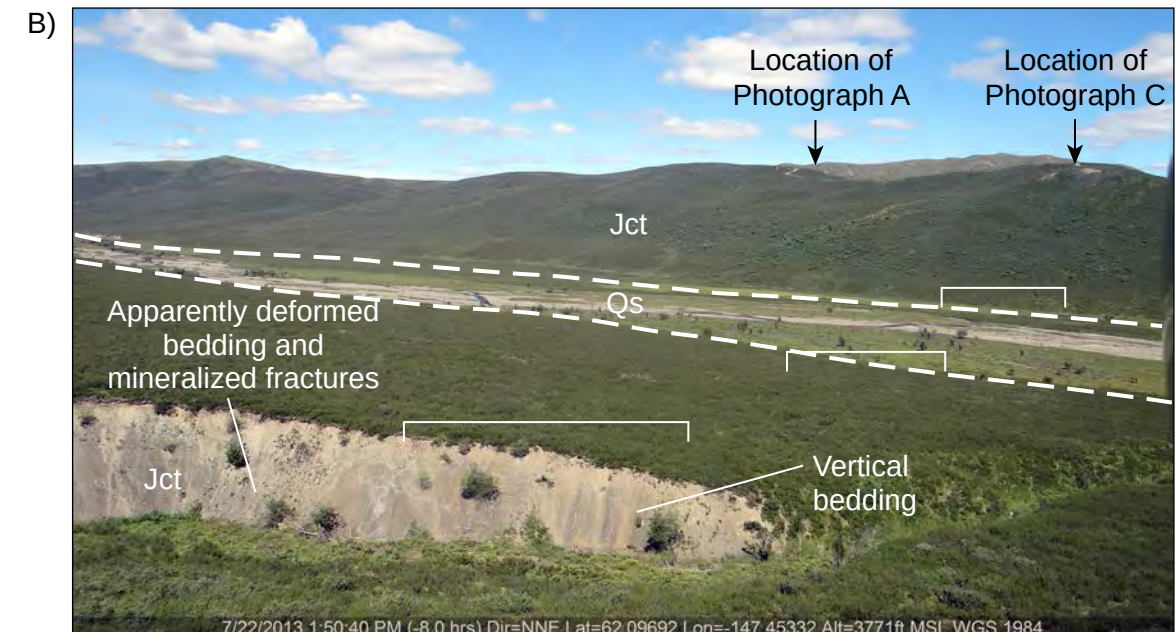
View looking west at creek exposure shown in Photograph H, Figure A-BP.2, showing morphology of Quaternary deposits along strike.



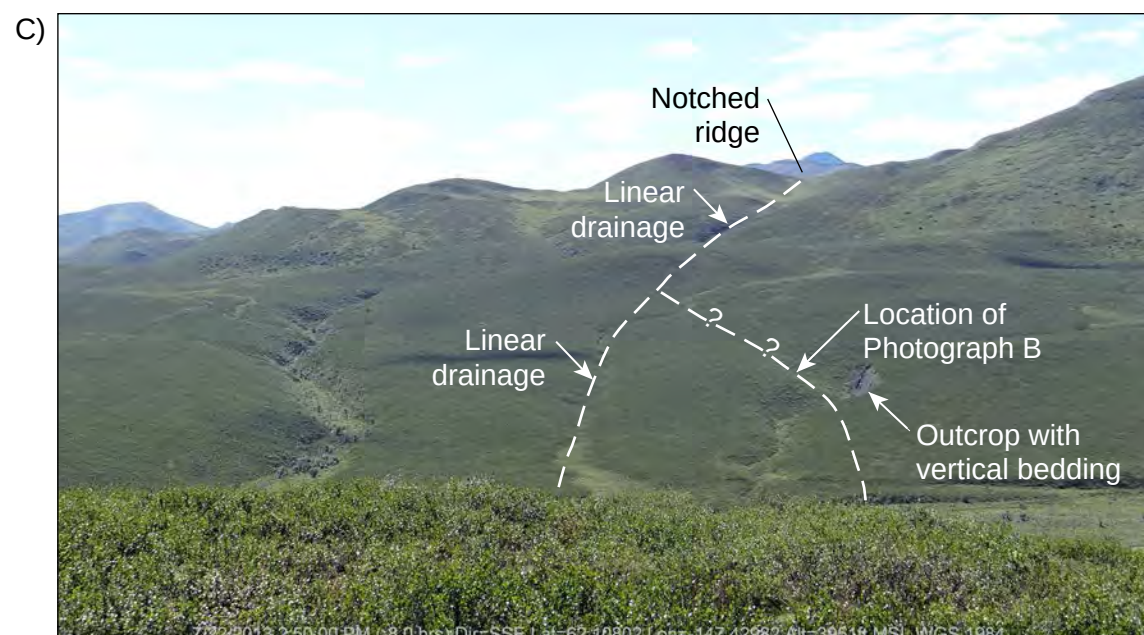
View looking east at uninterrupted interfluvies in dissected Quaternary glacial drift along with the mapped fault projects. Undisturbed surfaces support absence of Quaternary faulting.



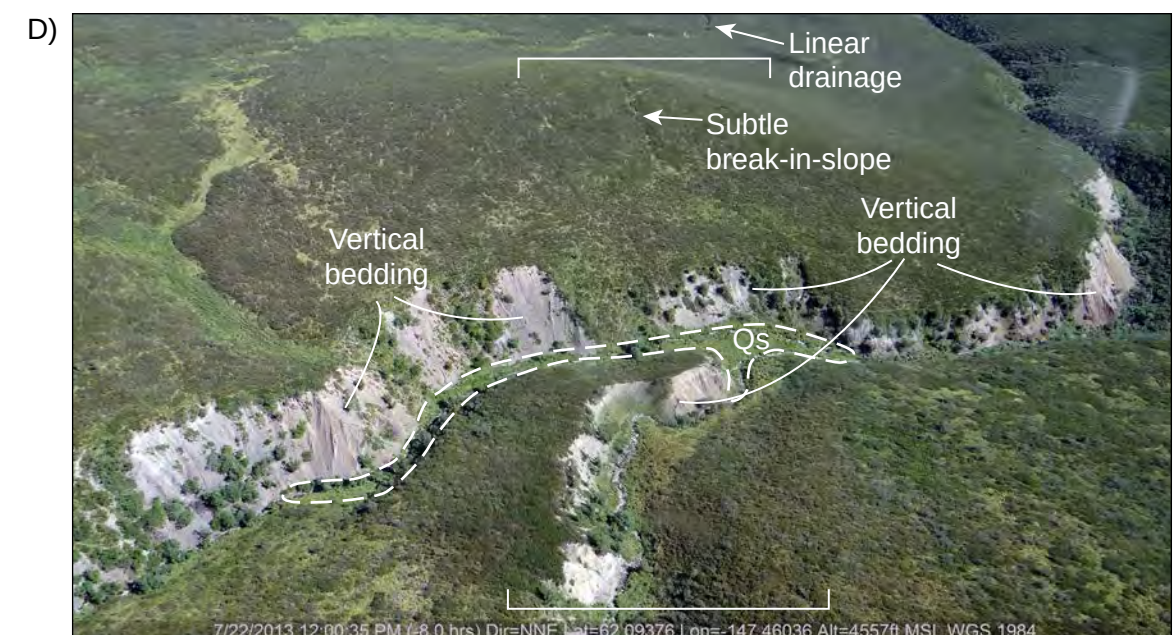
View looking southwest from location A, nearly along-strike with Csejtey et al. (1978) mapped faults. Note clear expression of linear features on bedrock landscape and absence of linear expression in Quaternary deposits.



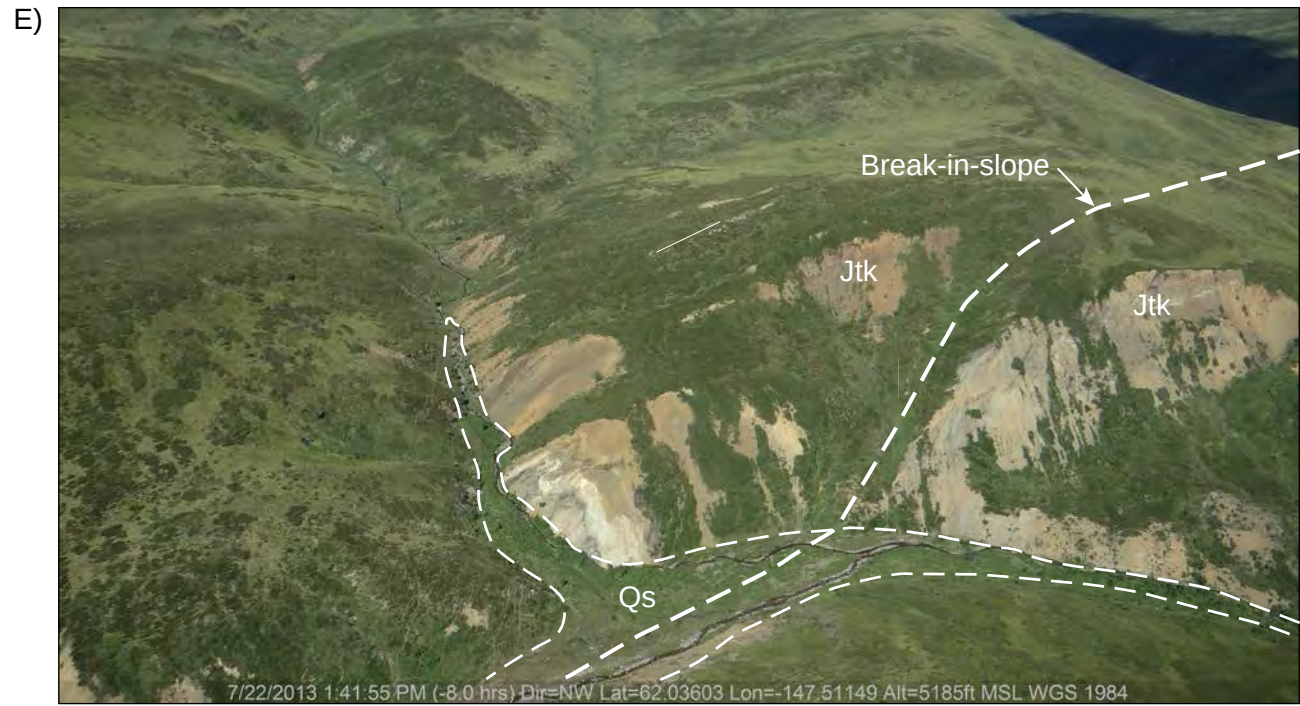
View looking northeast from location B nearly along-strike with Csejtey et al. (1978) mapped fault. The mapped fault segment projects through the vertical beds observed in the outcrop towards photograph location C. Note apparent undeformed hillslope and Quaternary deposits over projected trace of fault.



View looking southwest from location C. Note alignment of features over mapped trace of fault.



View looking northeast from location D along-strike with a Csejtey et al. (1978) mapped fault. A wide zone of deformation is expressed as vertical bedding exposed in outcrops. Note alignment of the break-in-slope on ridge crest, linear drainage, and the deformation zone.



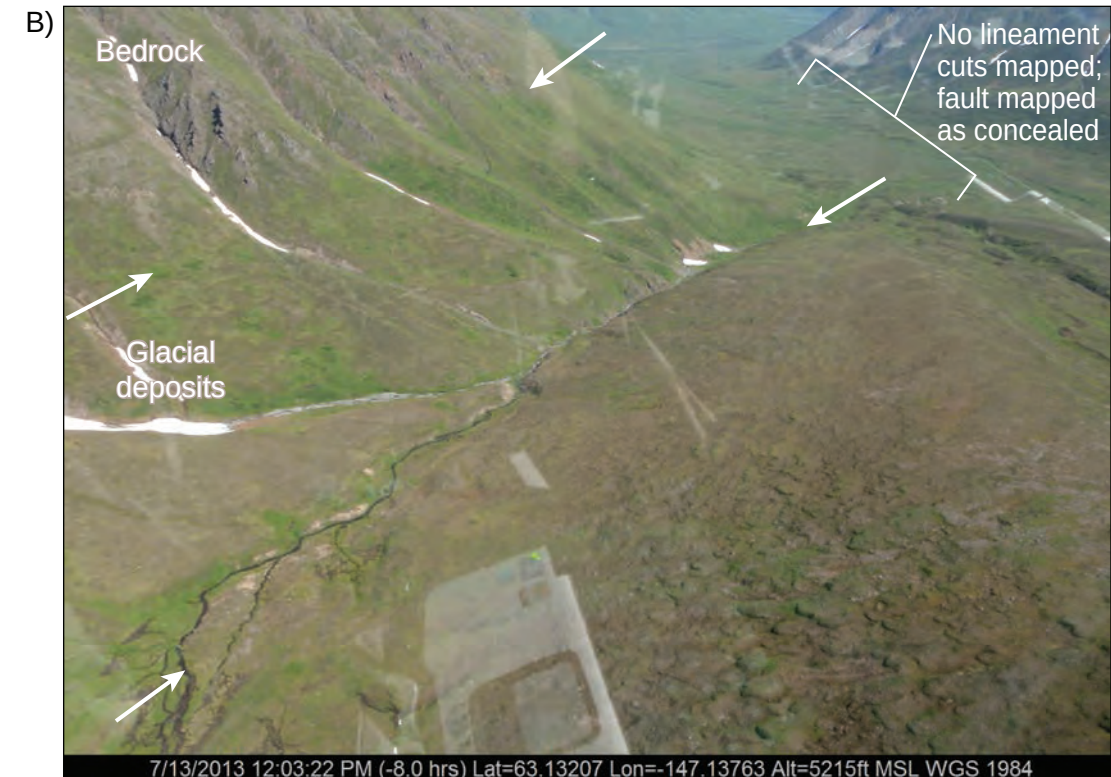
View looking northwest from location E at faulted Jurassic units. The fault occupies the linear valley then climbs the hill-slope where it correlates with a clear break-in-slope on the ridge crest.



View looking north-northeast from location F. The fault juxtaposes Cretaceous against Jurassic bedrock and coincides with a break-in-slope on each ridge crest.



View looking northwest at mine site located along apparent rock type contrast and mapped fault. Arrows point along mapped fault.



View looking northeast along linear drainage mapped as a lineament by FCL that coincides with a mapped fault. Another FCL-mapped lineament lies at the subtle break-in-slope and may correspond to the ice limit elevation.



View looking northeast through the broad saddle at the head of the linear drainage shown in Photograph B. Note the absence of any tectonic geomorphic features.



View looking northwest at location of FCL-mapped lineaments and mining roads partly shown in Photograph C. Note that FCL-mapped lineaments on the sidehill are not readily apparent and correspond to subtle break-in-slope like that shown in Photograph B.



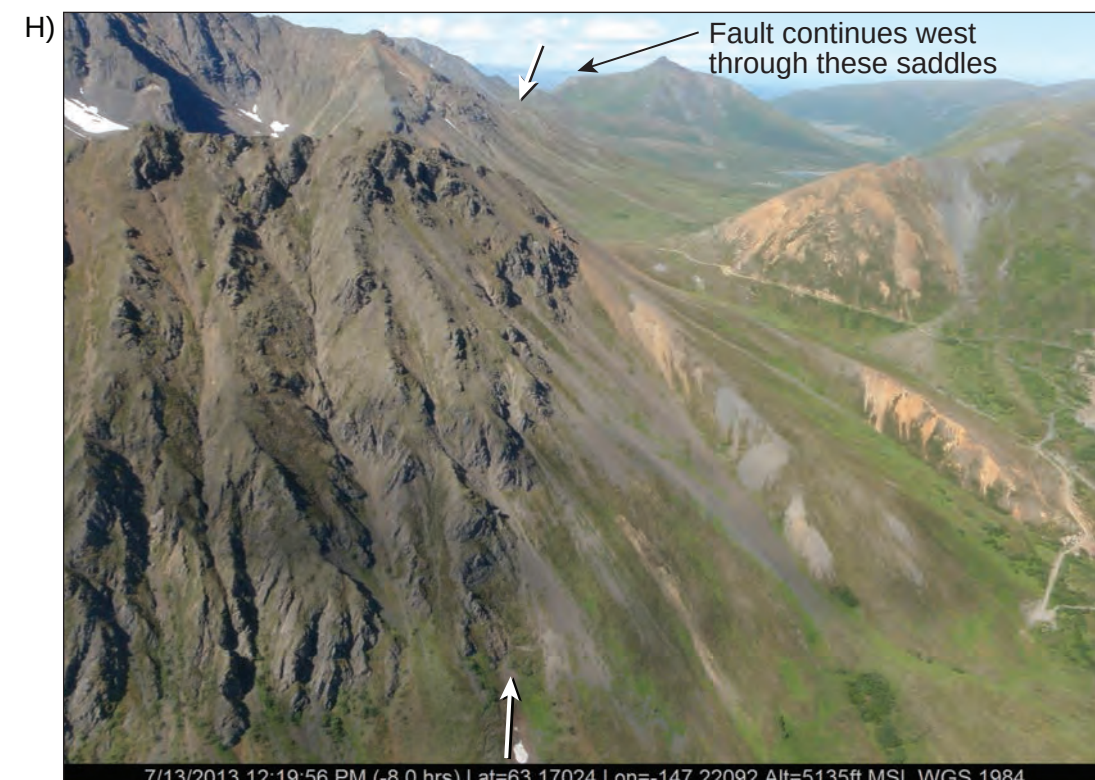
View looking southwest at several rock type contrasts (shown by arrows) that coincide with previously mapped faults.



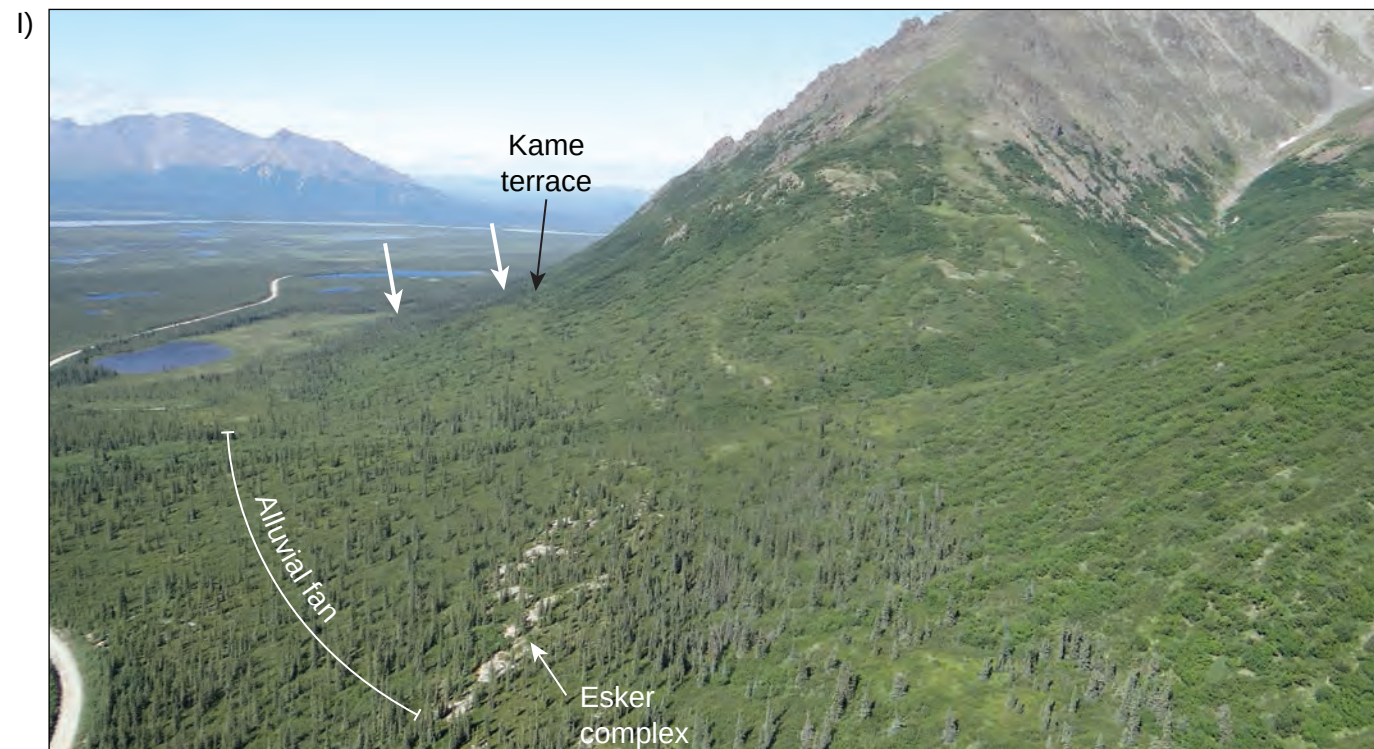
View looking south-southwest up glaciated valley that shows no expression of the mapped Black Creek fault that is present in adjacent bedrock ridges.



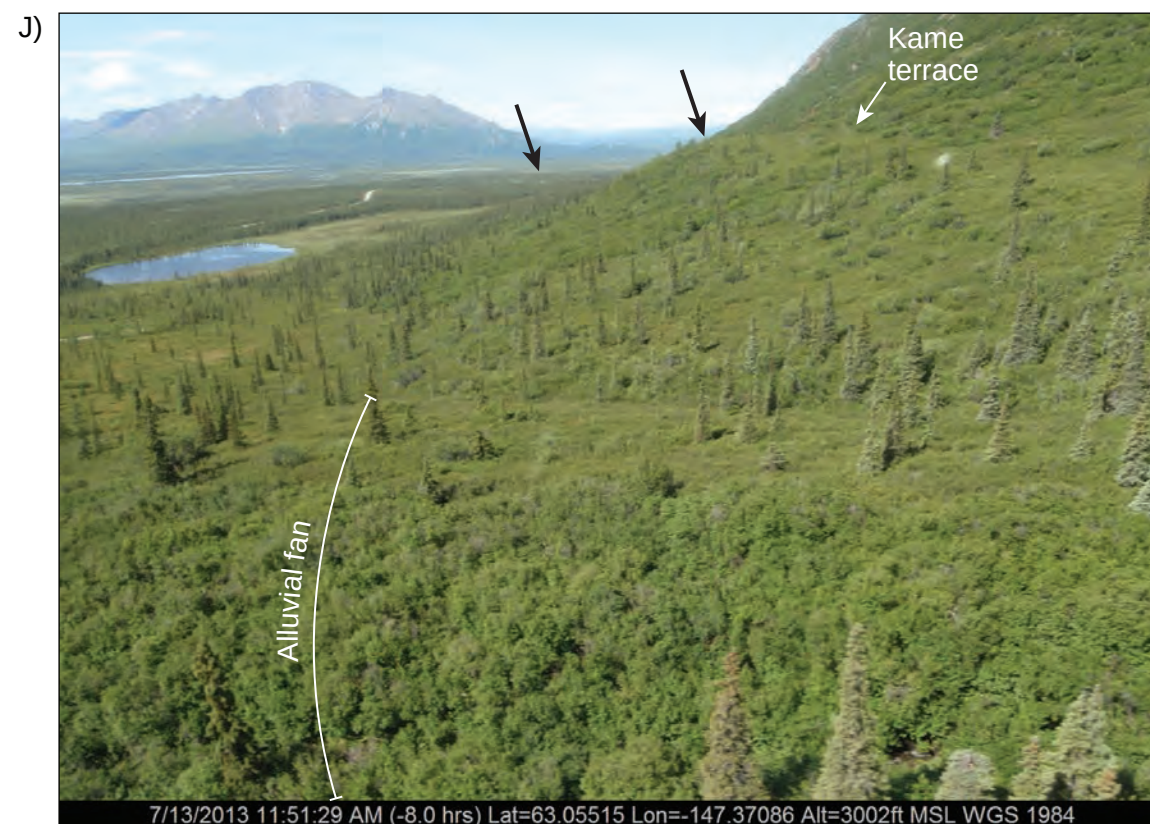
View looking southwest across an FCL-mapped lineament that corresponds to the trace of mapped Black Creek fault marked by a rock contrast. Note that no expression of faulting exists along trend in the glacial sediments of the valley floor.



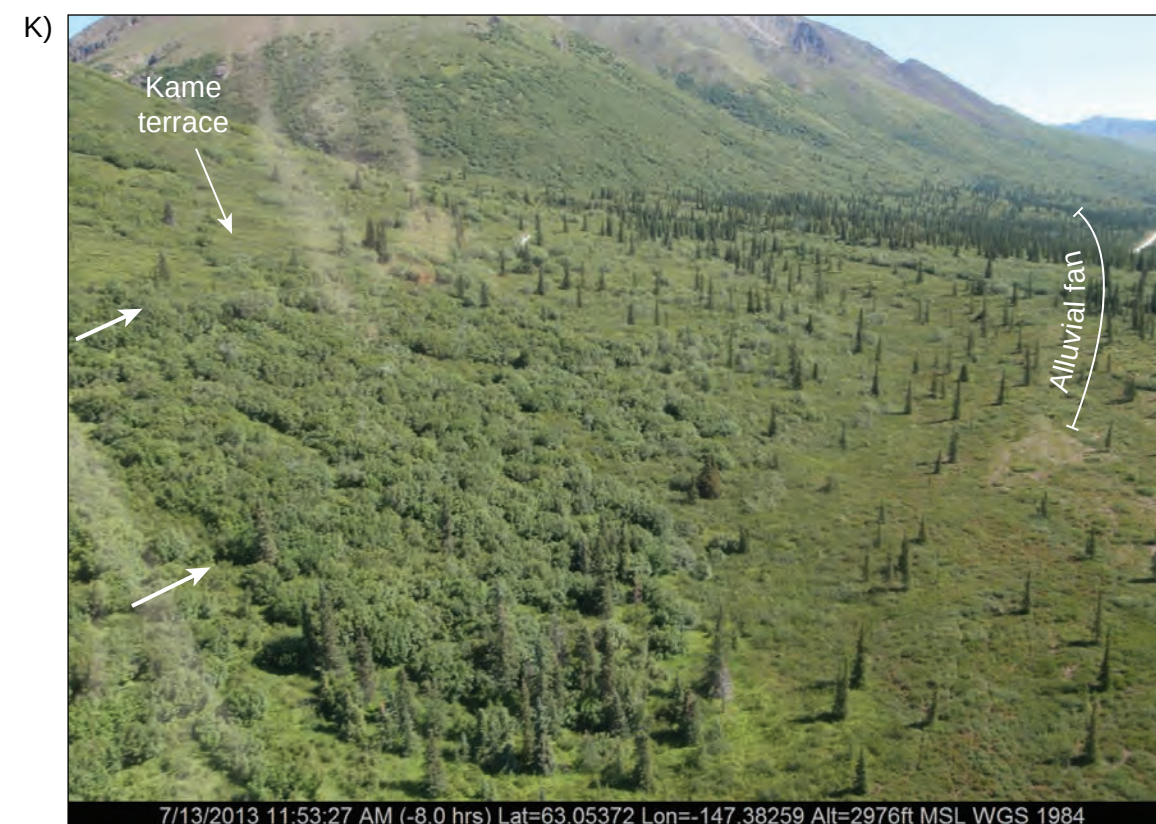
View looking west along the Black Creek fault. Note the obvious rock type contrast across the fault. Aerial reconnaissance confirmed the presence of the fault in bedrock ridges to the west and the lack of expression in glacial sediments in adjacent valley bottoms.



Overview looking west along mapped FCL-mapped lineaments that coincide with left-lateral moraines and kame terraces. The lineaments are interrupted by an alluvial fan and esker complex. Large arrows point along the mapped lineaments.



Close-up view looking west along FCL-mapped lineaments.



Close-up view looking east along FCL-mapped lineaments.

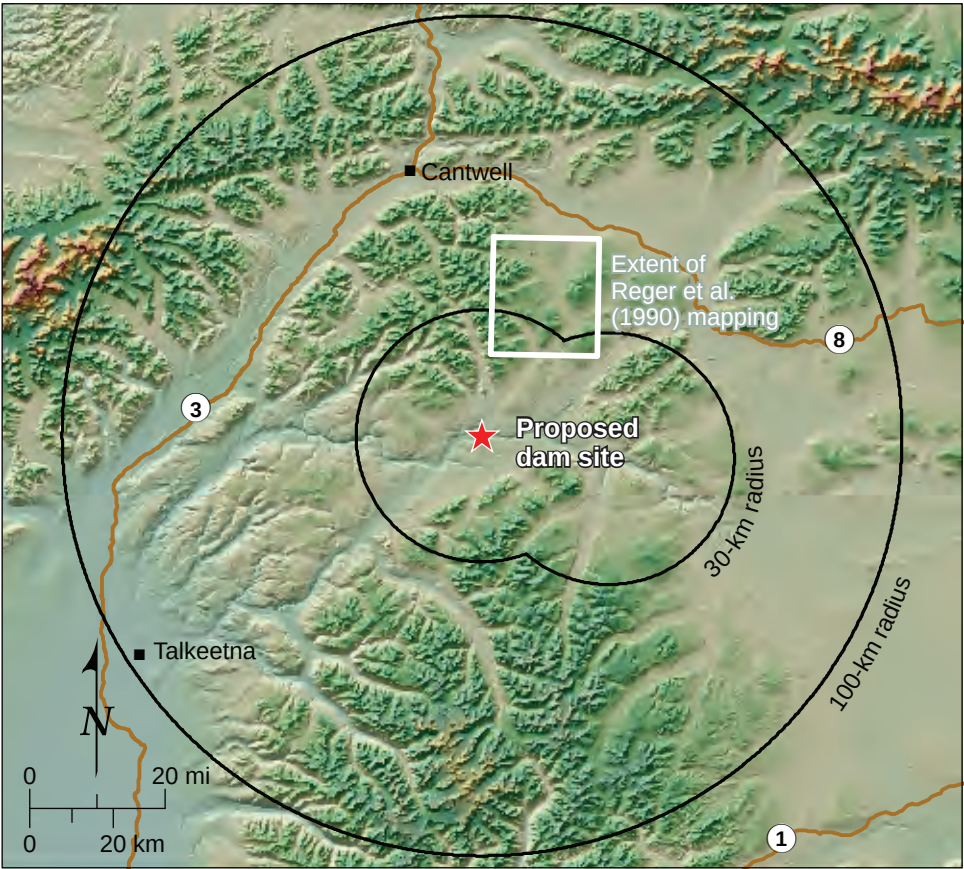
**Appendix B:
Strip Maps and Photographic Documentation
of Lineament Data for Lineaments Mapped by Reger et al. (1990)**

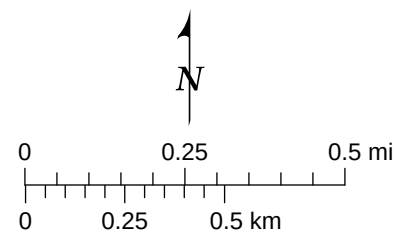
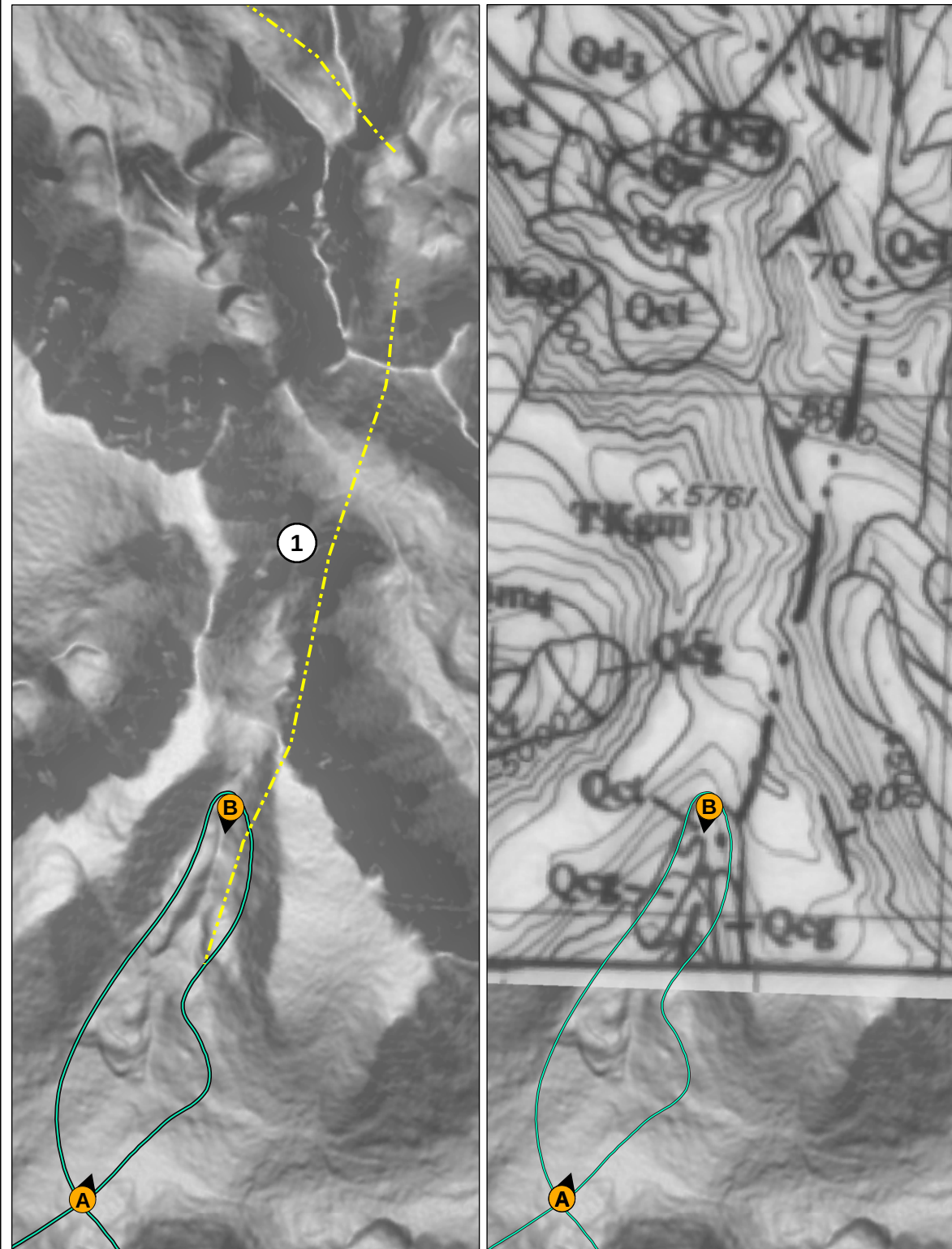
79_218900_Alaska_Railbelt/2189_Lineament Report October 2013. modified 12.19.13



- Explanation**
- ① Feature ID
 - GPS track
 - 21a** No previously mapped fault or lineament coincides with lineament group
 - Features (Reger et al., 1990)*
 - Photo lineament
 - Fault (dashed where inferred)

Feature Number	Appendix B Figure Number
1	B-02
2	B-03
3	B-04
4	B-05
5	B-05
6	B-06
7	B-07a, B-07b
8	B-07a, B-07b
9	B-08
10	B-09a, B-09b
11	B-10
12	B-10
13	B-11a
14	B-11a
15	B-11a, B-11b
16	B-11a, B-11b
17	B-12a
18	B-12a, B-12b
19	B-12a, B-12b
20	B-12a, B-12b
21	B-13
22	B-14a, B-14b
23	B-14a, B-14b
24	B-15
25	B-15
26	B-16
27	B-16
28	B-17

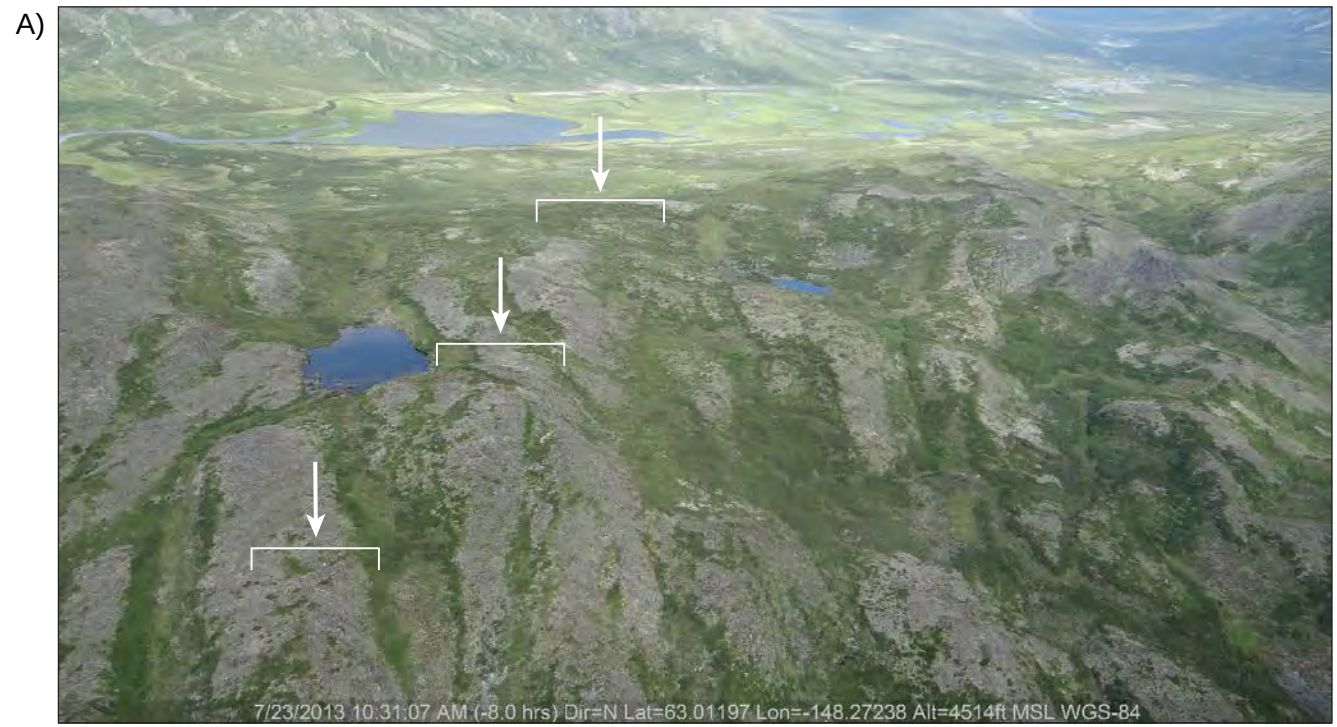
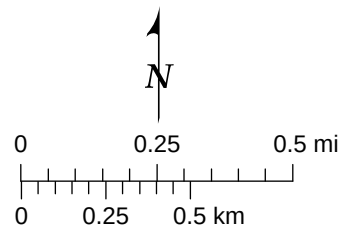
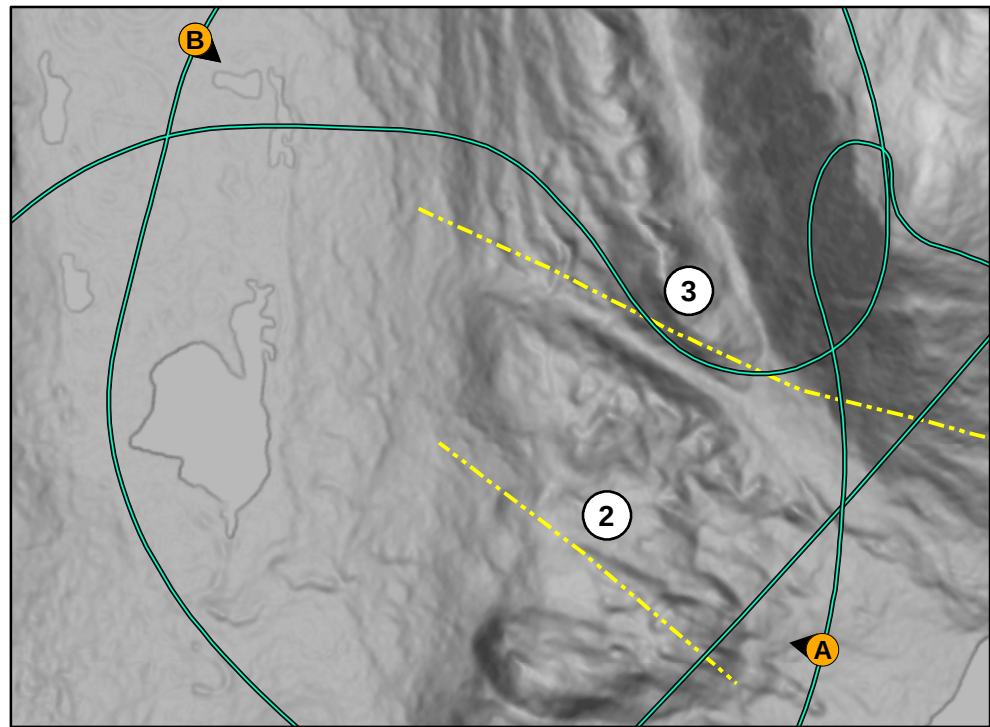




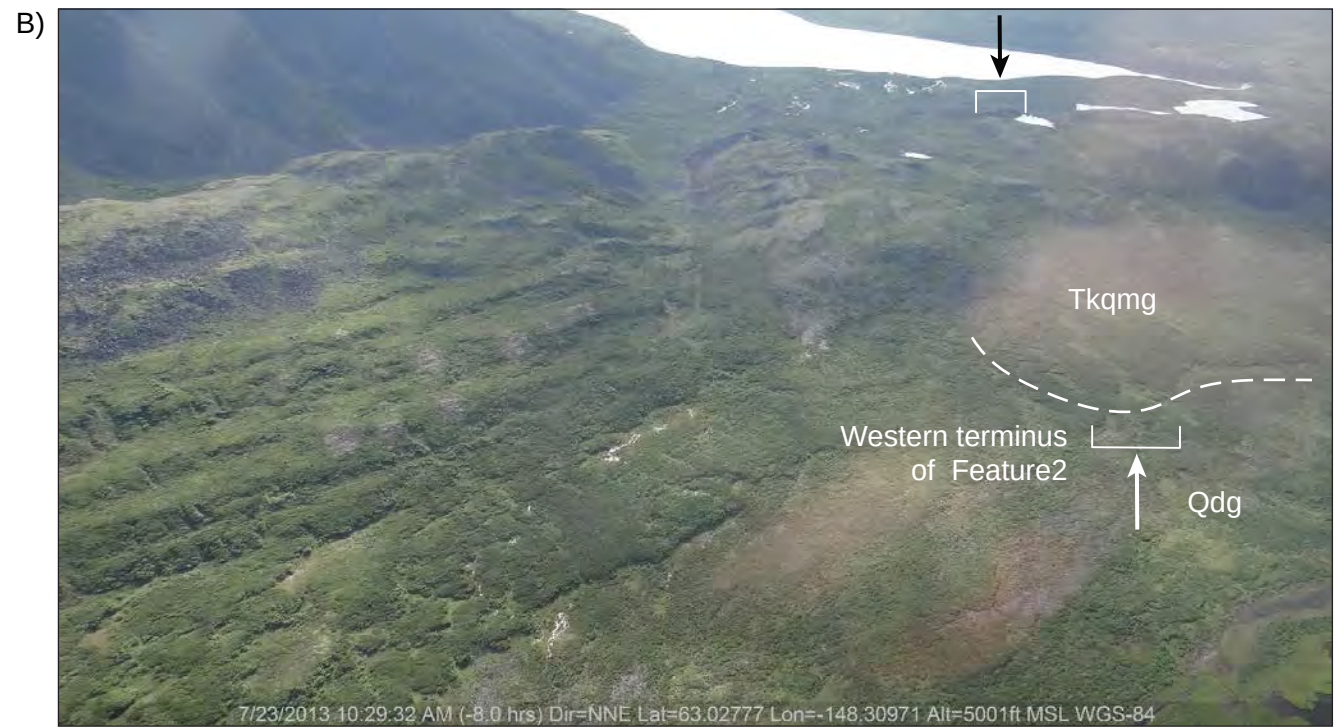
View looking northeast from location A. Arrows show location of mapped trace of lineament.



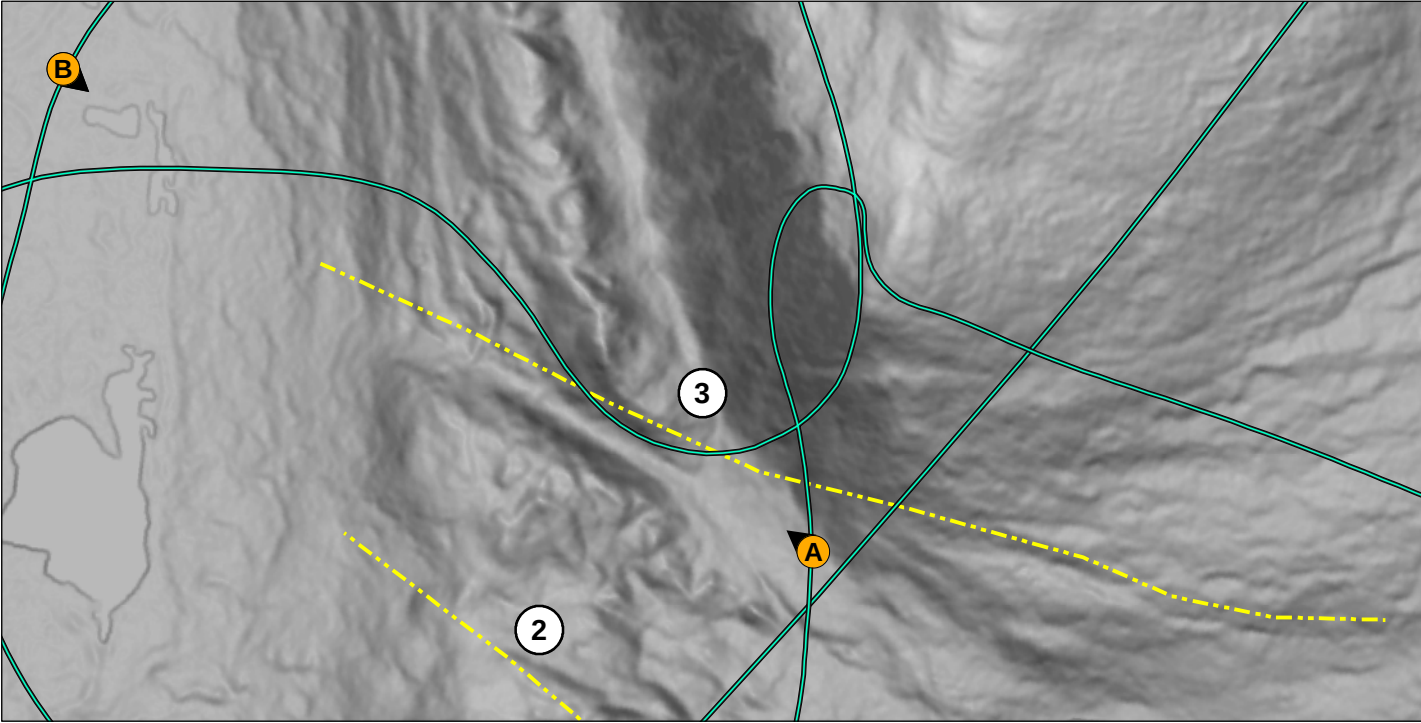
View looking southwest from location B. Arrows show the location of lineament. Note the semi-linear and lobate toe of talus deposit.



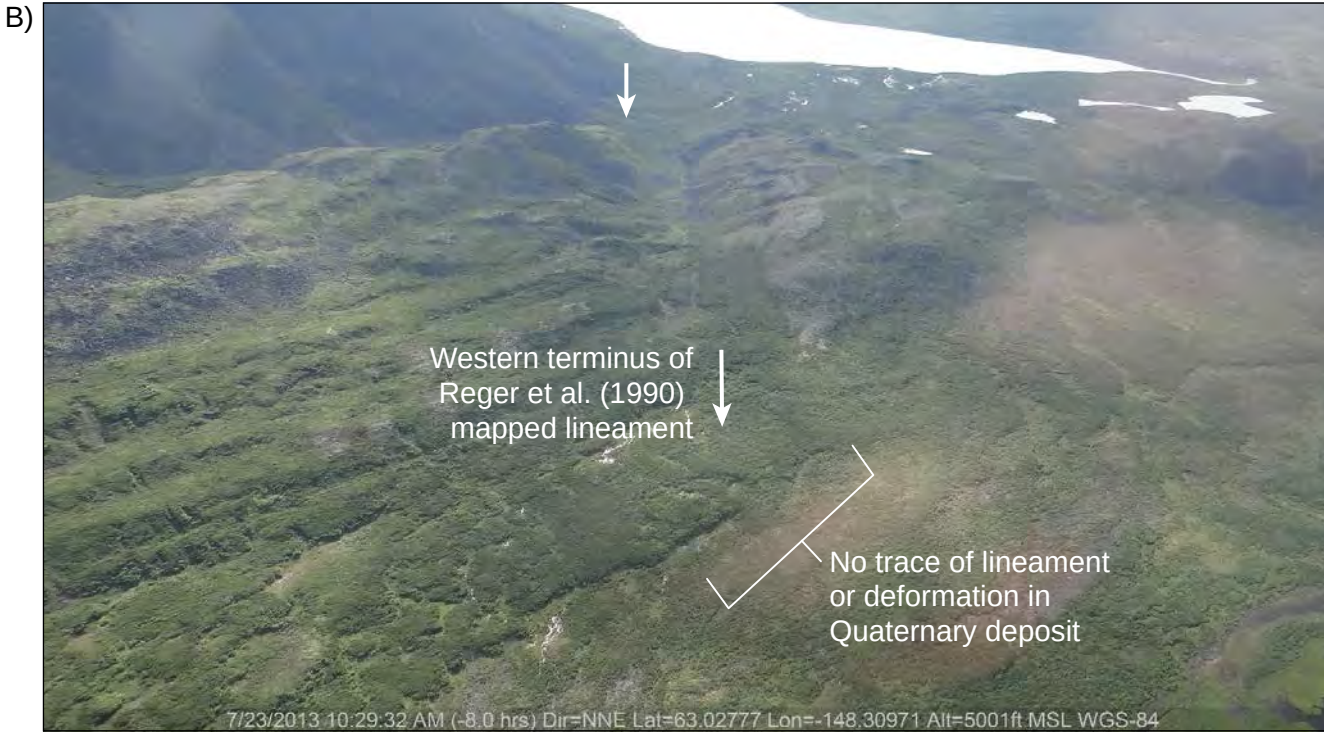
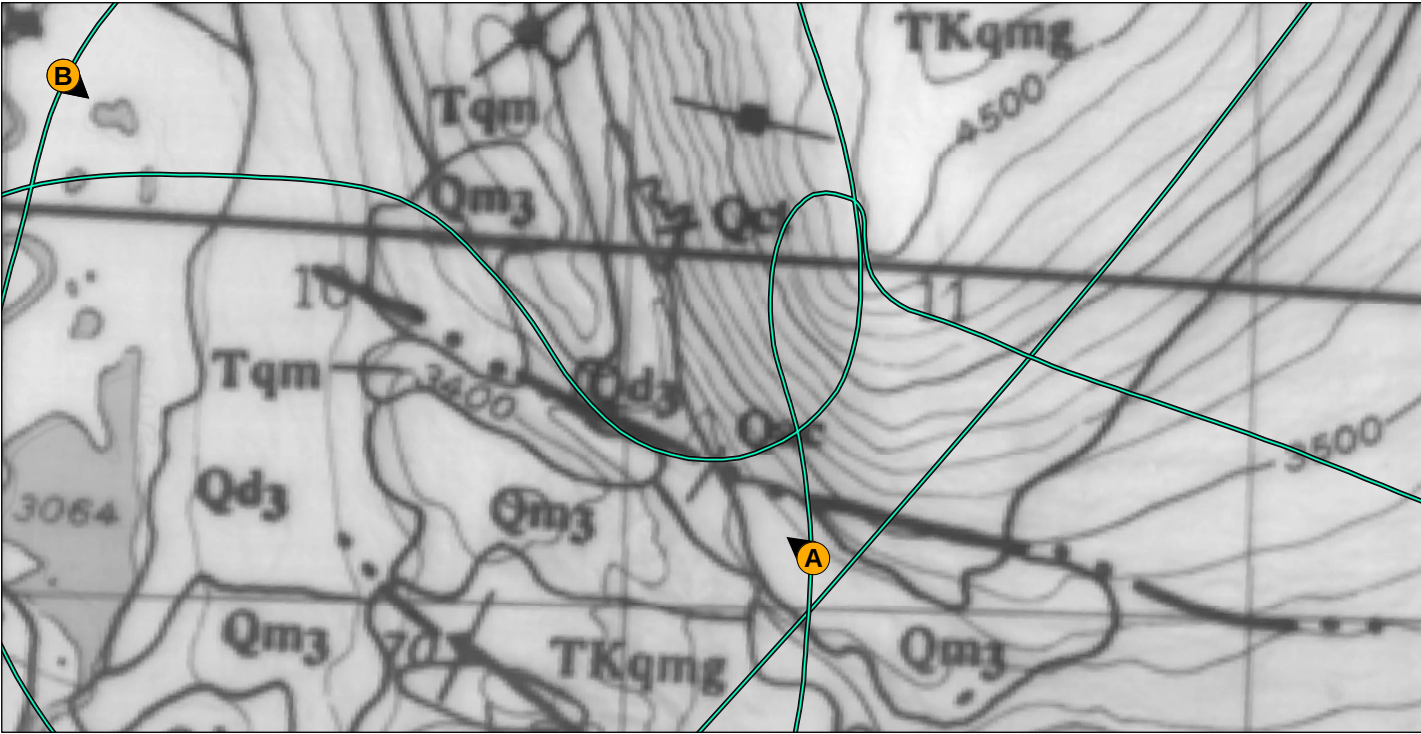
View looking northwest from location A. Arrows and brackets show projected trace of lineament. Note absence of continuous lineament across projected trace.



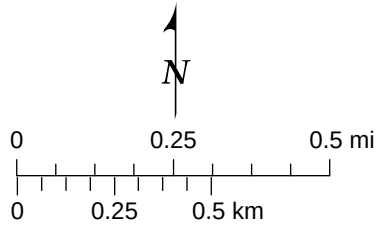
View looking southeast from location B. Arrows and brackets show projected trace of lineament. Note lack of deformation or lineament trace in foreground within Quaternary deposits.

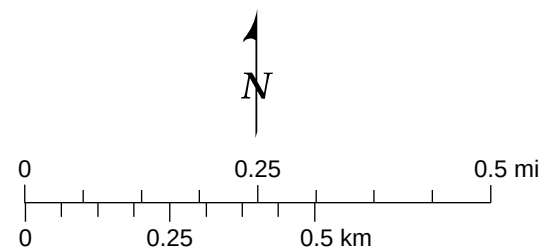
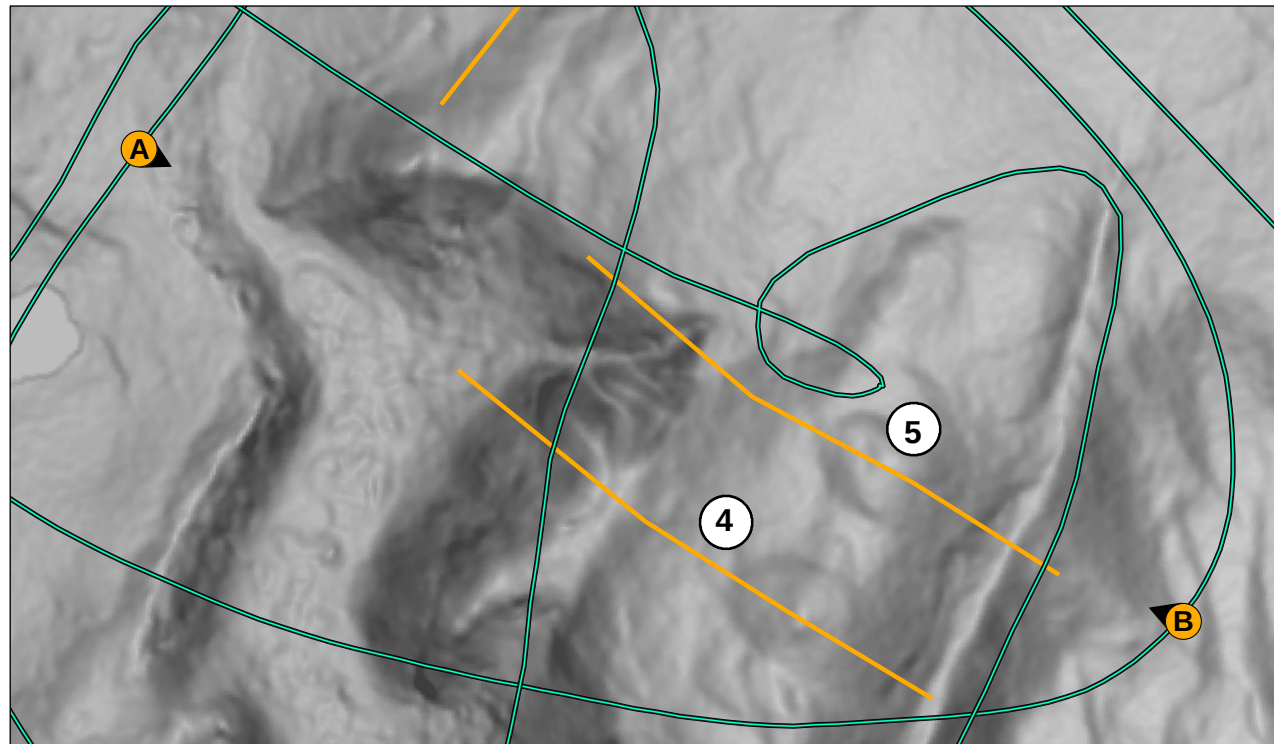


View looking northwest from location A. Arrows show the projected trace of lineament. Note absence of lineament or deformation in Quaternary deposits.

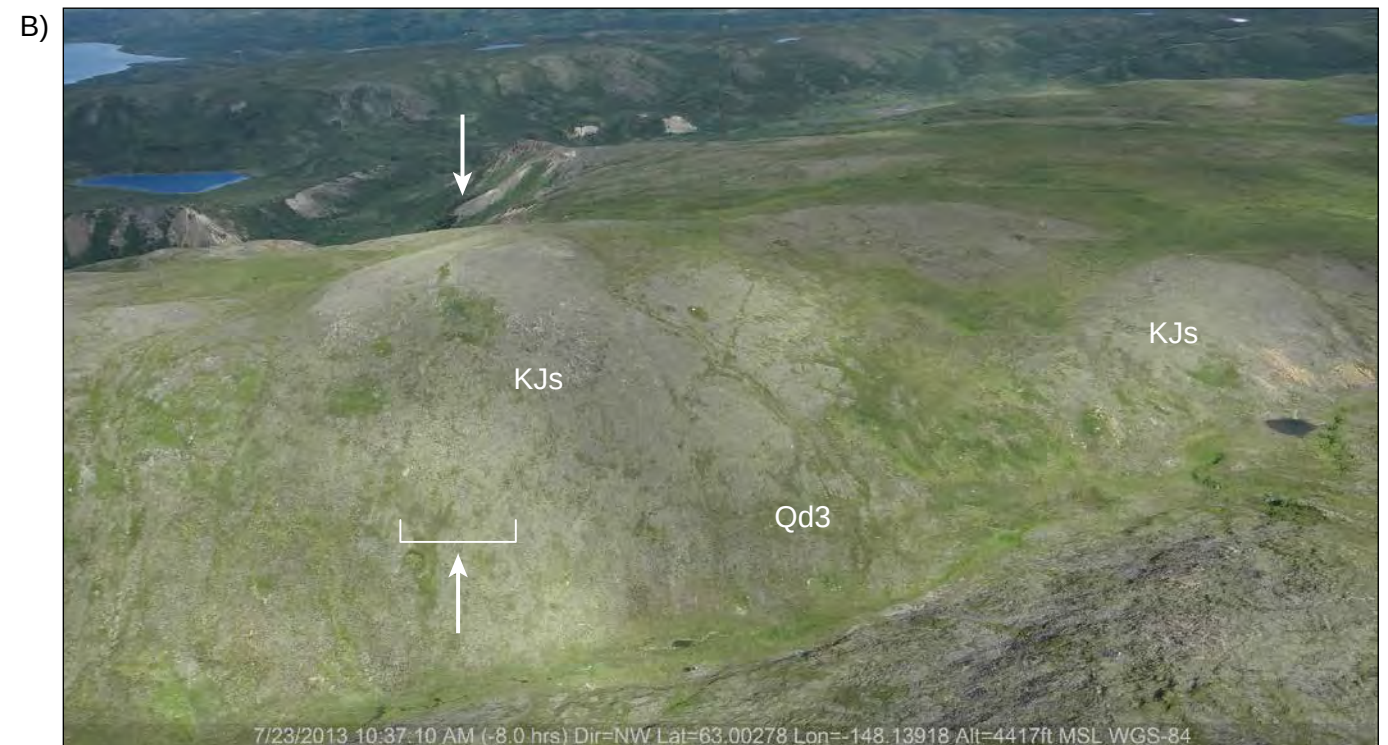


View looking southeast from location B. Arrows show the projected trace of lineament. Note absence of lineament or deformation in Quaternary deposits.

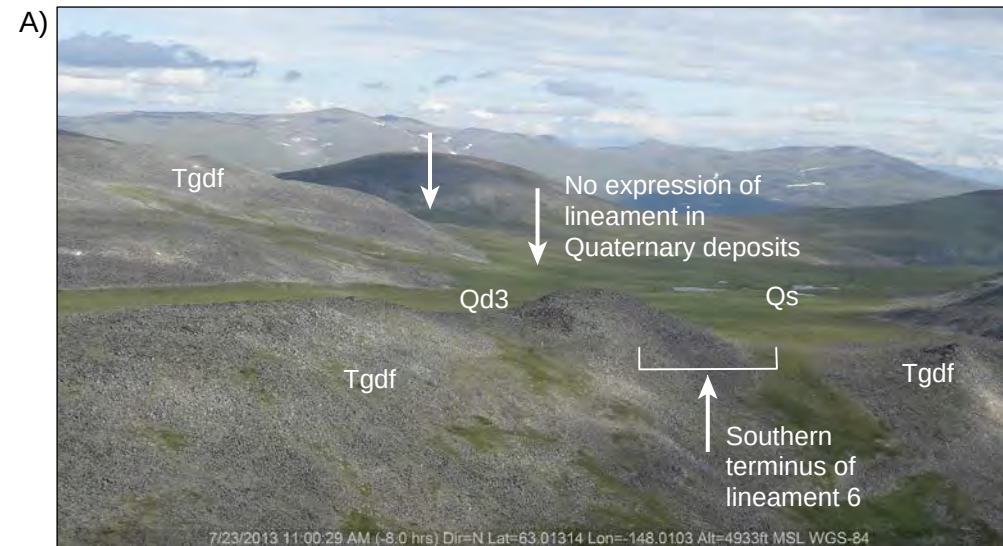
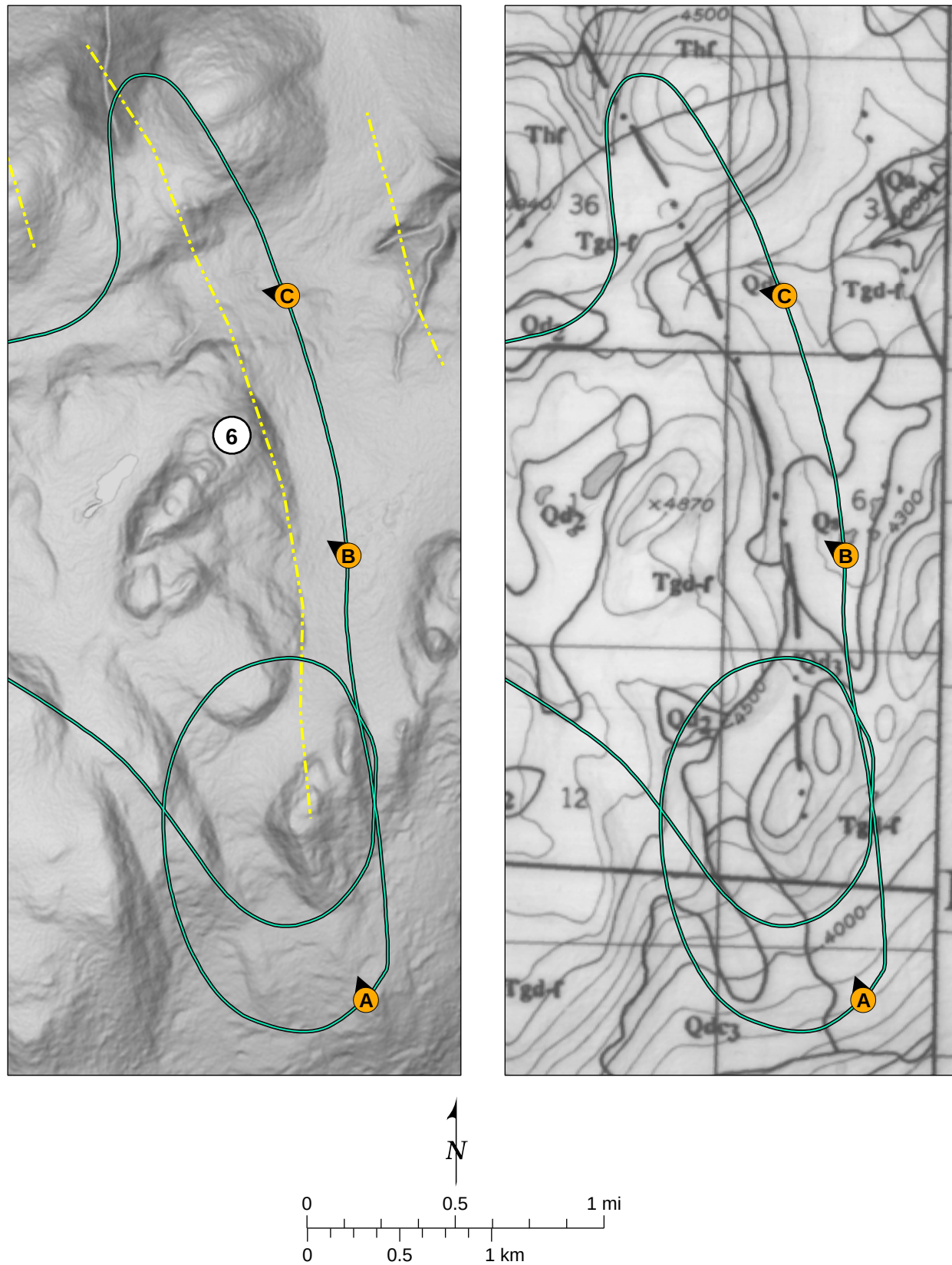




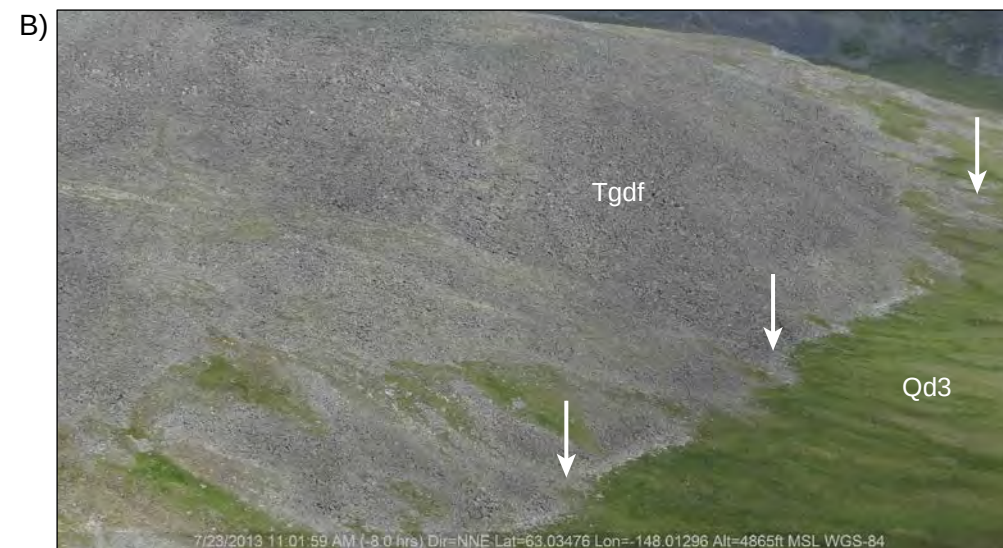
View looking southeast from location A. Arrows show the projected traces of Features 4 and 5. Note absence of lineament or deformation in Quaternary deposits in foreground.



View looking northwest from location B. Arrows show the projected trace of Feature 5. Note absence of discernable lineament along mapped trace.



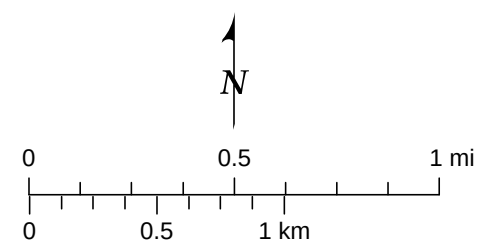
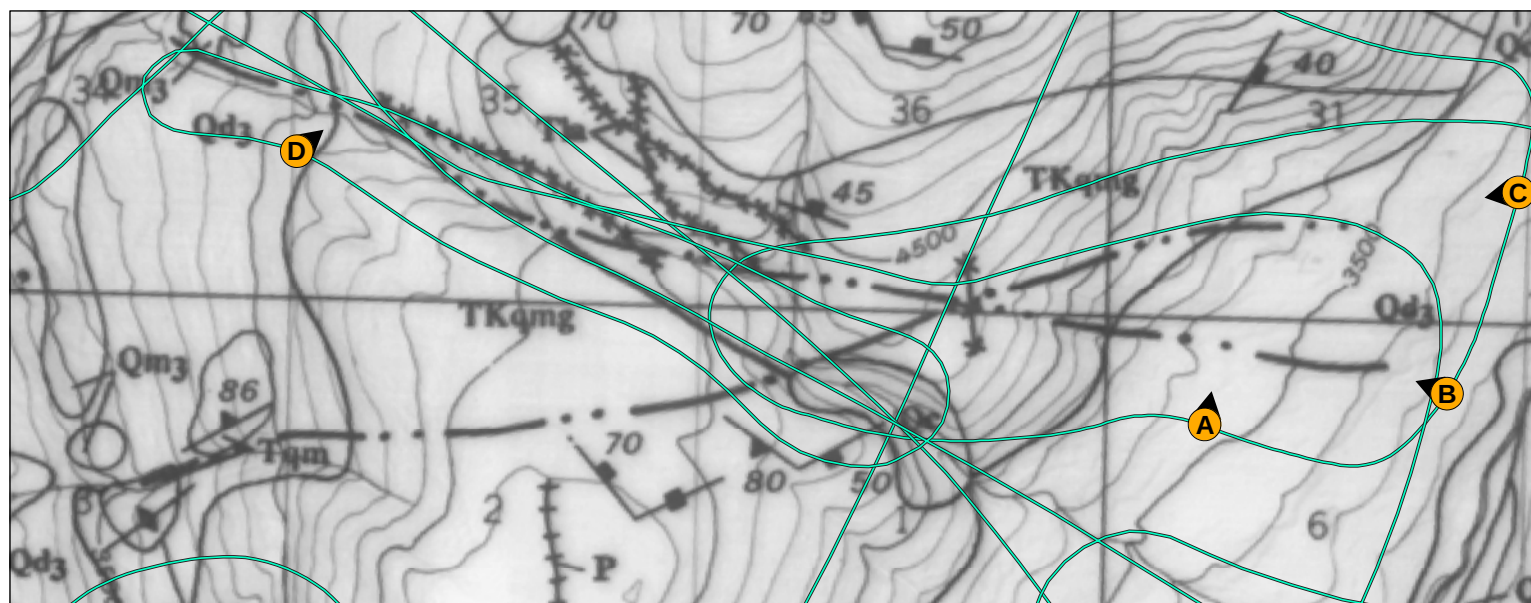
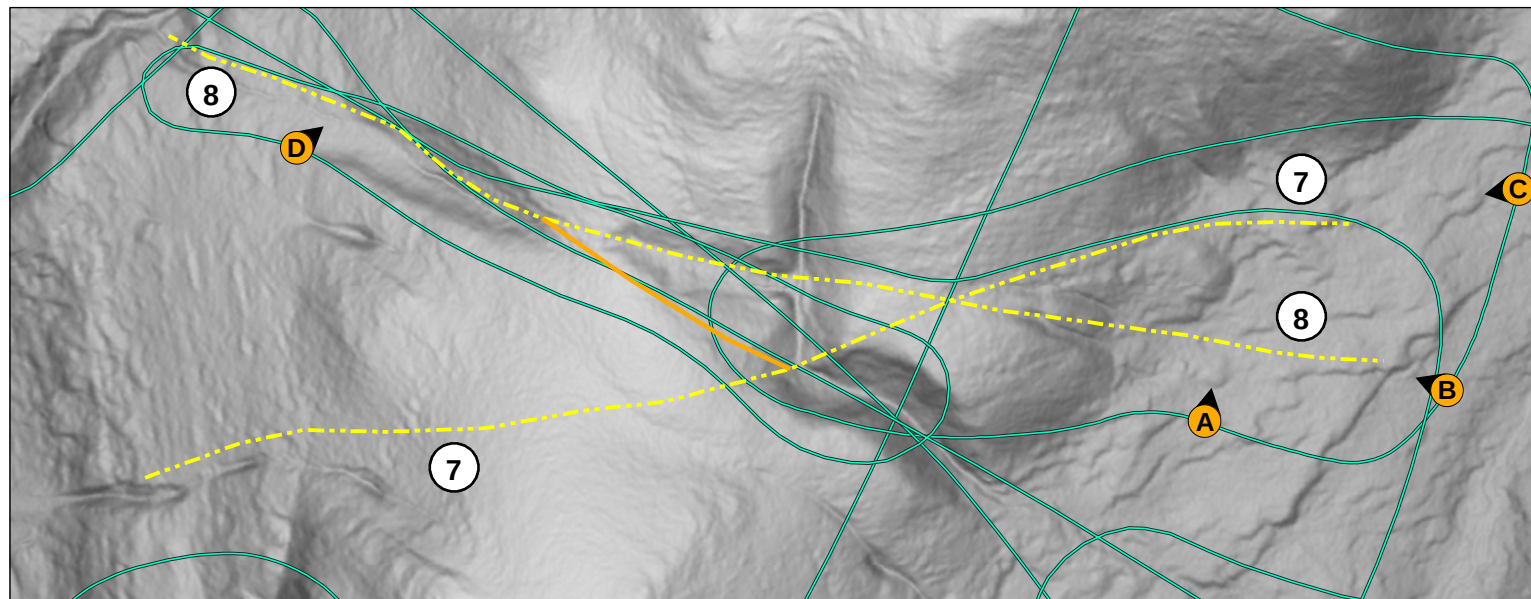
View looking northwest from location A. Arrows and brackets show the projected trace of mapped lineament. Note absence of lineament or deformation in Quaternary deposits.



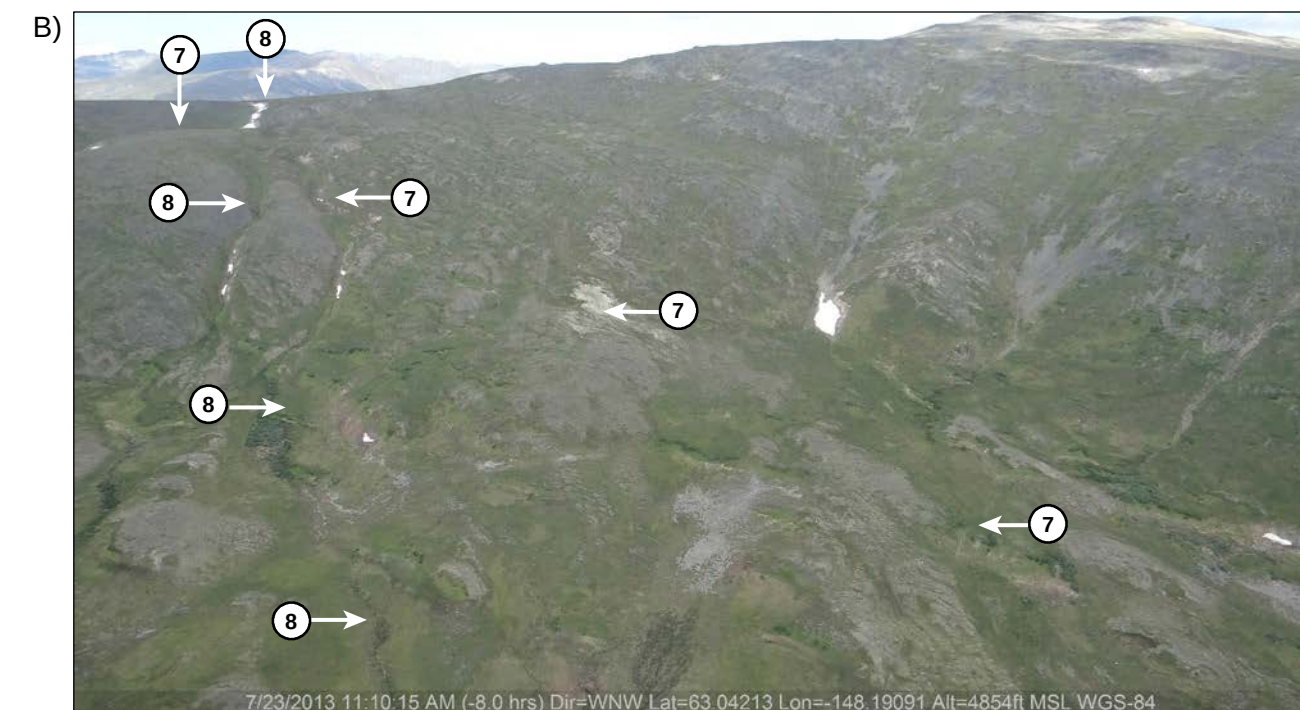
View looking northwest from location B. Arrows show the projected trace of lineament.



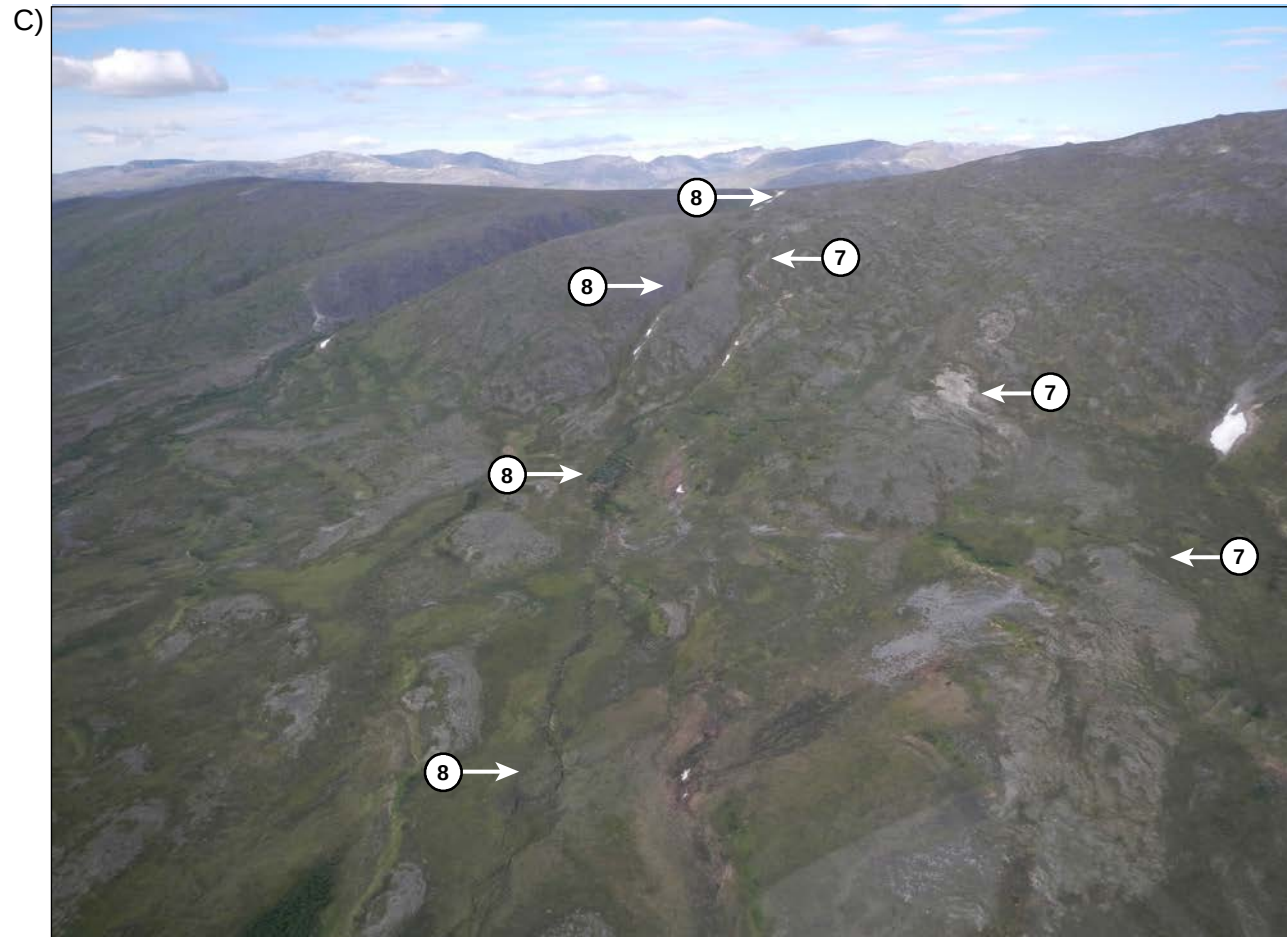
View looking west from location C. Brackets indicate the projected trace of lineament. Note absence of lineament or deformation in Quaternary deposits.



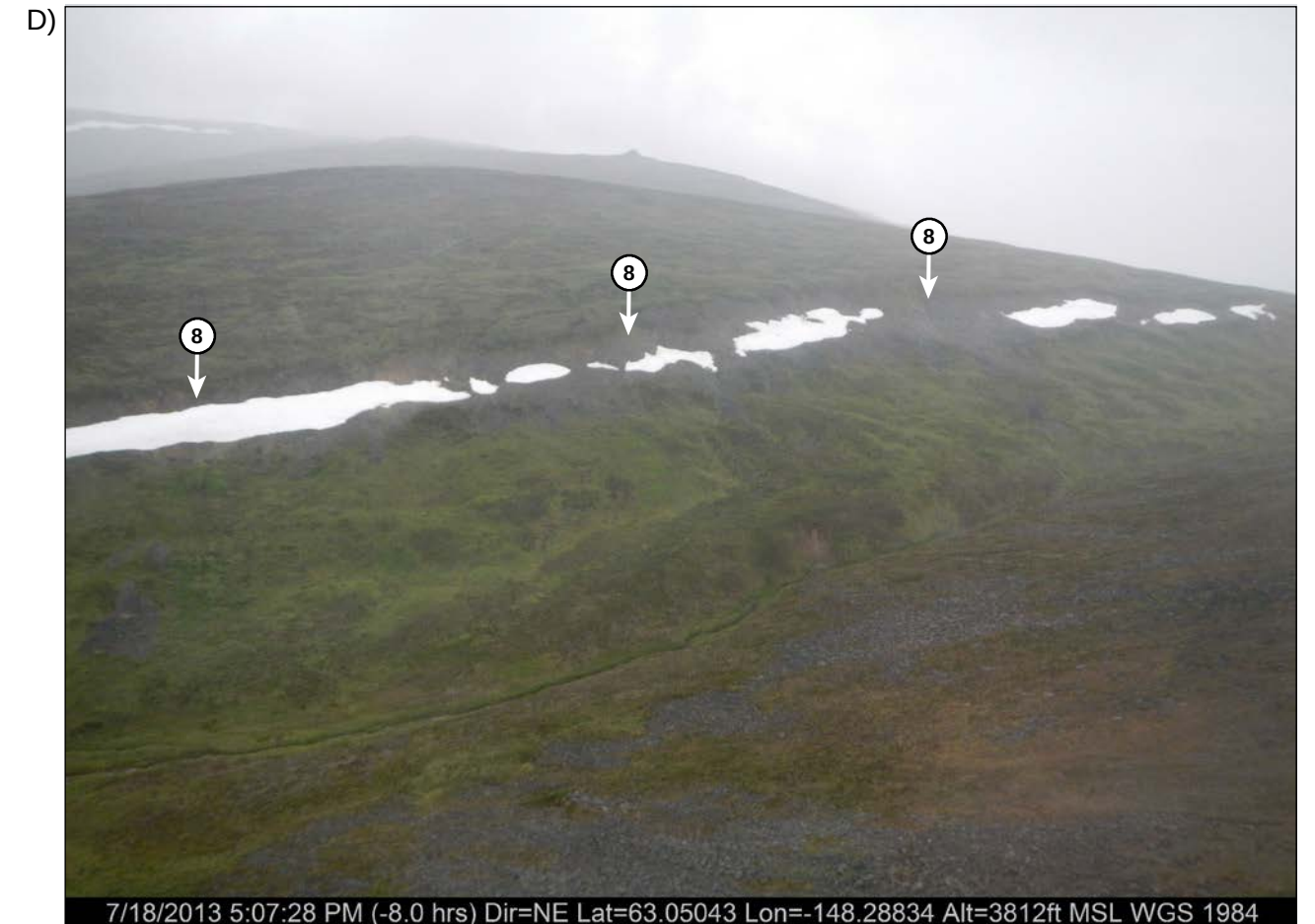
View looking northeast at lineaments 7 and 8 from photograph location A.



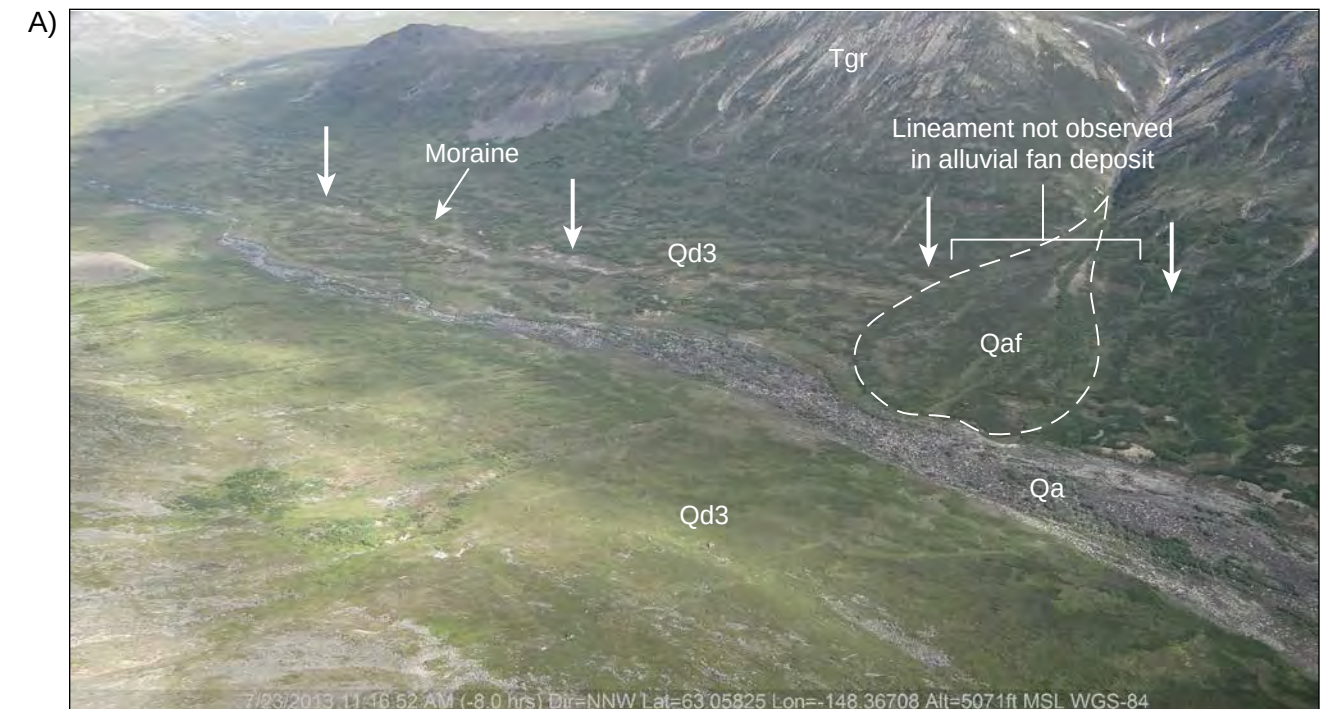
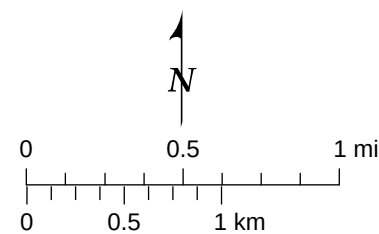
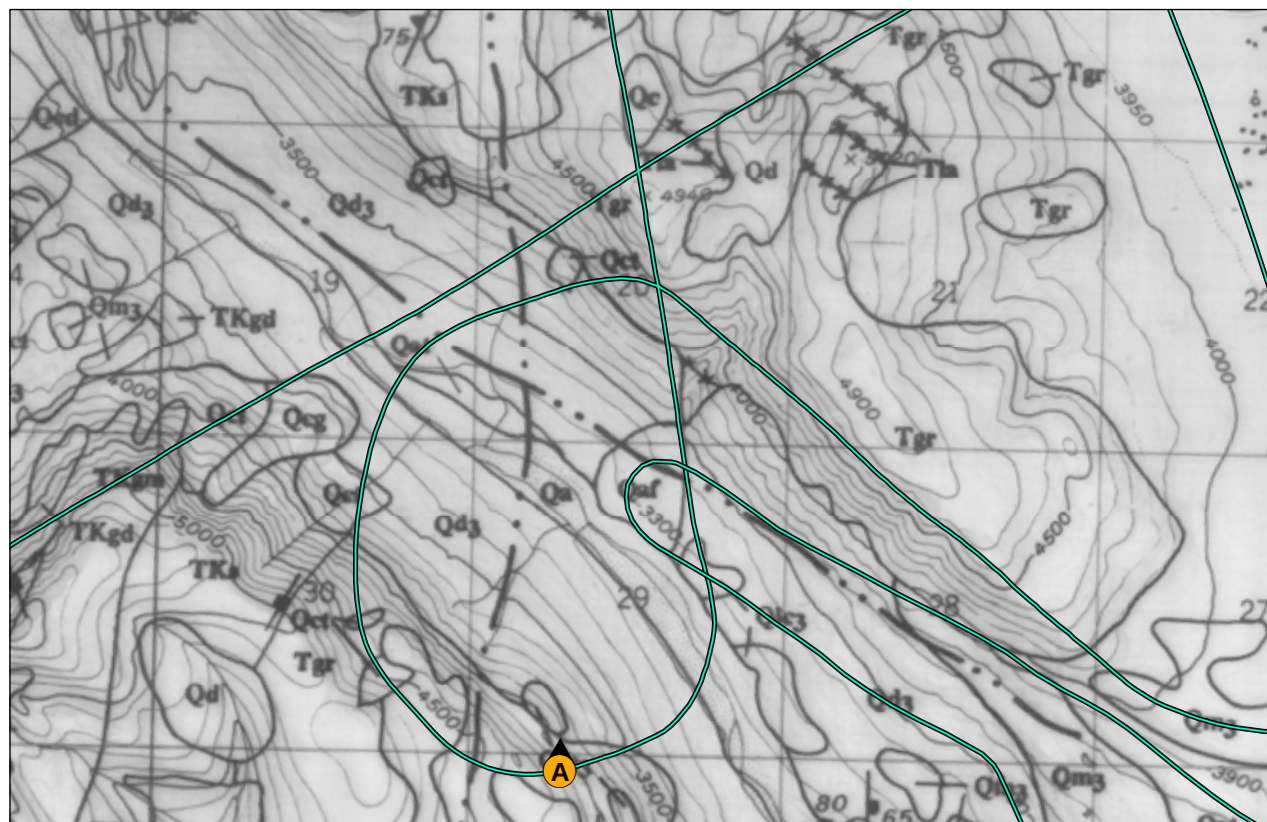
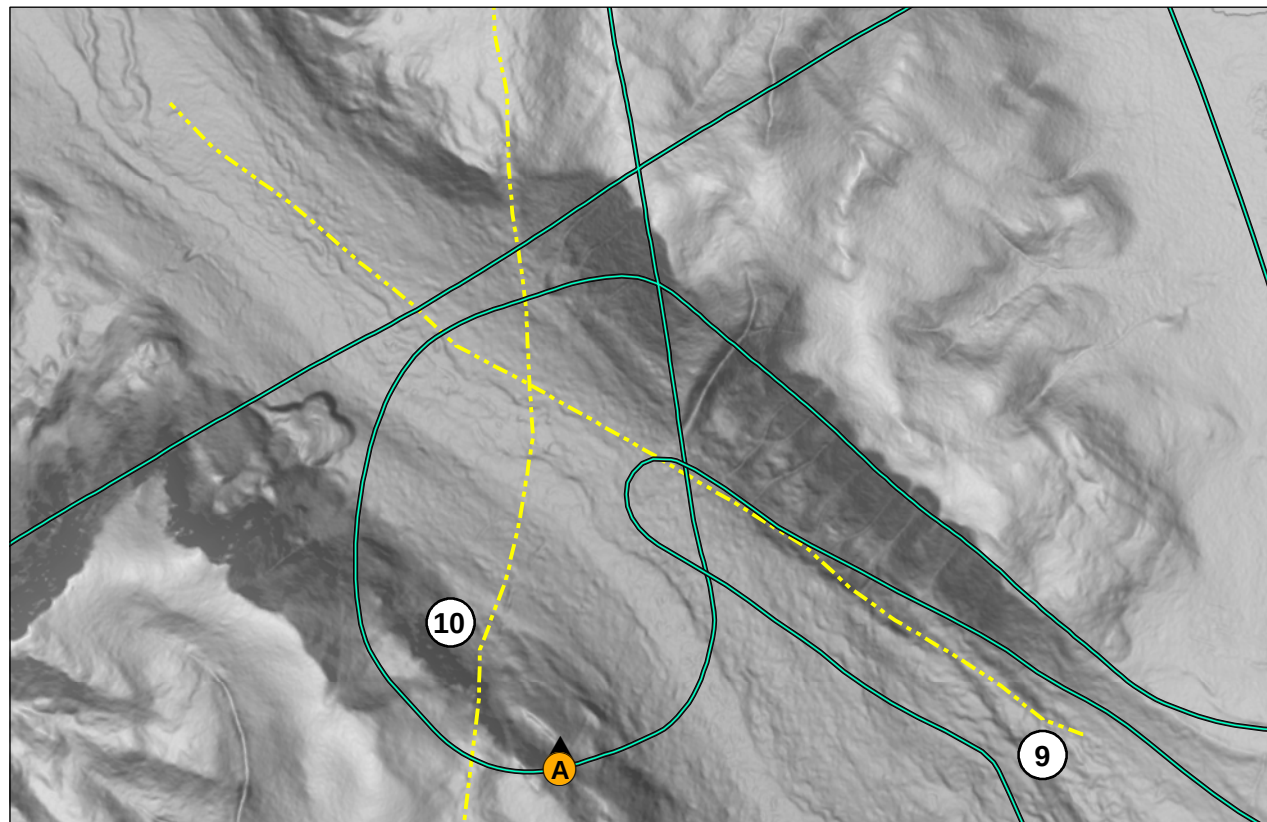
View looking west at lineaments 7 and 8 from photograph location B. Note that lineament 7 is a linear series of unrelated features.



View looking southwest at lineaments 7 and 8 from photograph location C.



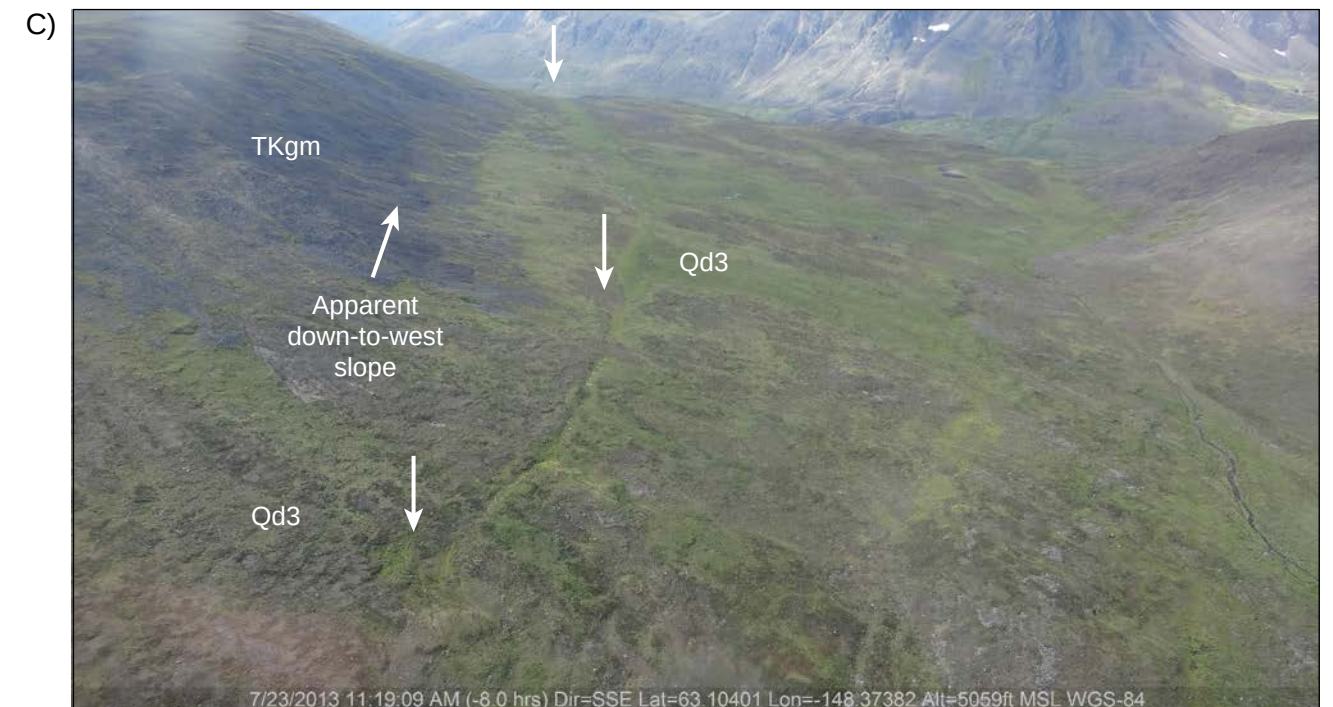
View looking northeast at lineament 7 from photograph location D.



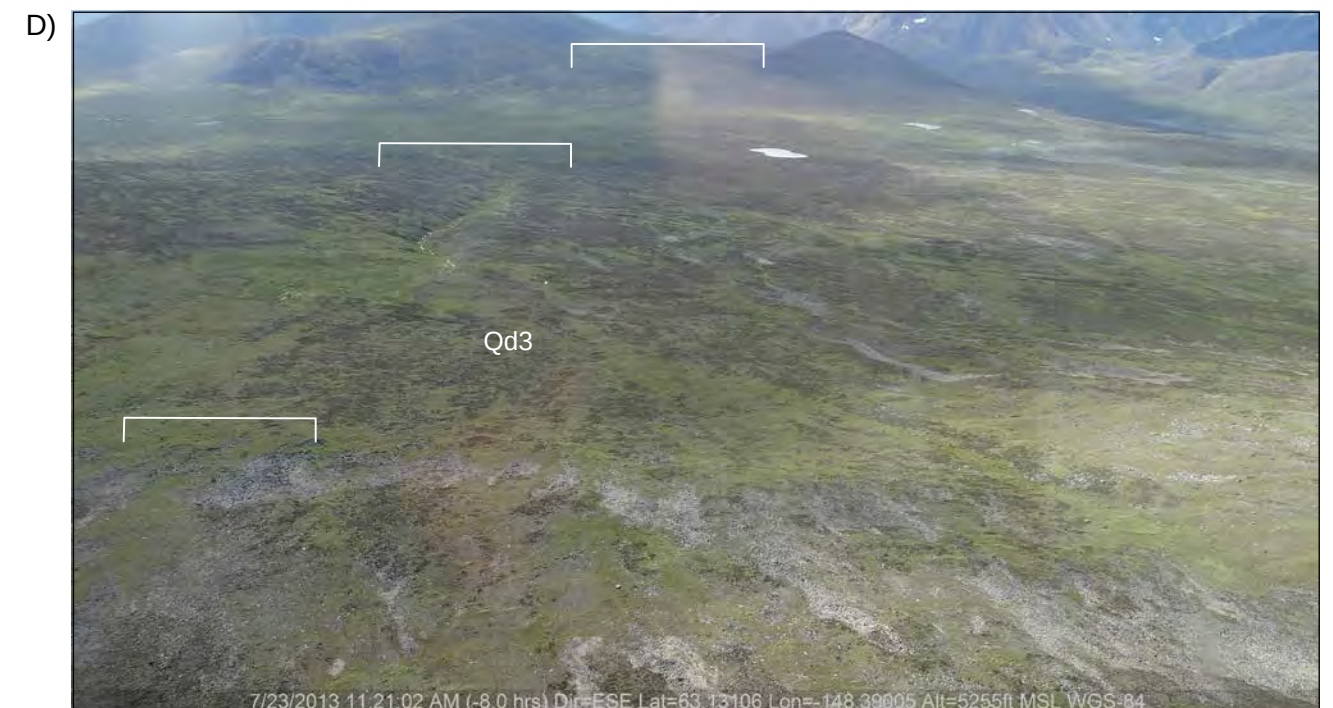
View looking north from location A. Arrows show projected trace of Feature 9 lineament. Note lineament is overprinted with Quaternary alluvial fan deposit.



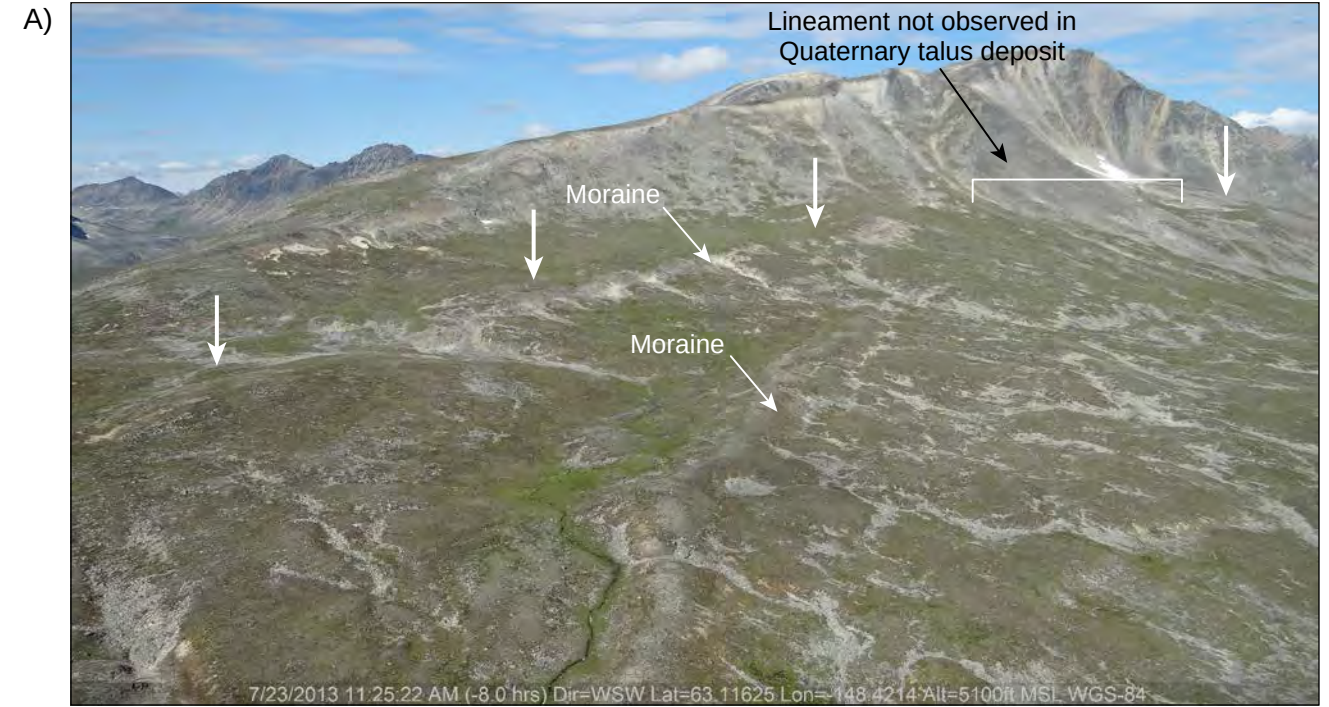
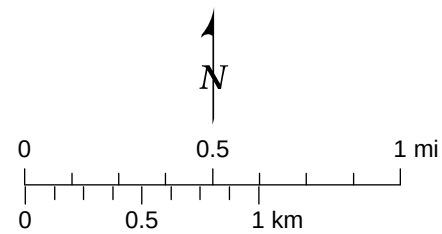
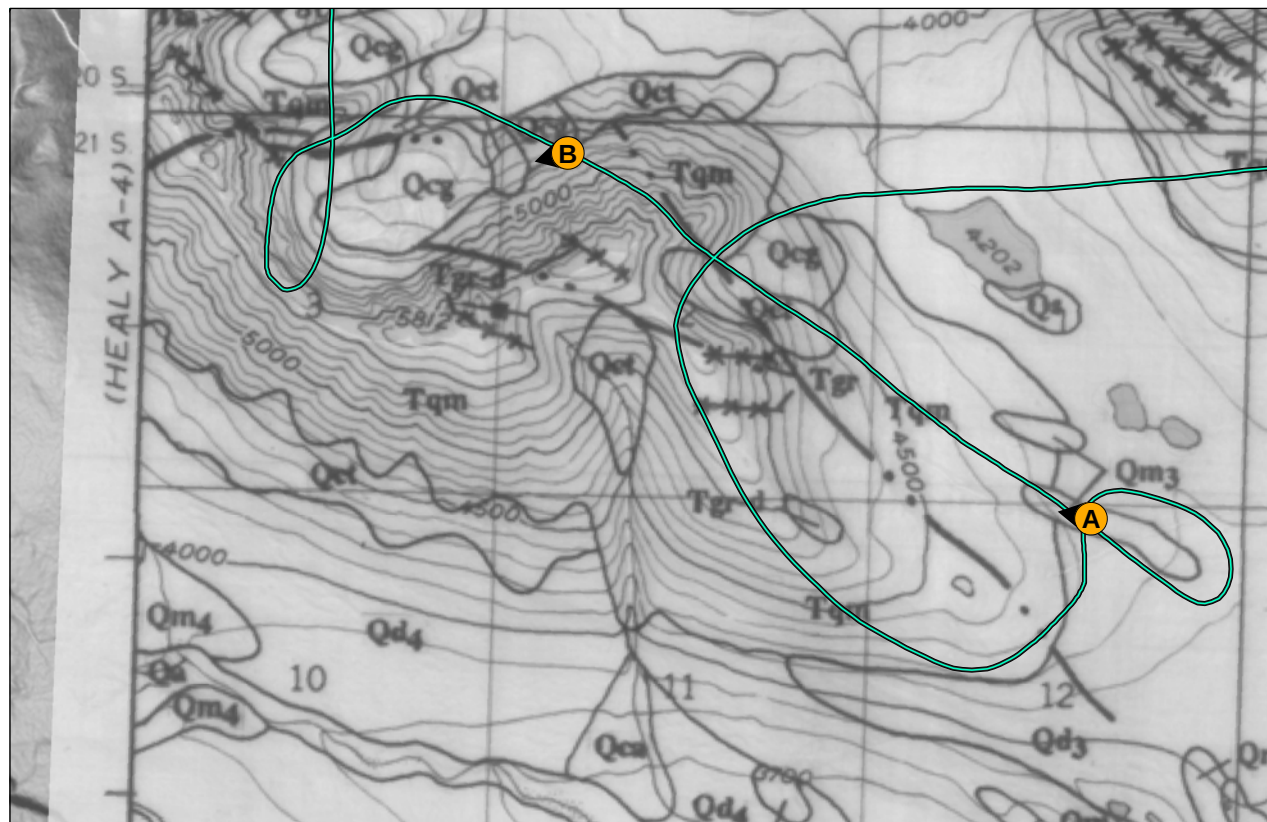
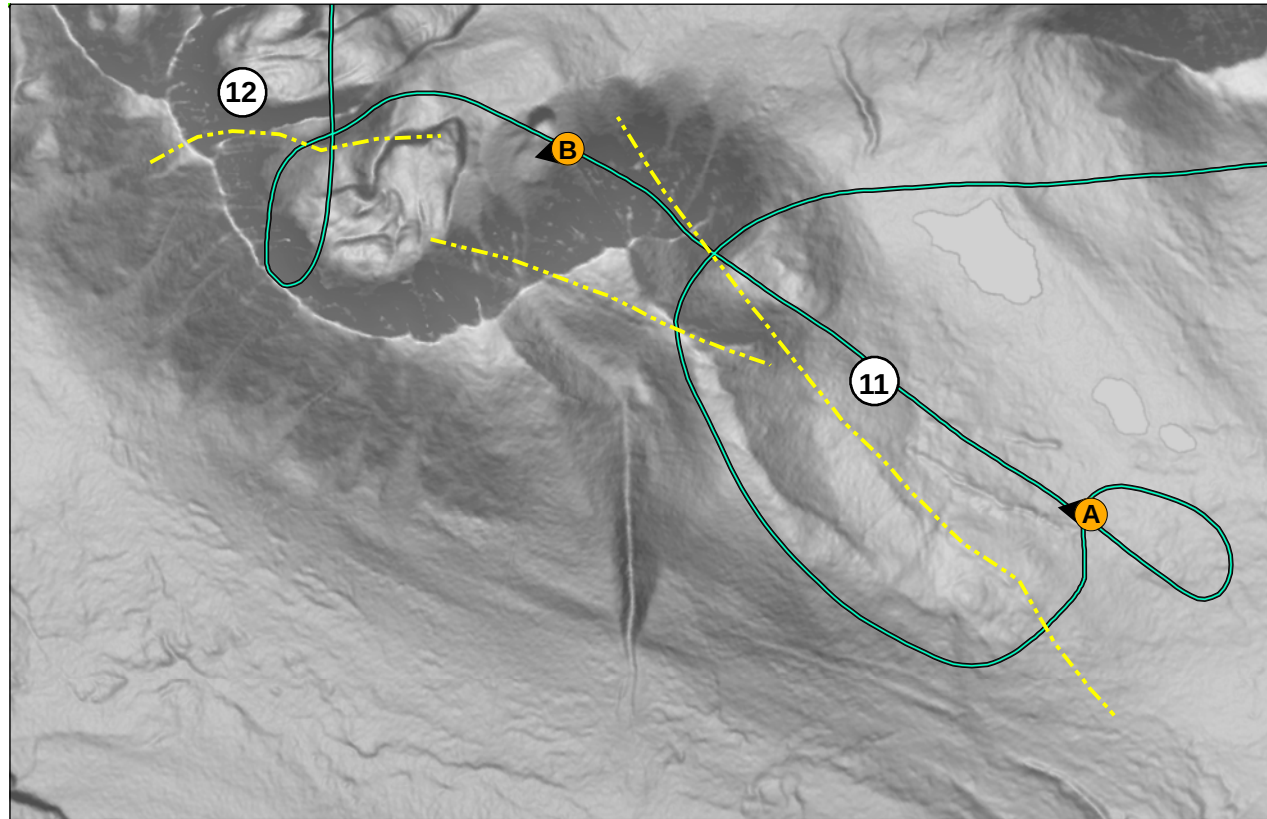
View looking south from photograph location B. Arrows show the projected trace of lineament. In Qd3 (till) the lineament is coincident with linear drainage in till deposit. Note absence of lineament in Qa deposit.



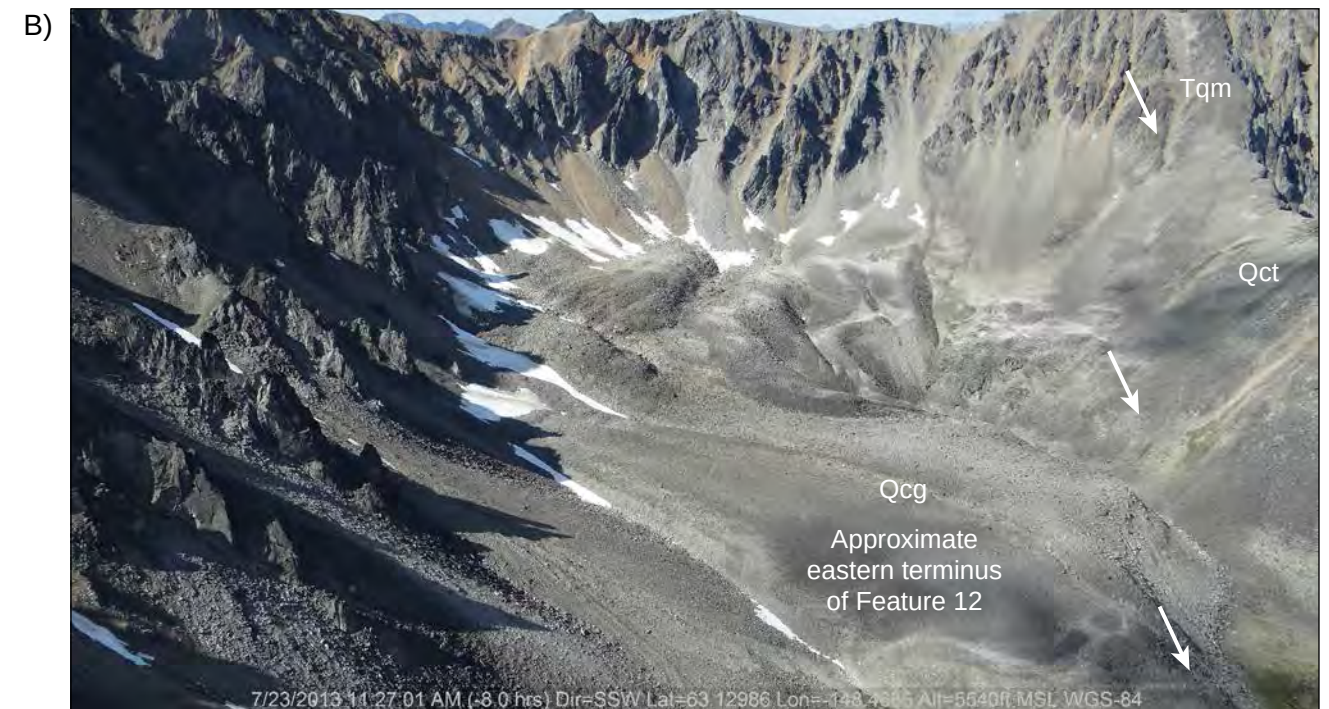
View looking south from photograph location C. Arrows show the projected trace of lineament. Note lineament is coincident with a linear drainage in this view.



View looking south from location C. Brackets show the projected trace of lineament.

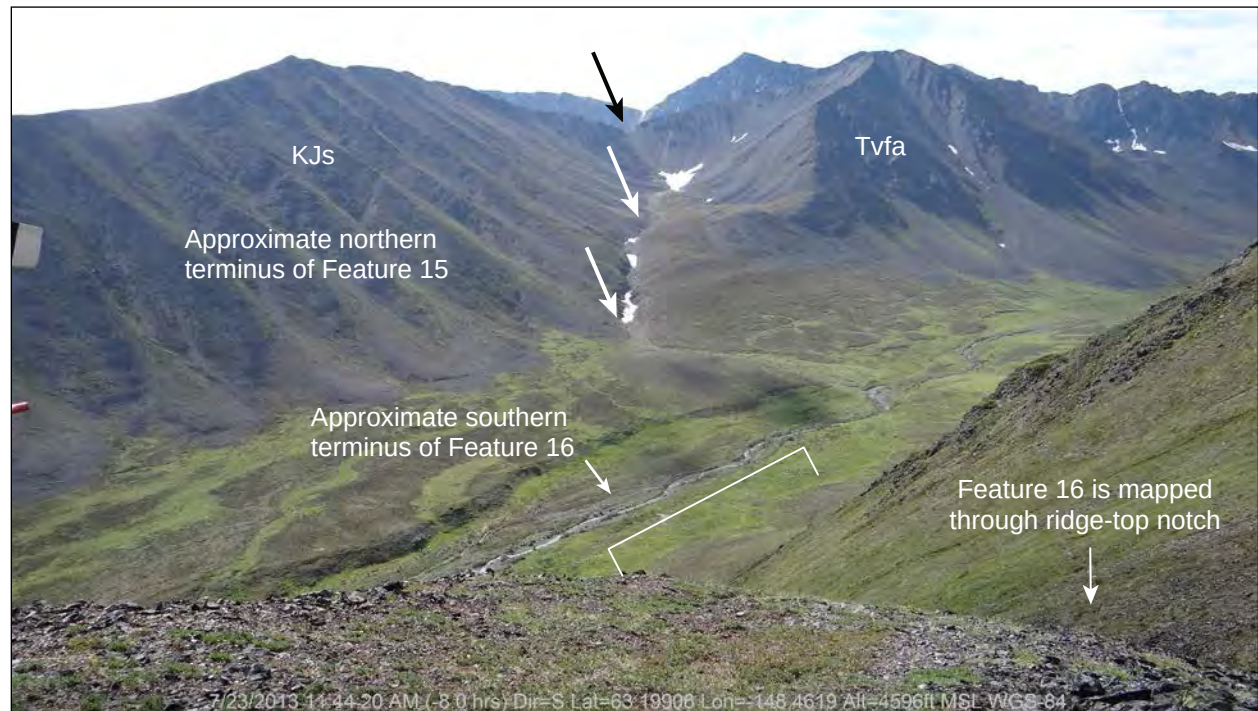


View looking west from location A. Arrows and brackets show projected trace of Feature 11 lineament. Note the mapped lineament correlates with a moraine crest.

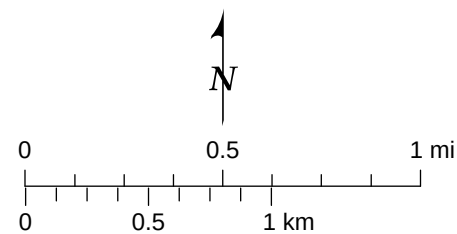
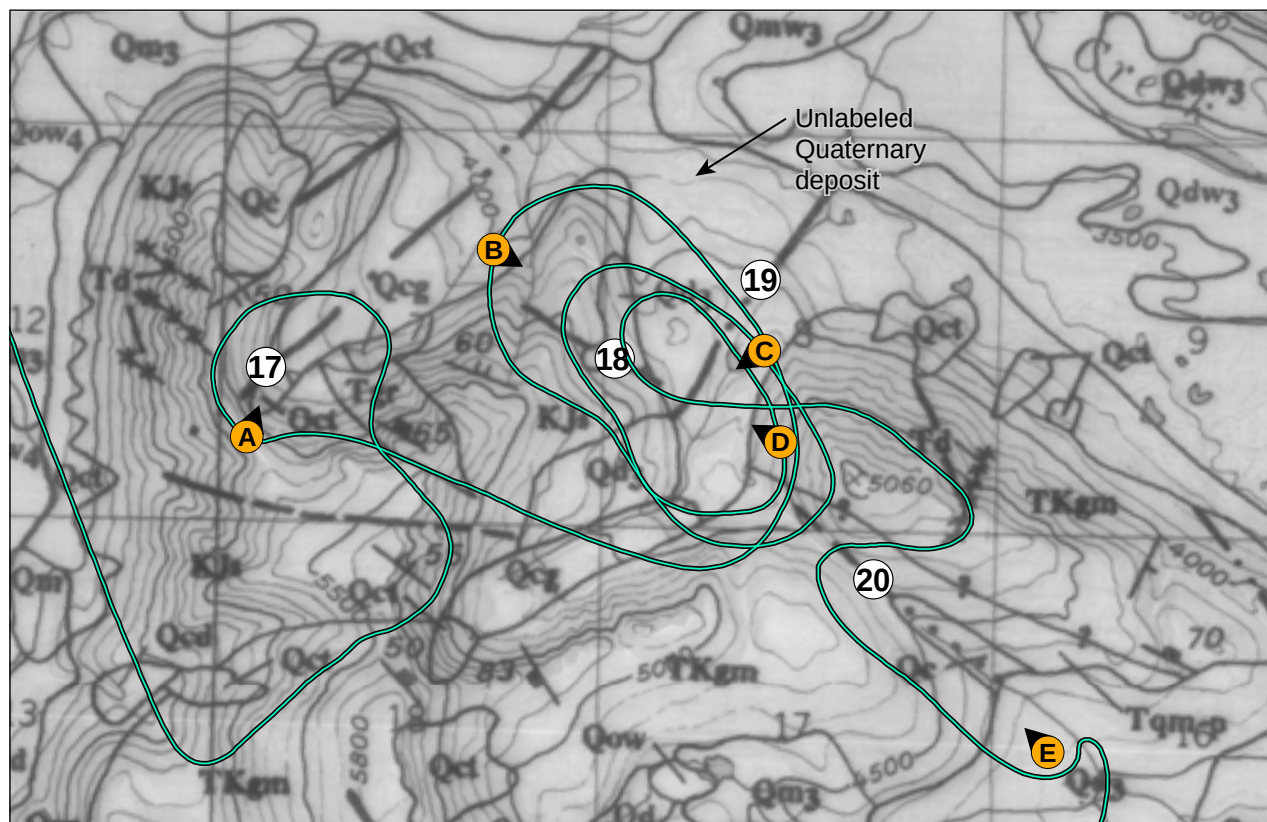
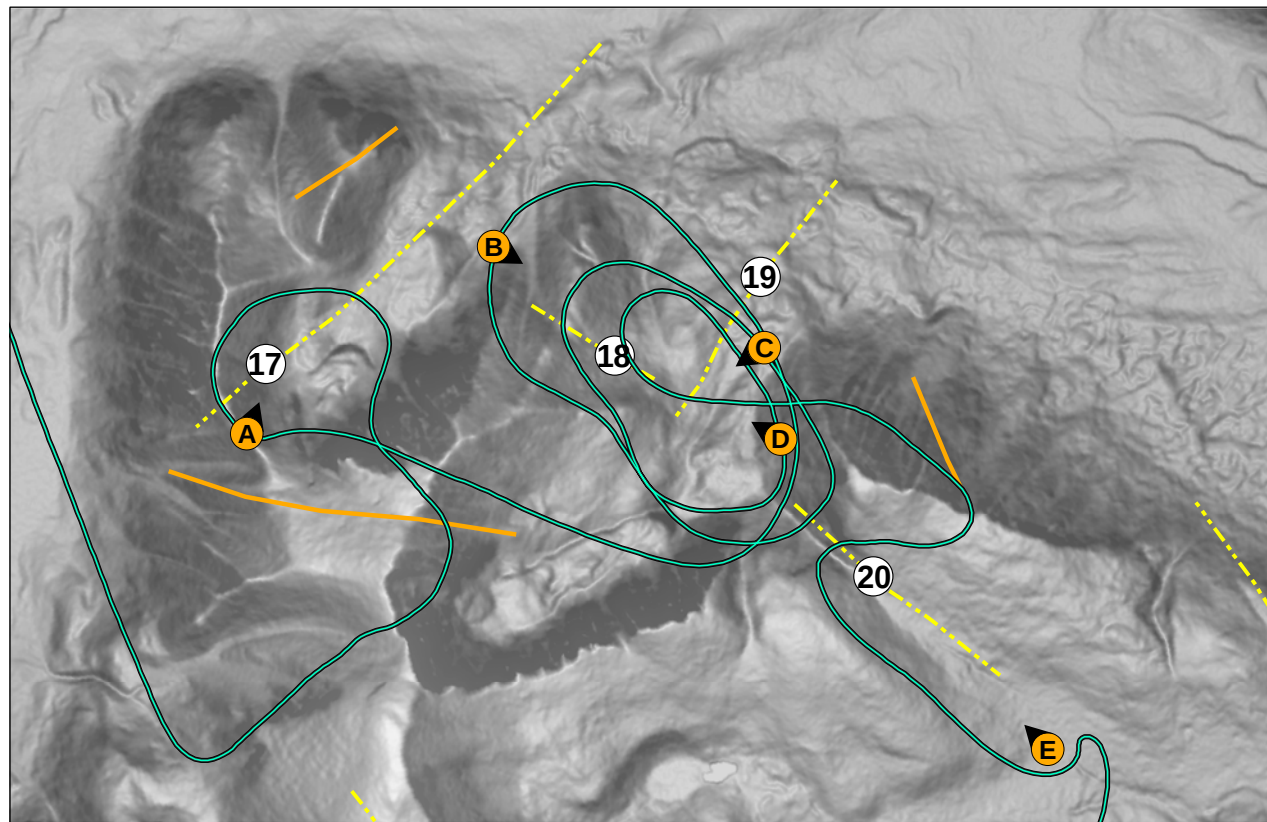


View looking west from location A. Brackets show projected trace of Feature 12 lineament. Note the trace of the lineament is a collection of unrelated features rather than a through-going feature.

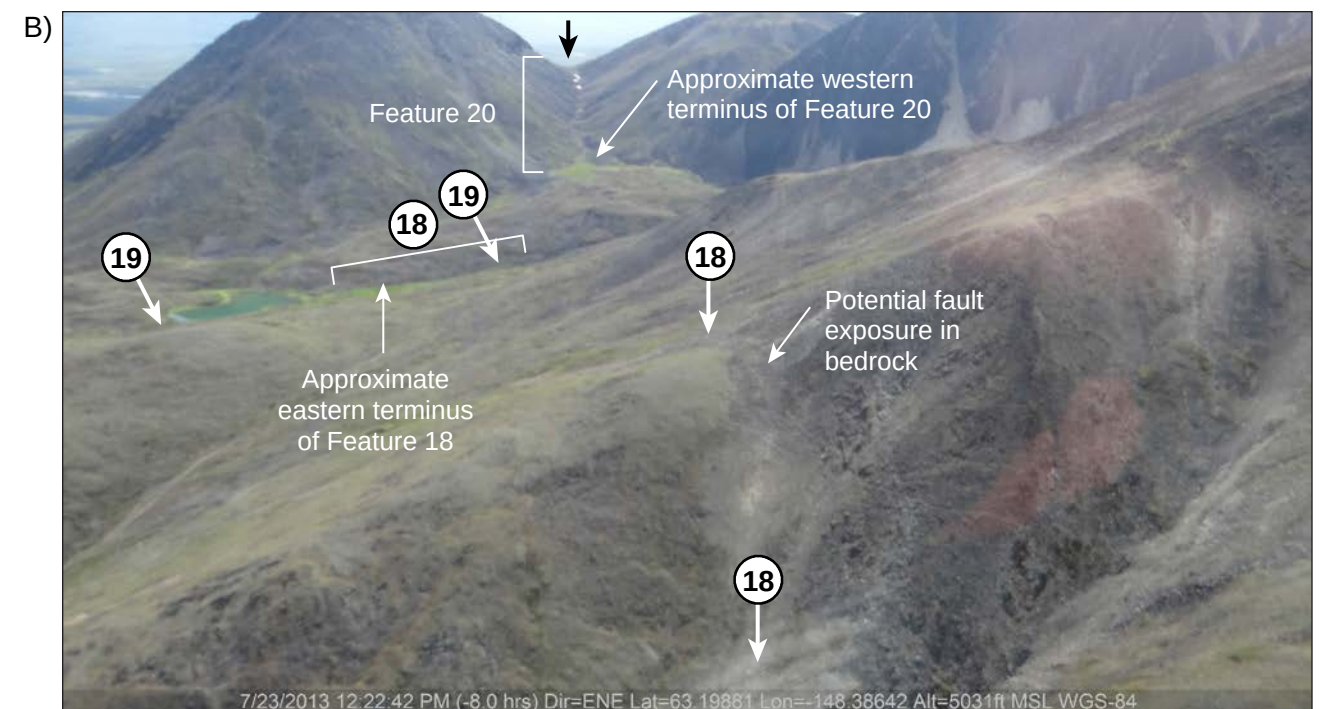
C)



View looking south from location C. The arrows and bracket indicates the projected path of Feature 15 and 16 faults. Note absence of linear expression in valley floor within Quaternary deposits.



View looking northeast from location A. Arrows and brackets show projected trace of lineament 17.



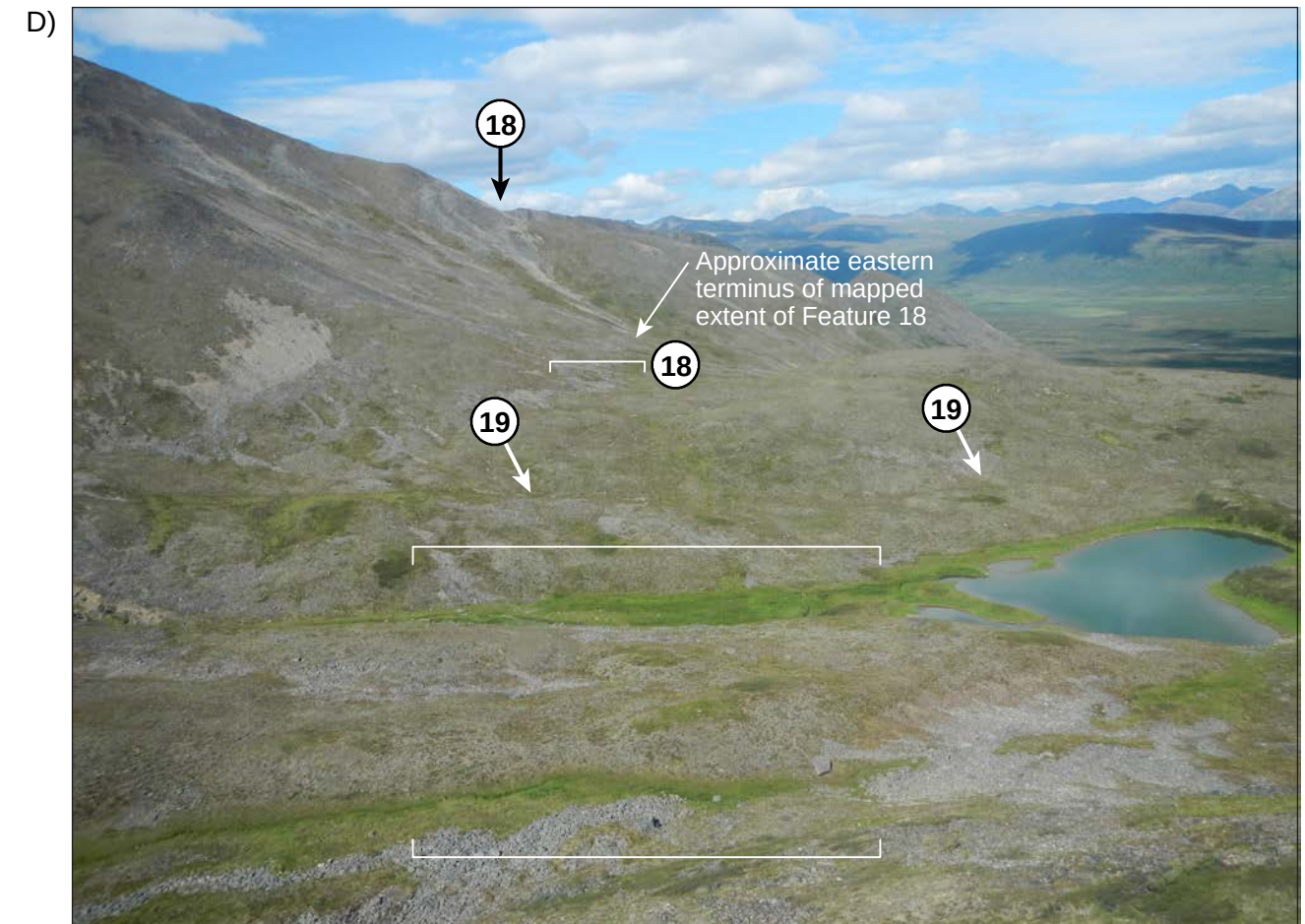
View looking southeast from photograph location B. Arrows and brackets indicated the projected trace of lineaments 18, 19, and 20.



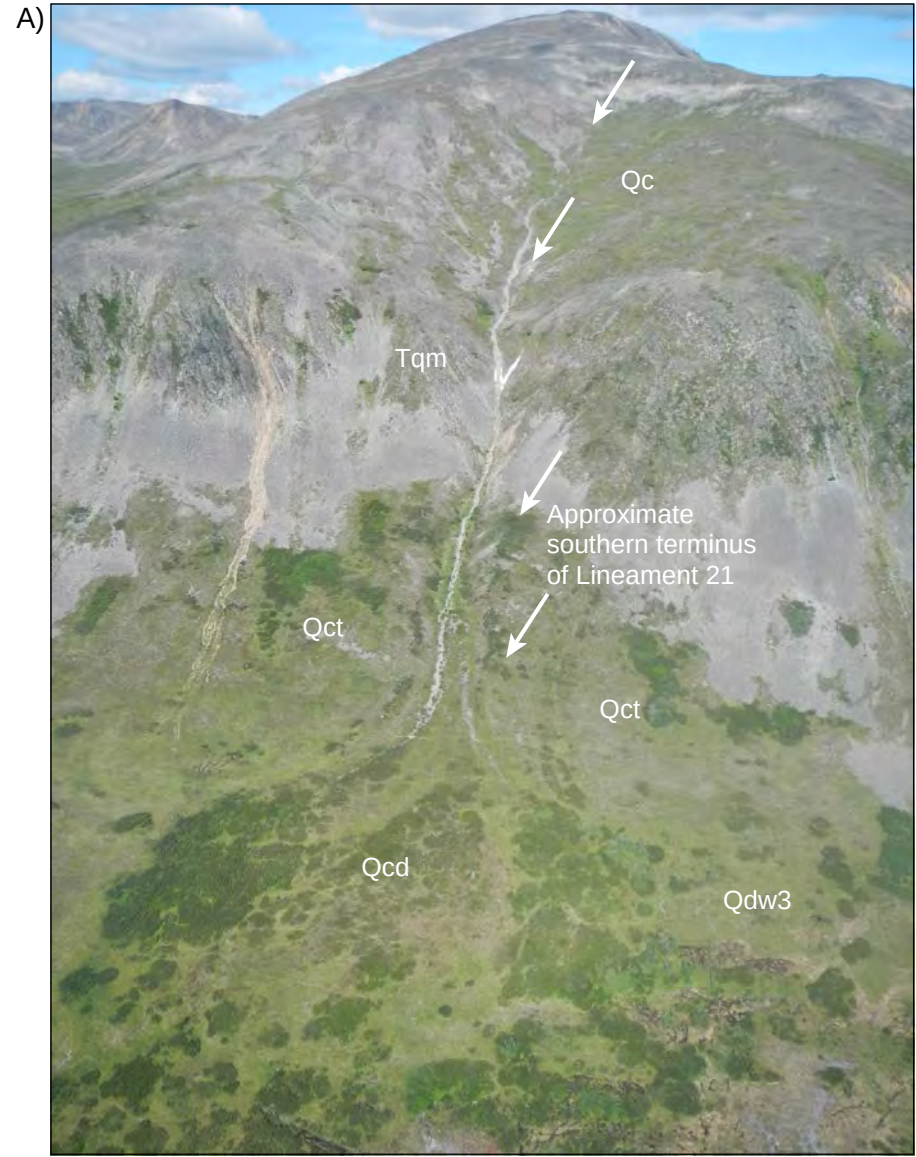
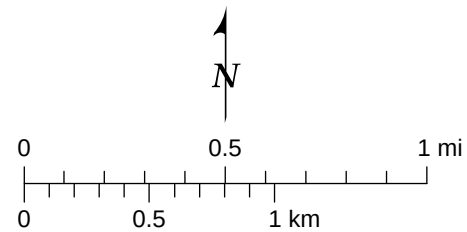
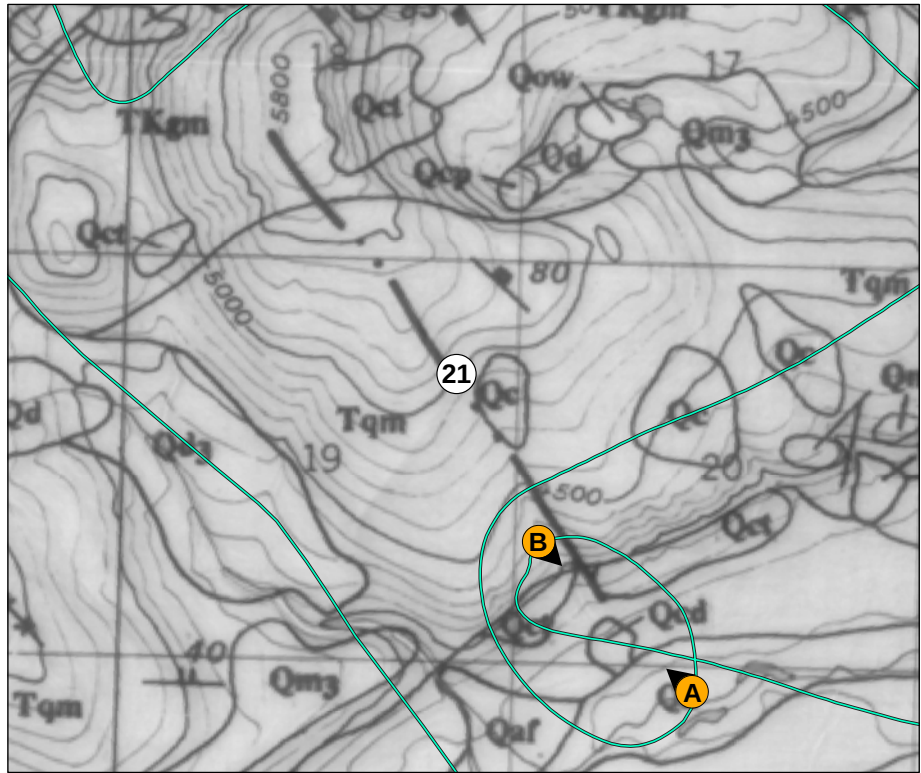
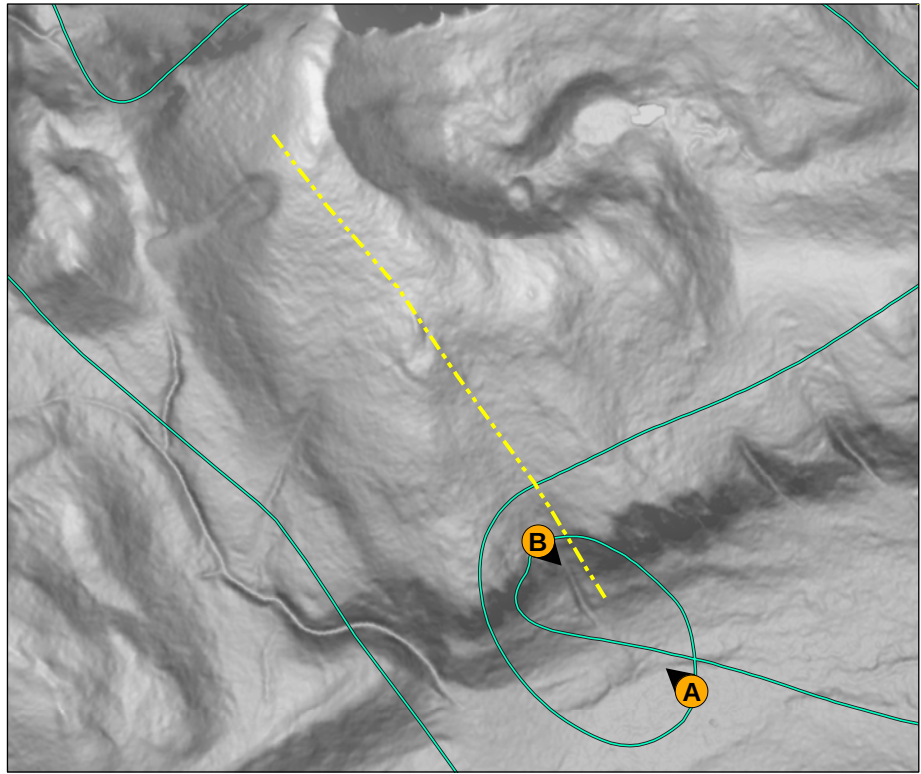
View looking southwest from photograph location C. The arrows indicate the projected path of Feature 19 lineament.



View looking northwest from photograph location E. Arrows show the mapped trace of Feature 20 lineament. Note mapped trace of Feature 20 is coincident with linear drainage.



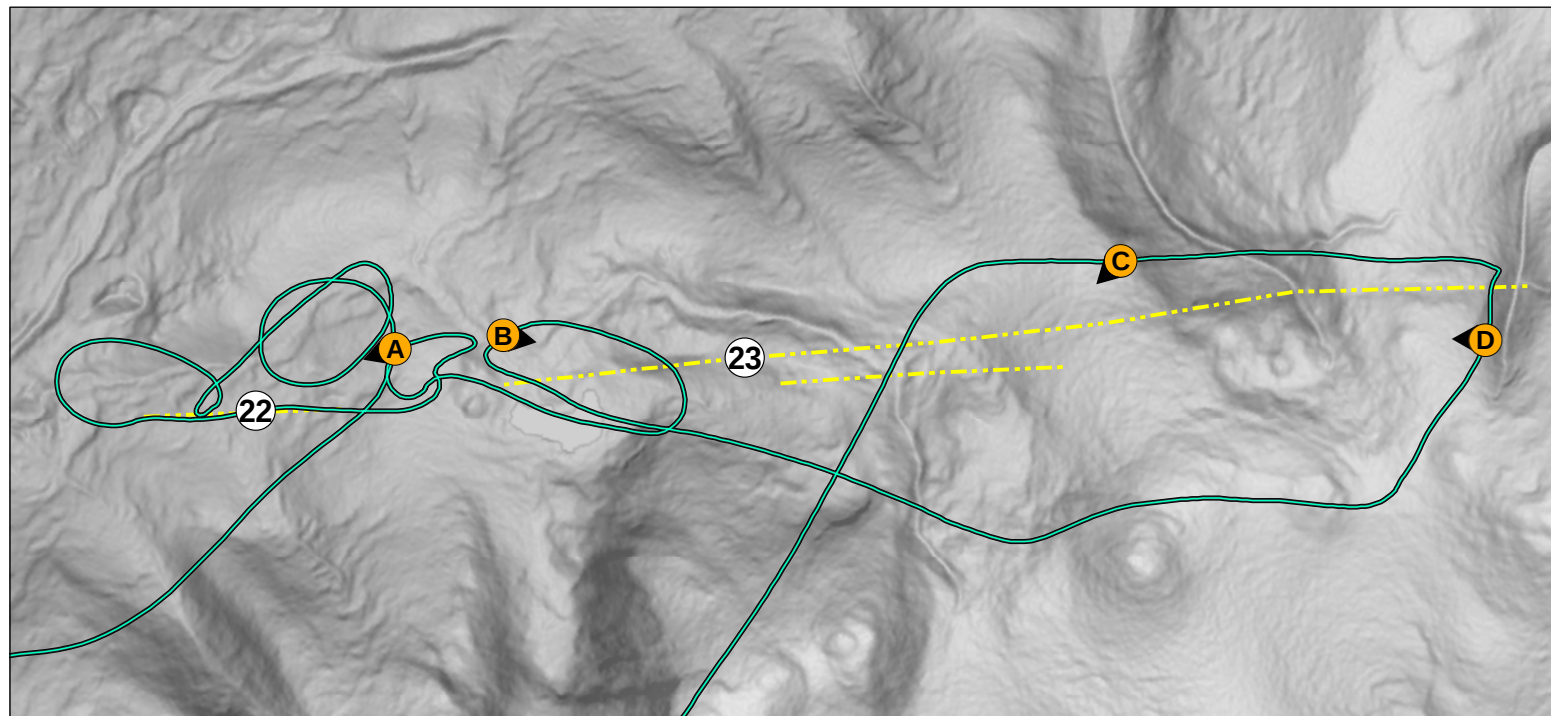
View looking northwest from photograph location D. Arrows show the mapped trace of Features 18 and 19. Note absence of lineaments or apparent deformation in Quaternary deposits between brackets in lower middle portion of photograph.



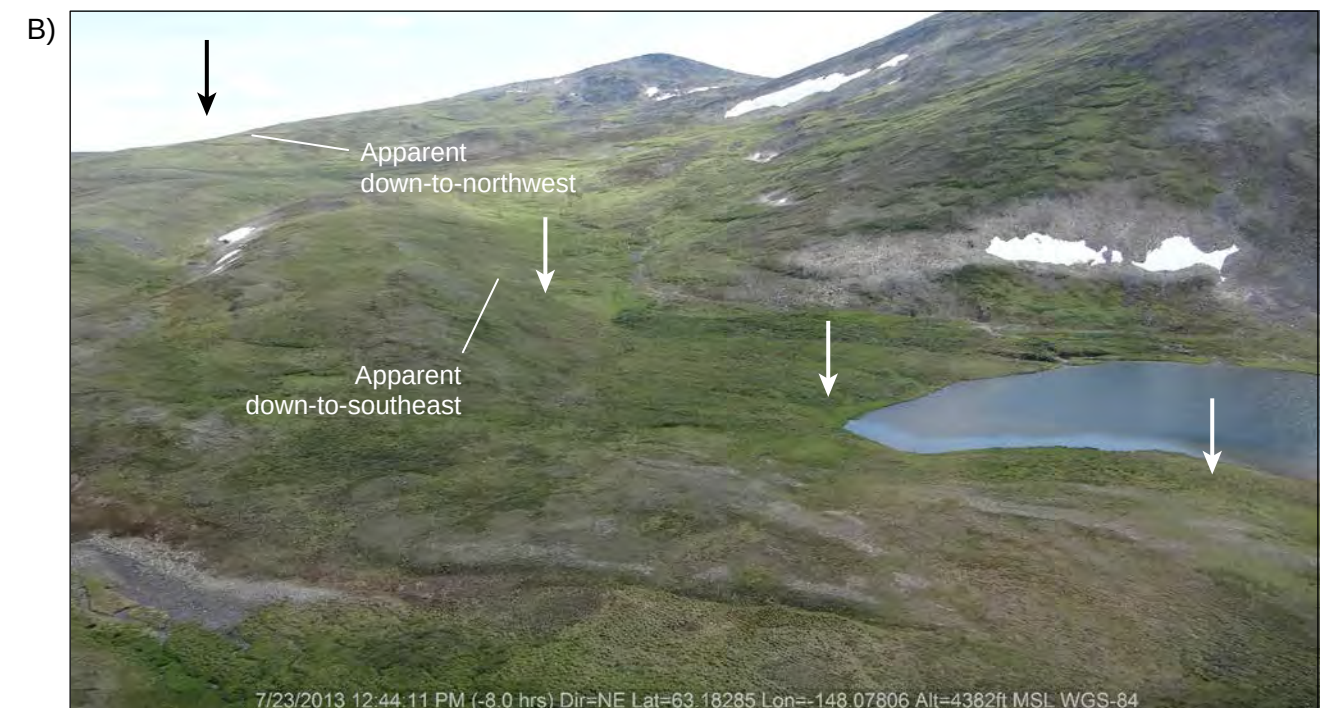
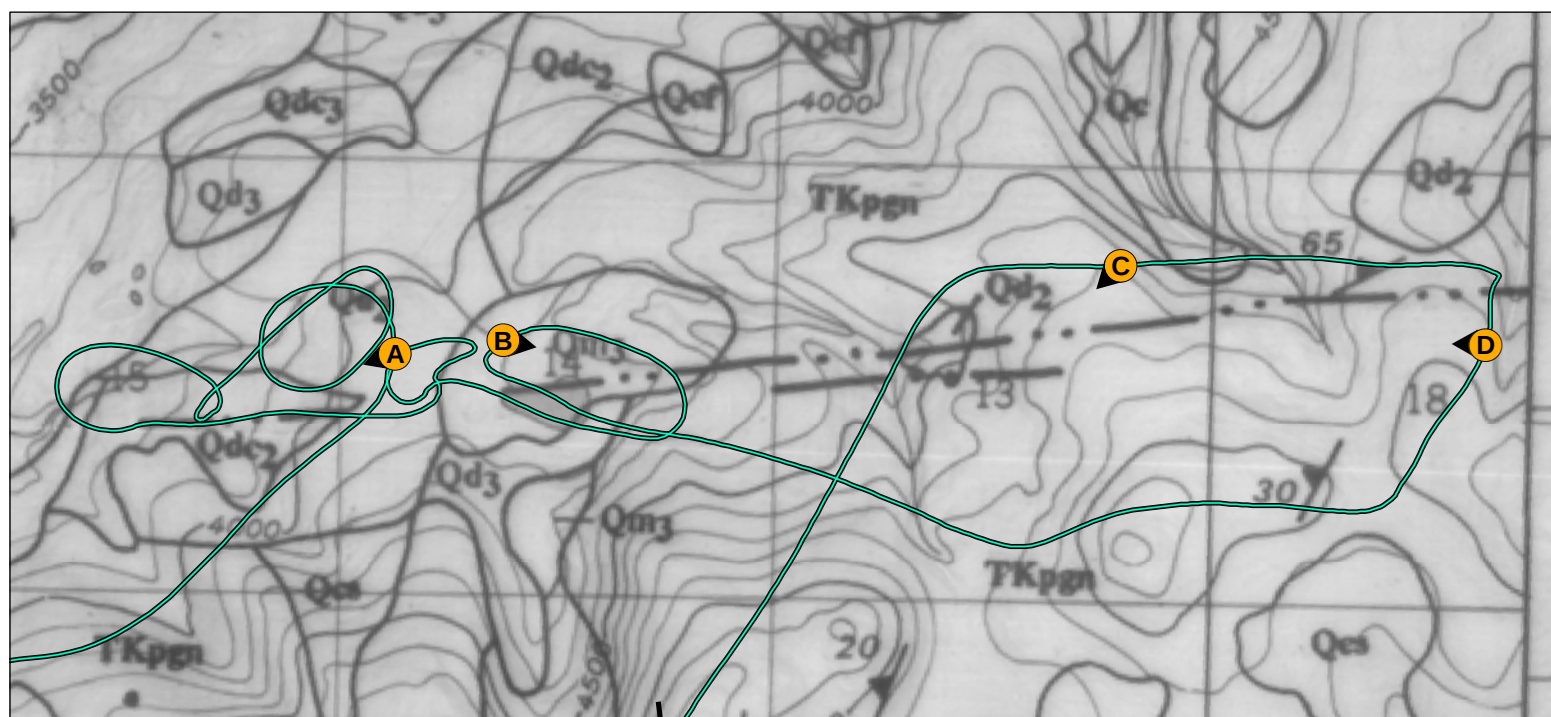
View looking northwest from photograph location A. Arrows indicate the projected path of Feature 21 lineament.



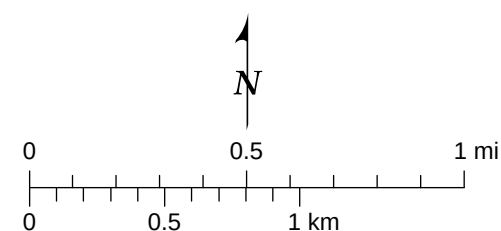
View looking southeast from photograph location B. Arrows show the projected trace of Feature 21 lineament.



View looking west from photograph location A. Brackets show the projected trace of Feature 22. Note the absence of a continuous lineament along the projected trace and exposed till on low relief ridge crest between drainages.

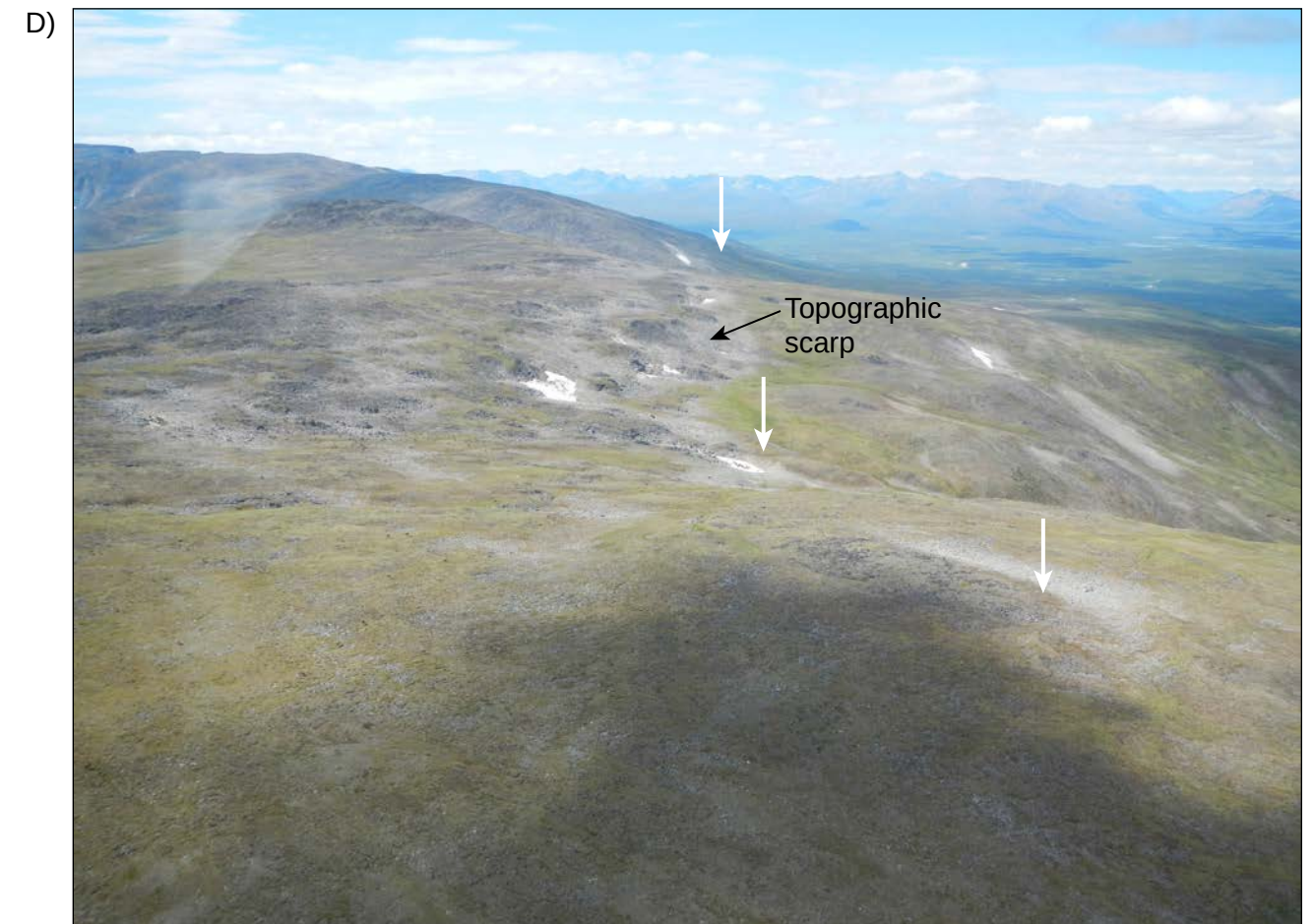


View looking east from photograph location B. Arrows and brackets indicate the projected path of Feature 22 lineament. Note change in apparent vertical displacement.

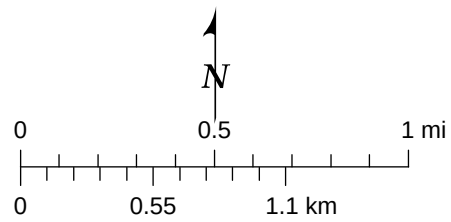
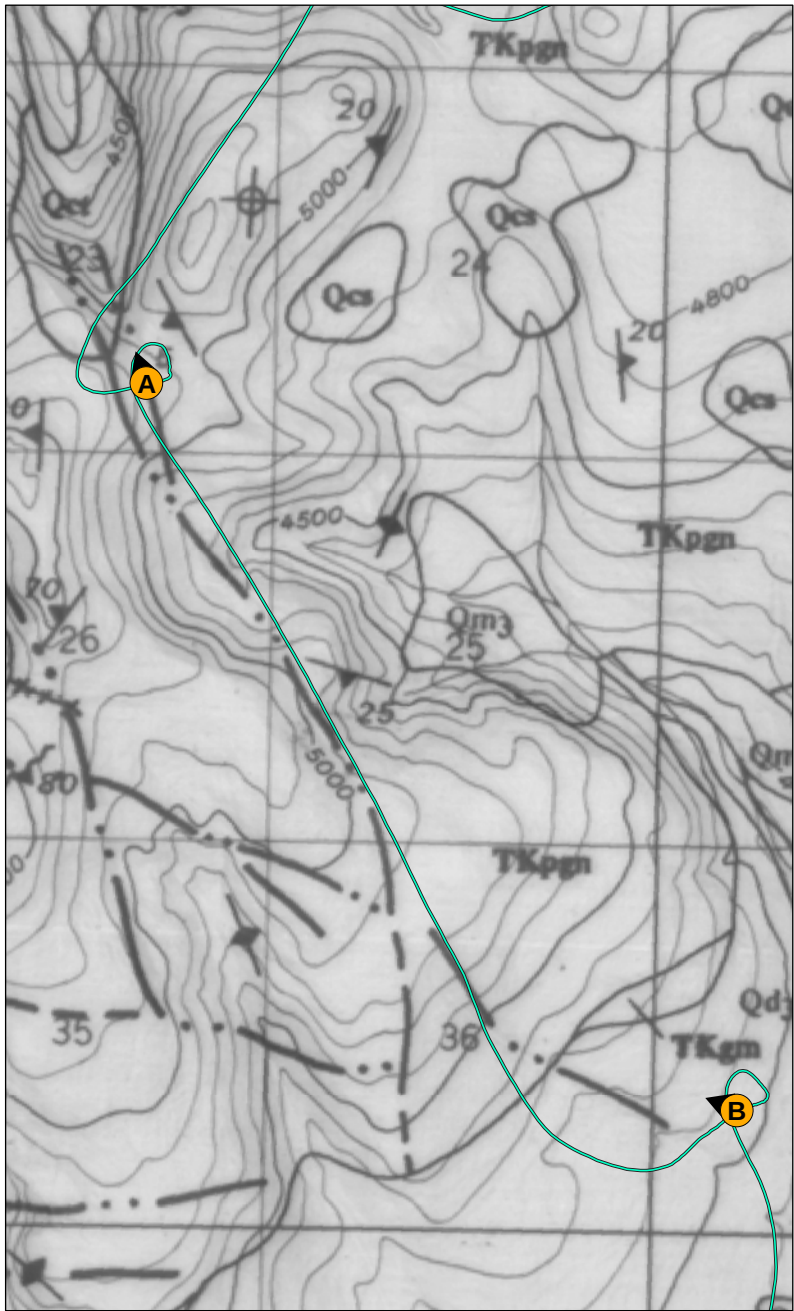
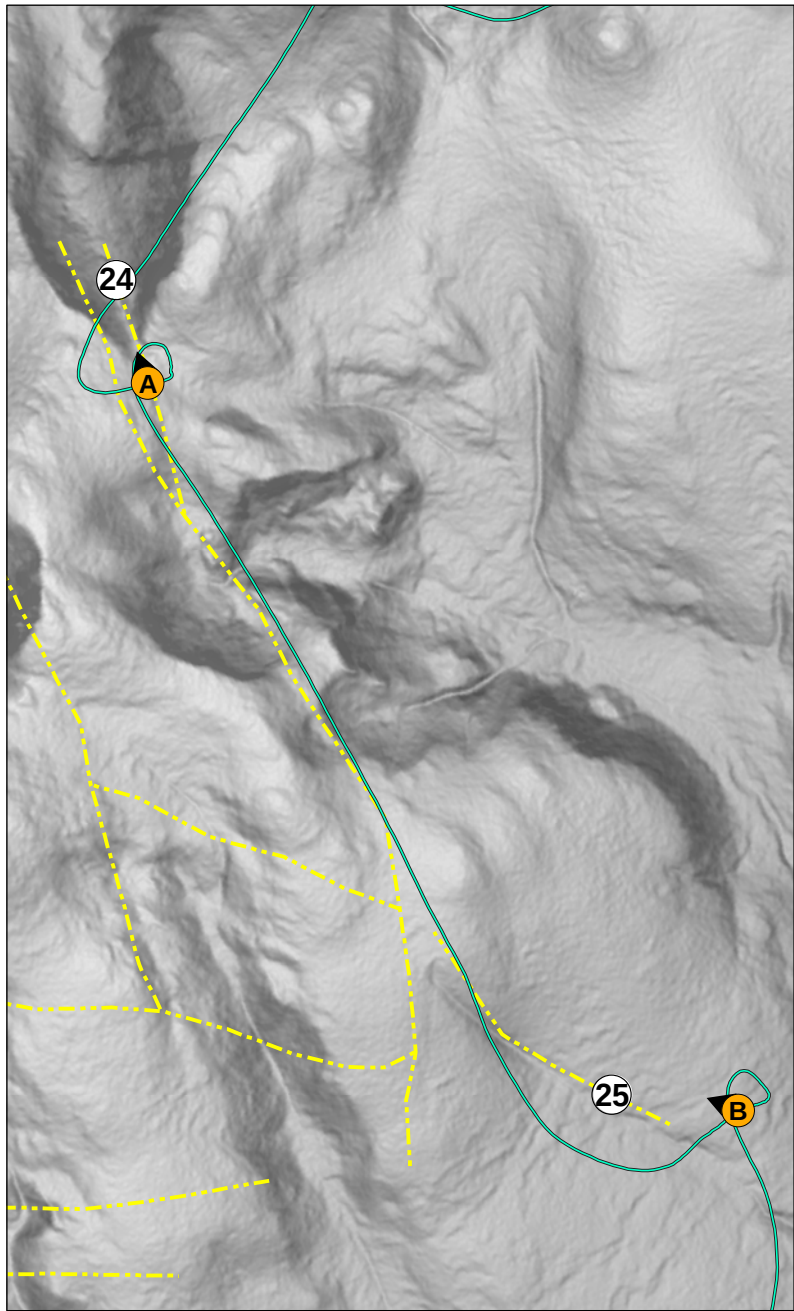




View looking west from photograph location C. Arrows show the projected trace of the Feature 22 lineament. Note linear expression is coincident with solifluction lobes and not continuous.



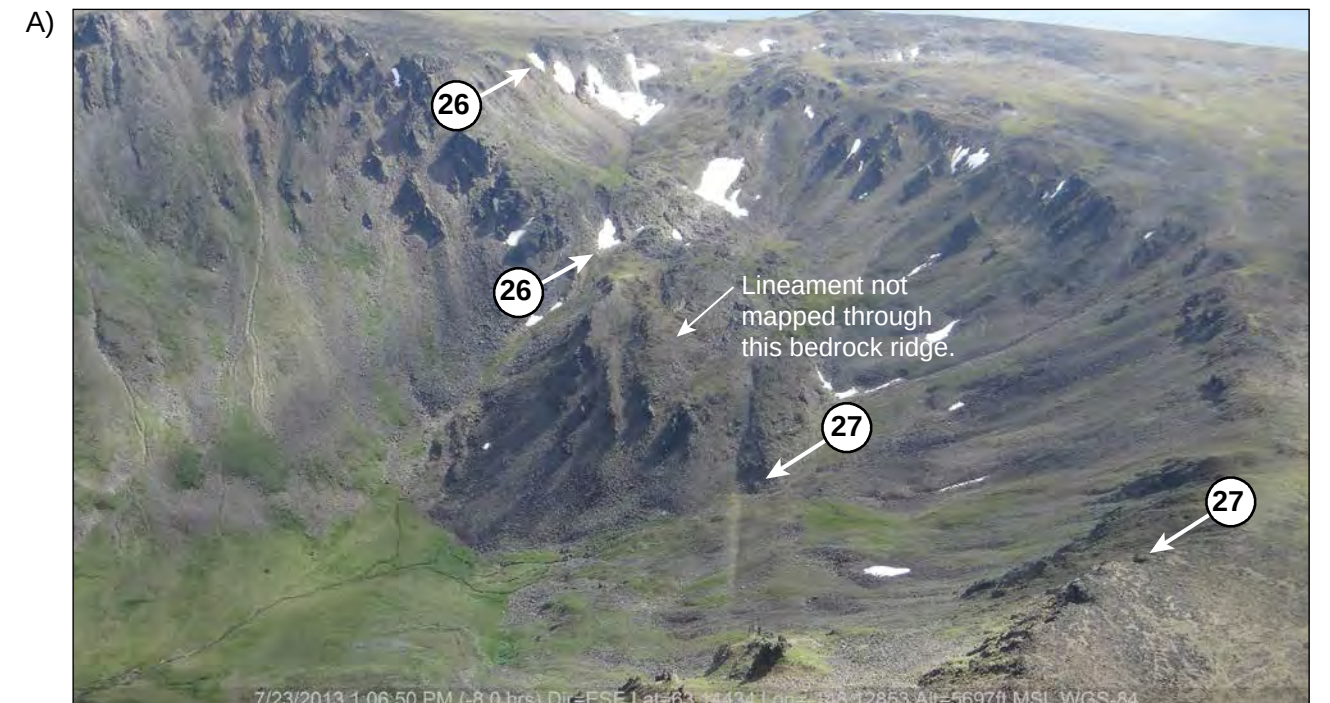
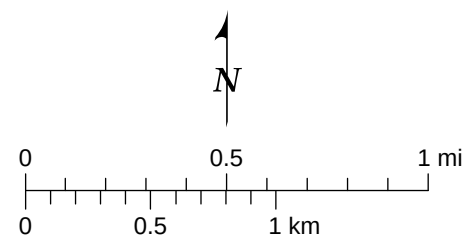
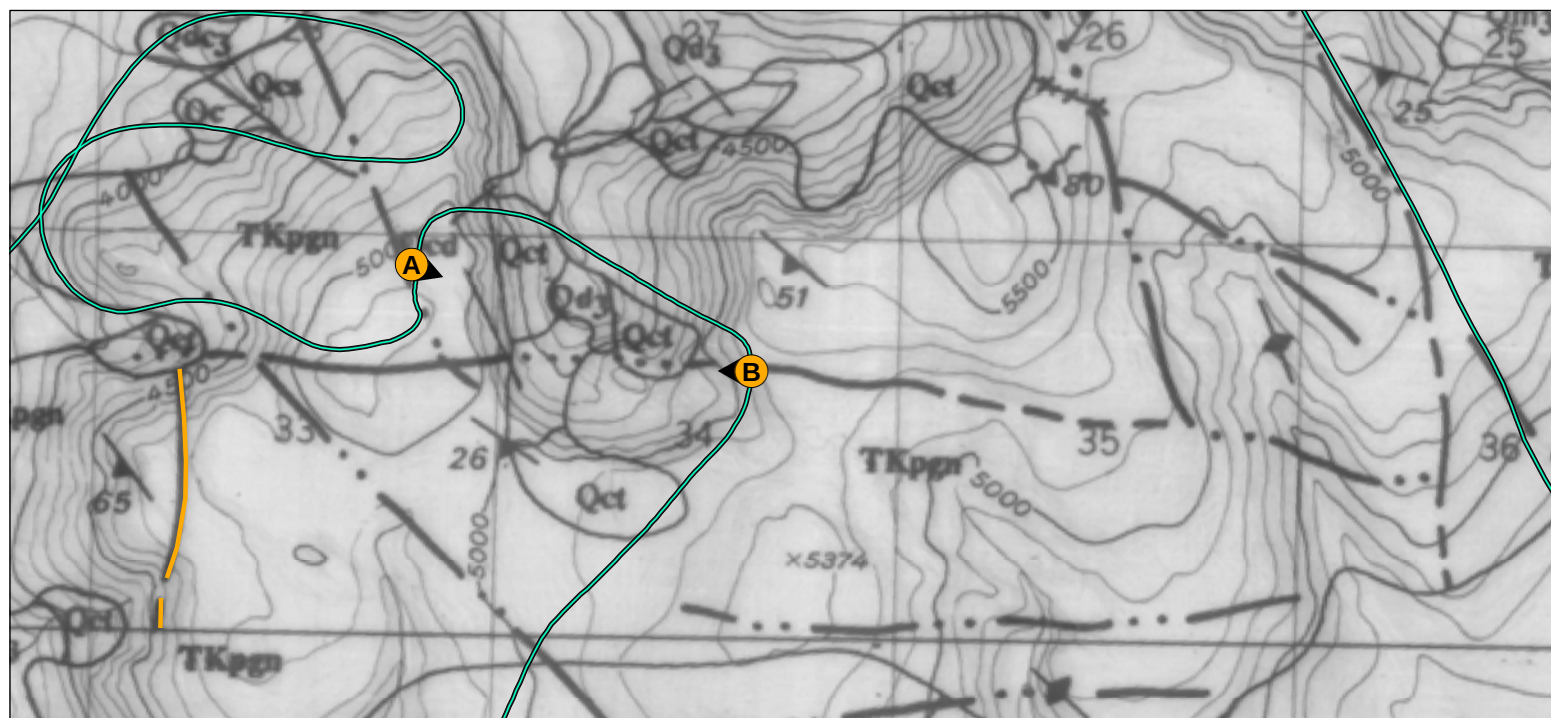
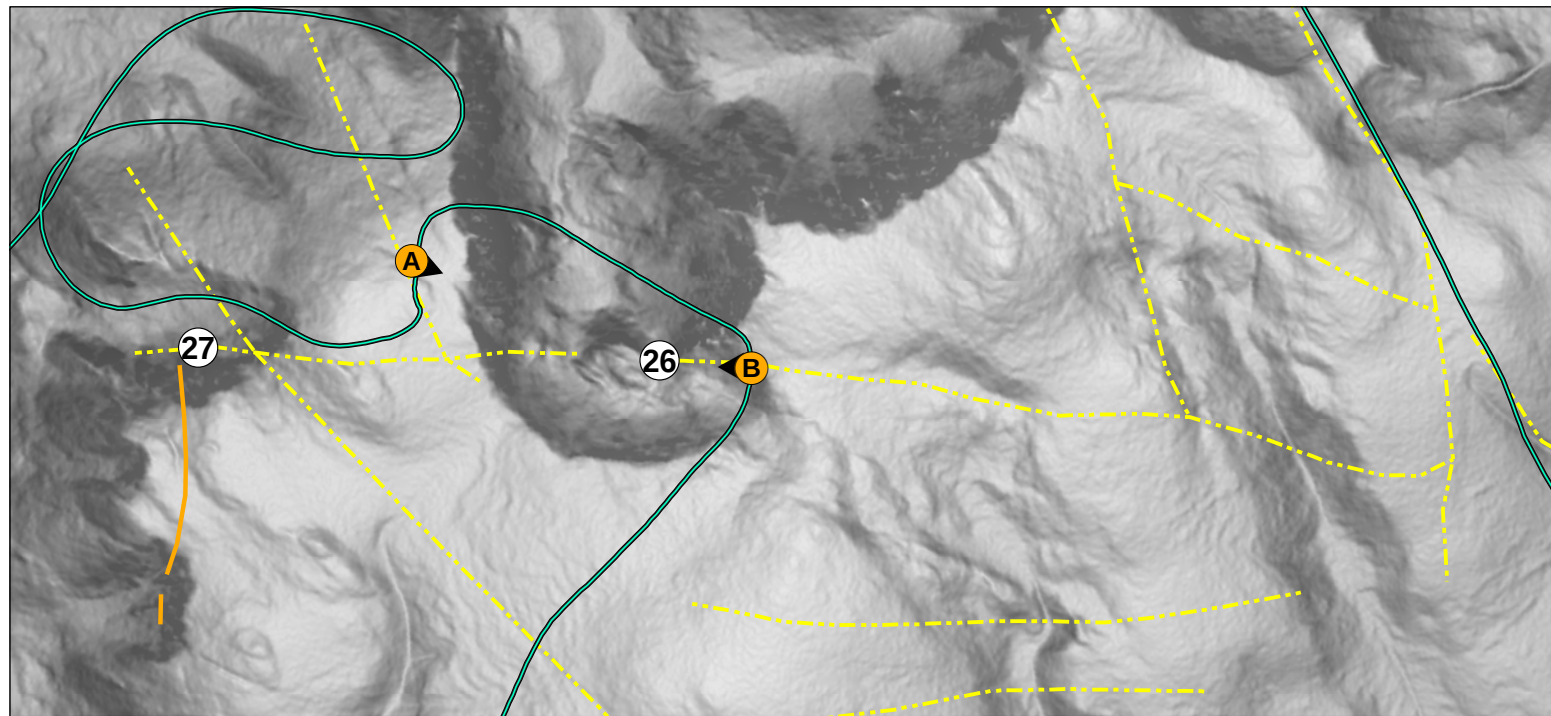
View looking west from photograph location C. Arrows show the projected trace of the Feature 22 lineament. Note topographic scarp in Photograph D is not proportional to minor scarps associated with solifluction in Photograph C.



View looking west from photograph location C. Arrows indicate the projected path of the Feature 24 lineament.



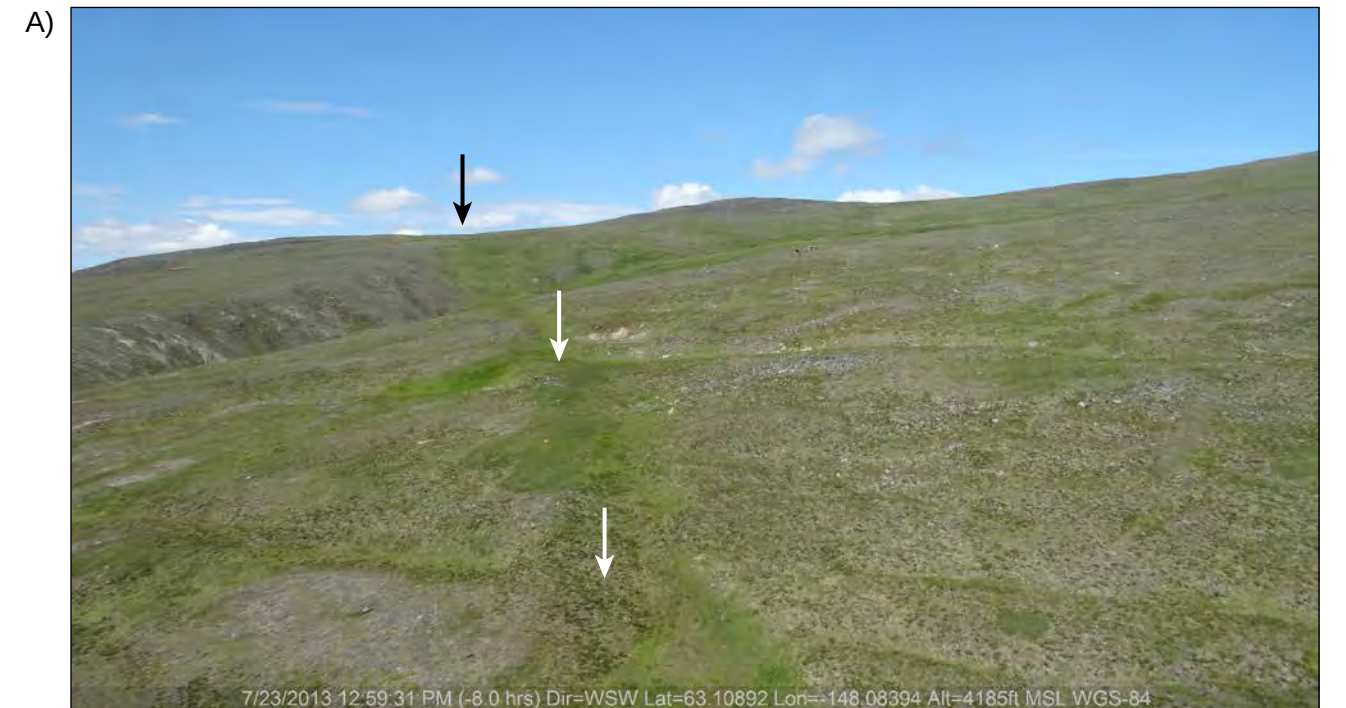
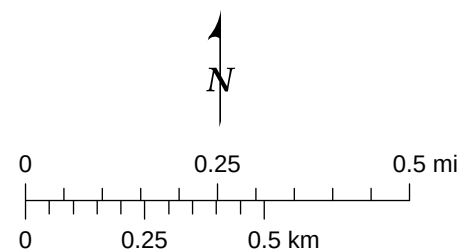
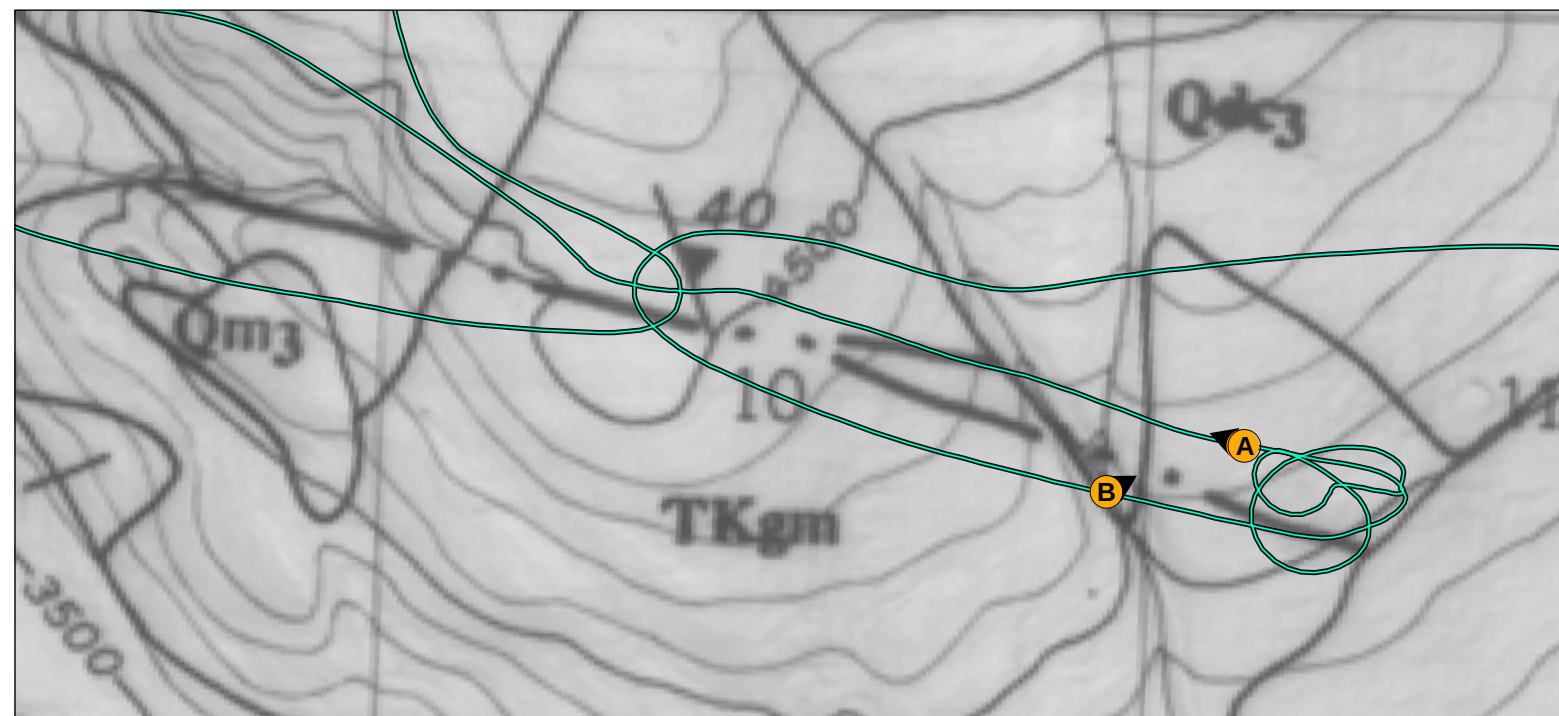
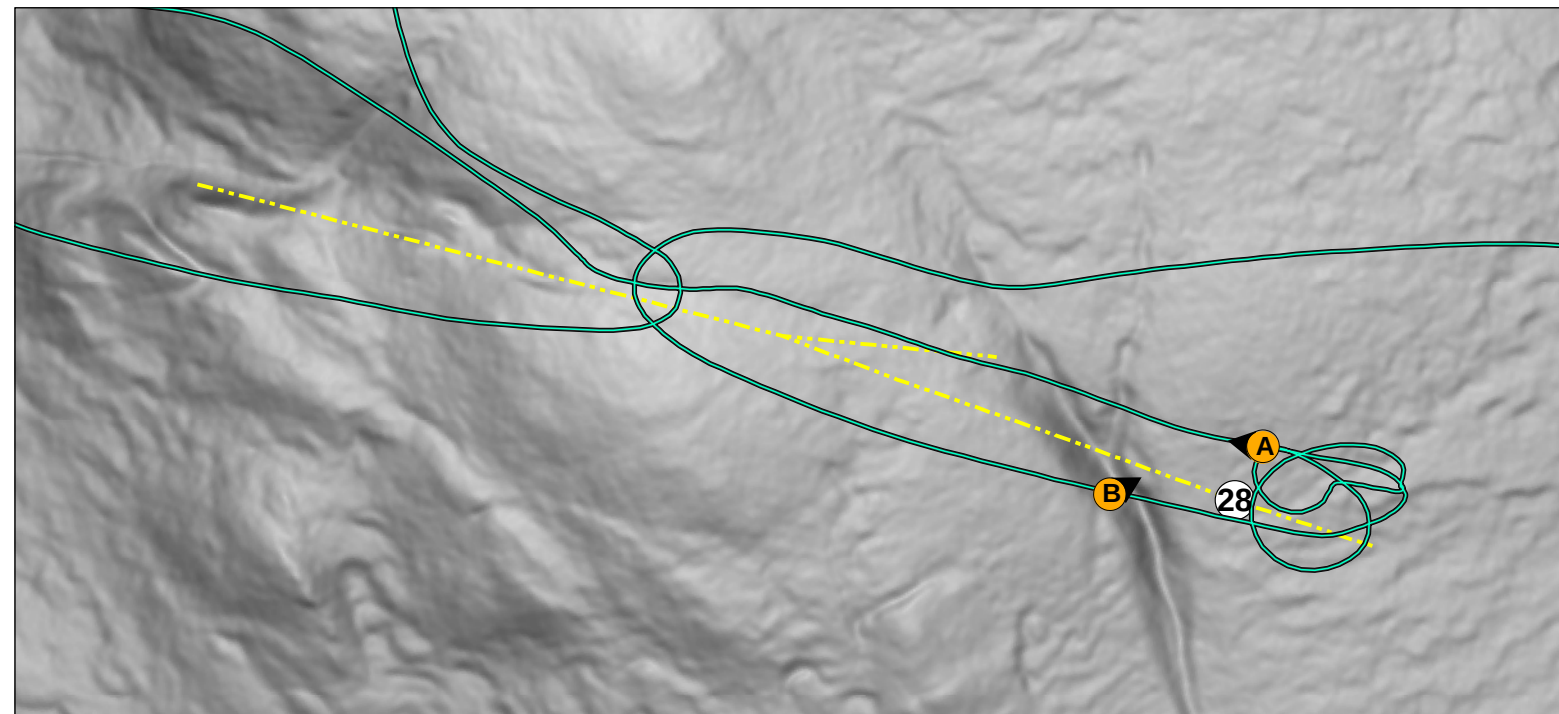
View looking west from photograph location C. Arrows indicate the projected path of the Feature 25 lineament.



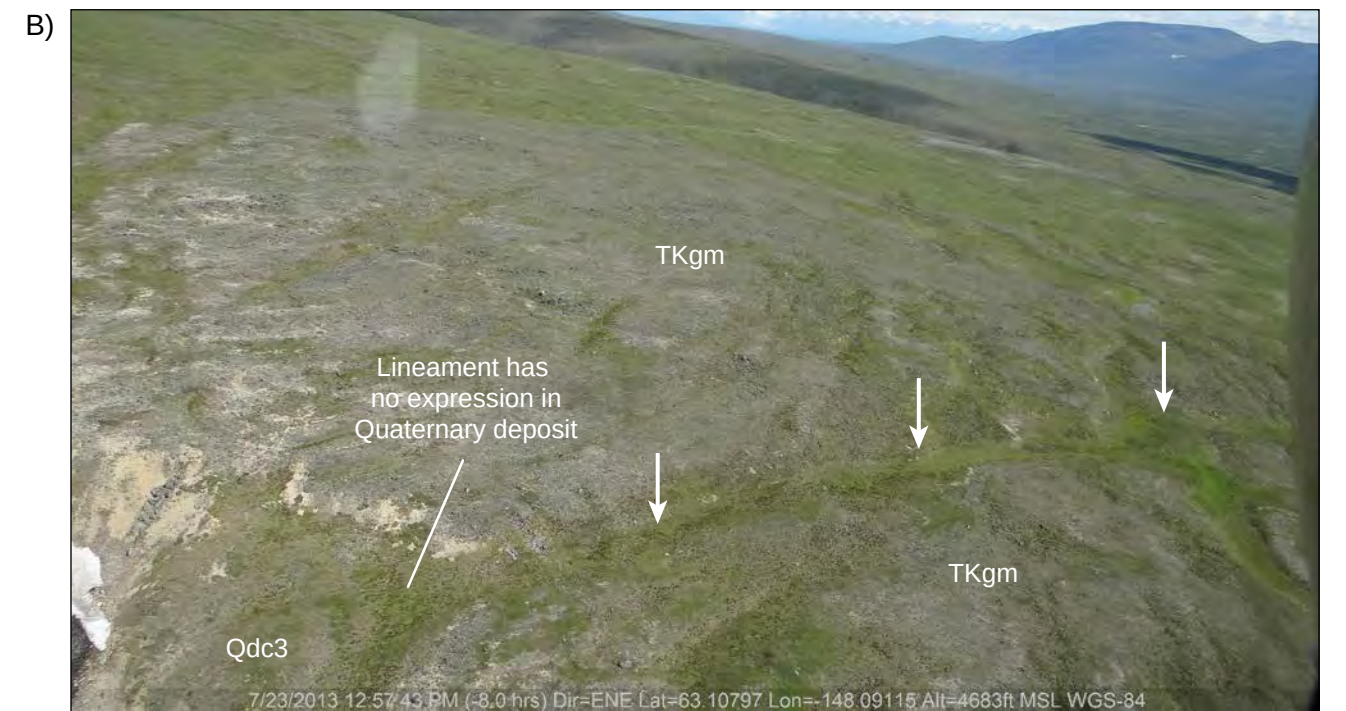
View looking west from photograph location A. Arrows show the projected trace of Features 26 and 27. Note the absence of a continuous and clear lineament along projected traces.



View looking east from photograph location B. Arrows and brackets indicate the projected path of Feature 26 and 27 lineaments. Note the absence of a continuous and clear lineament along projected traces.

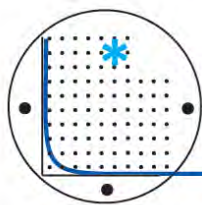


View looking west-northwest from photograph location A. Arrows show mapped trace of Feature 28. Note lineament corresponds to subtle linear trough and linear vegetation trend.



View looking east from photograph location B. Arrows indicate the mapped trace of Feature 28. Note absence of linear expression in Quaternary deposits.

**Appendix C:
Final Luminescence Age Report, Prepared by Utah State University
Luminescence Laboratory**



Project: **Susitna-Watana Dam, AK**
Scientist: **Dean Ostenaa, Fugro Consultants**

Project: **204**
Report date: **March 31, 2015**

Preliminary Luminescence Age Report

Optically Stimulated Luminescence Age Information¹

Sample num.	USU num.	Depth (m)	Num. of aliquots ²	Dose Rate (Gy/ka)	$D_e^3 \pm 2\sigma$ (Gy)	OD ⁴ (%)	Preliminary OSL age $\pm 2\sigma$ (ka)
DMC-14-S1-1	USU-1890	0.43	15 (24)	2.49 ± 0.13	34.0 ± 14.2	41.8	14 $\pm$ 6
DMC-14-S1-2	USU-1891	0.53	17 (24)	2.67 ± 0.14	34.0 ± 3.7^5	15.7	13 $\pm$ 2
DMC-14-S1-3	USU-1892	0.85	14 (23)	2.57 ± 0.13	42.8 ± 9.4	14.7	17 $\pm$ 4
DMC-14-S1-4	USU-1893	1.03	13 (21)	2.44 ± 0.13	37.5 ± 8.4^6	24.6	15 $\pm$ 4

¹ Preliminary age analysis using the single-aliquot regenerative-dose procedure of Murray and Wintle (2000) on 2mm small-aliquots of quartz sand.

² Number of aliquots used in preliminary age calculation and number of aliquots analyzed in parentheses.

³ Equivalent dose (D_e) calculated using the Minimum Age Model of Galbraith and Roberts (2012), except where noted otherwise.

⁴ Overdispersion (OD) represents variance in D_e data beyond measurement uncertainties, OD >20% may indicate significant scatter due to depositional or post-depositional processes.

⁵ D_e calculated using the Central Age Model of Galbraith and Roberts (2012).

⁶ D_e calculated using the arithmetic mean.

Dose Rate Information¹

Sample num.	USU num.	Grain size (μm)	H_2O^2 (%)	K (%)	Rb (ppm)	Th (ppm)	U (ppm)	Cosmic (Gy/ka)
DMC-14-S1-1	USU-1890	125-212	6.1	1.70 ± 0.04	55.5 ± 2.2	6.1 ± 0.6	1.4 ± 1.0	0.19 ± 0.02
DMC-14-S1-2	USU-1891	125-250	20.5	1.74 ± 0.04	55.0 ± 2.2	6.9 ± 0.6	1.8 ± 0.1	0.22 ± 0.02
DMC-14-S1-3	USU-1892	125-250	7.0	1.81 ± 0.05	53.9 ± 2.2	7.4 ± 0.7	1.0 ± 0.1	0.22 ± 0.02
DMC-14-S1-4	USU-1893	90-250	3.3	1.71 ± 0.04	51.4 ± 2.1	6.6 ± 0.6	1.0 ± 0.1	0.21 ± 0.02

¹ Radioelemental concentrations determined by ALS Chemex using ICP-MS and ICP-AES techniques, dose rate is derived from concentrations by conversion factors from Guerin et al. 2011.

² *In-situ* gravimetric water content, assumed $6.5 \pm 3.0\%$ (average of USU-1890 and USU-1892) for moisture content to represent burial history for USU-1891 and USU-1893.