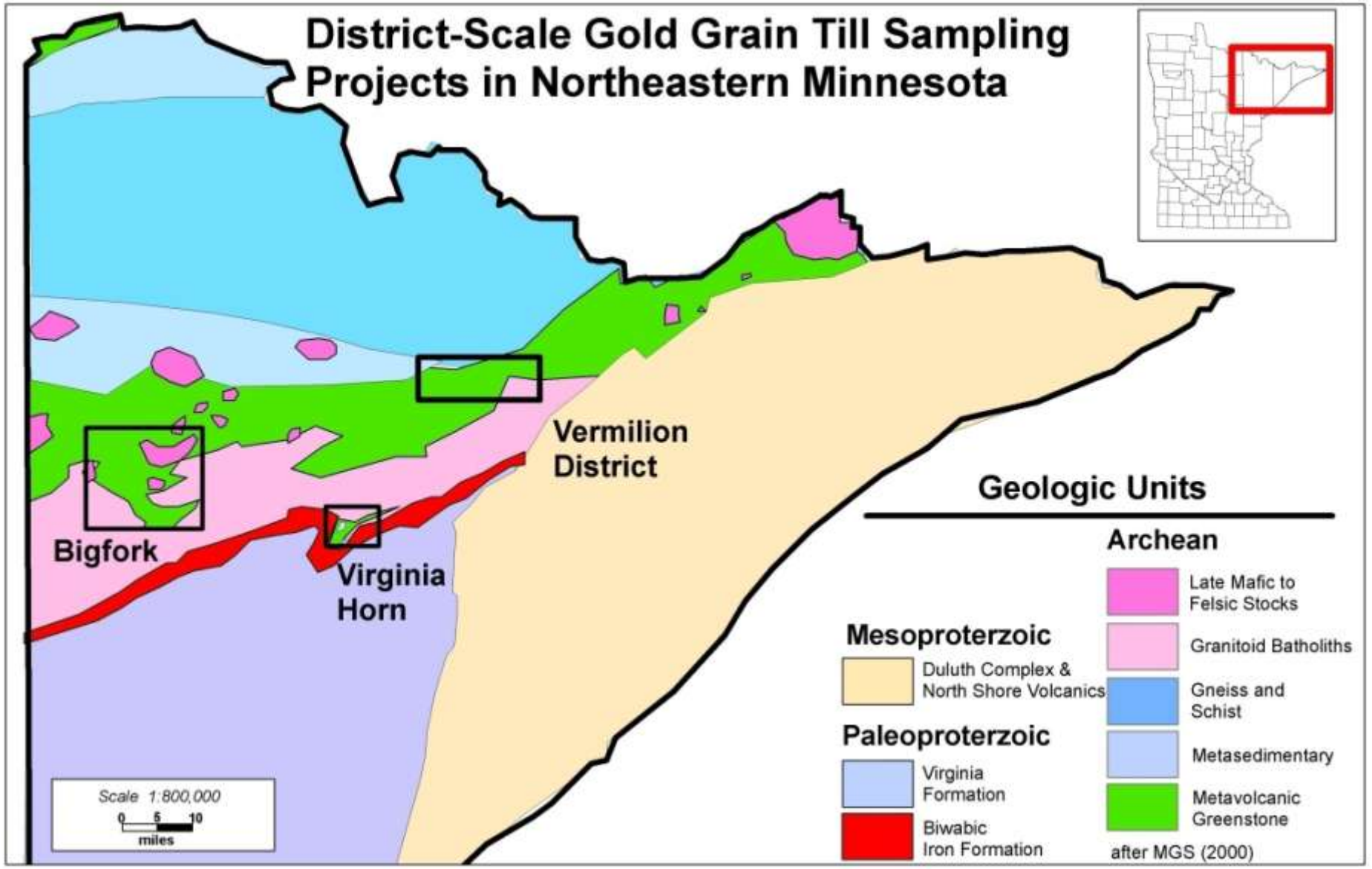
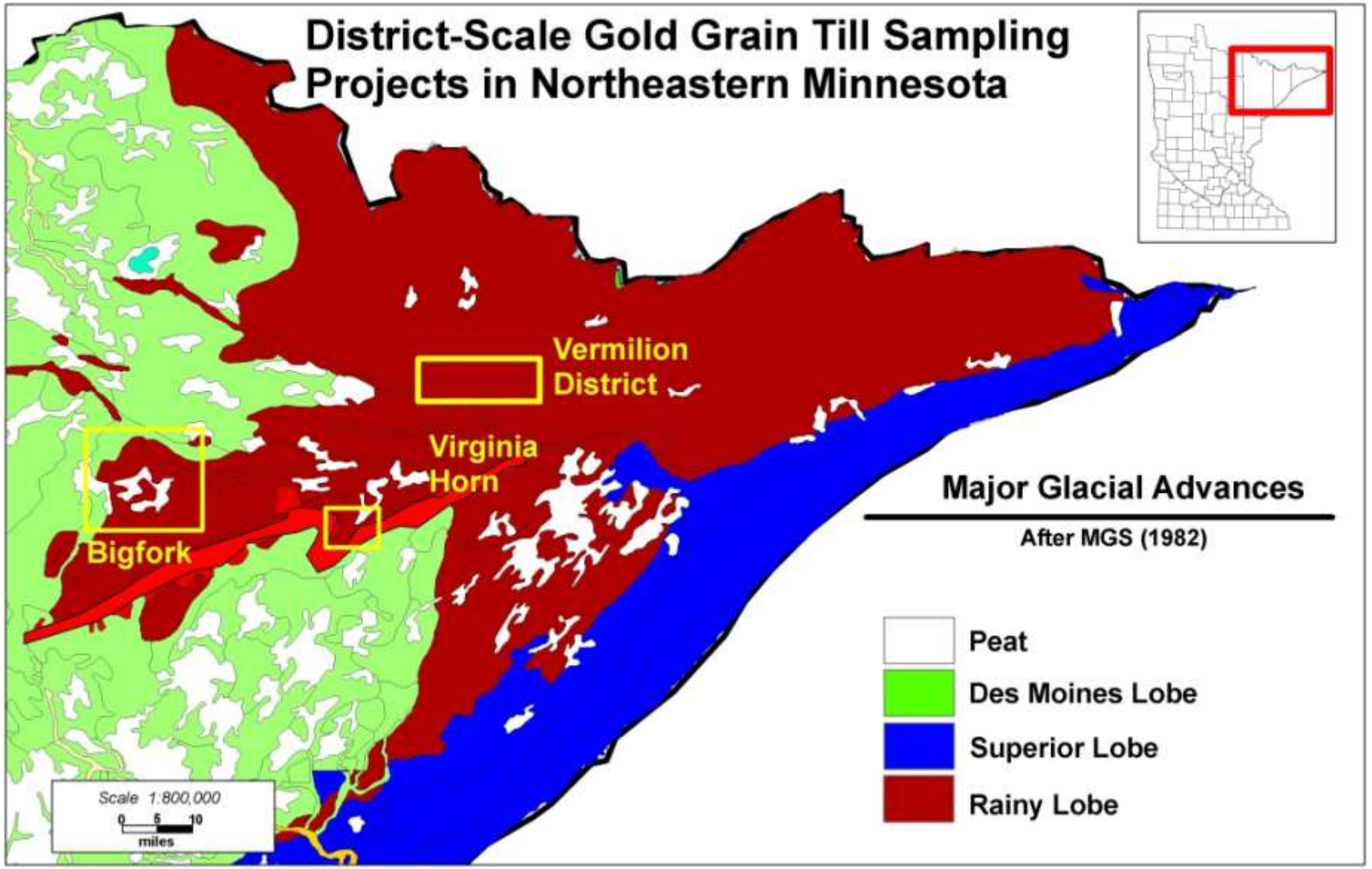
Regional Survey of Gold in Till, Bigfork Greenstone Belt, St. Louis & Itasca Counties, Minnesota: Follow-up Trenching in Areas with Anomalously High Gold Grain Counts

Don Elsenheimer, Ph.D
Glenn Melchert
Minnesota Dept. Natural Resources

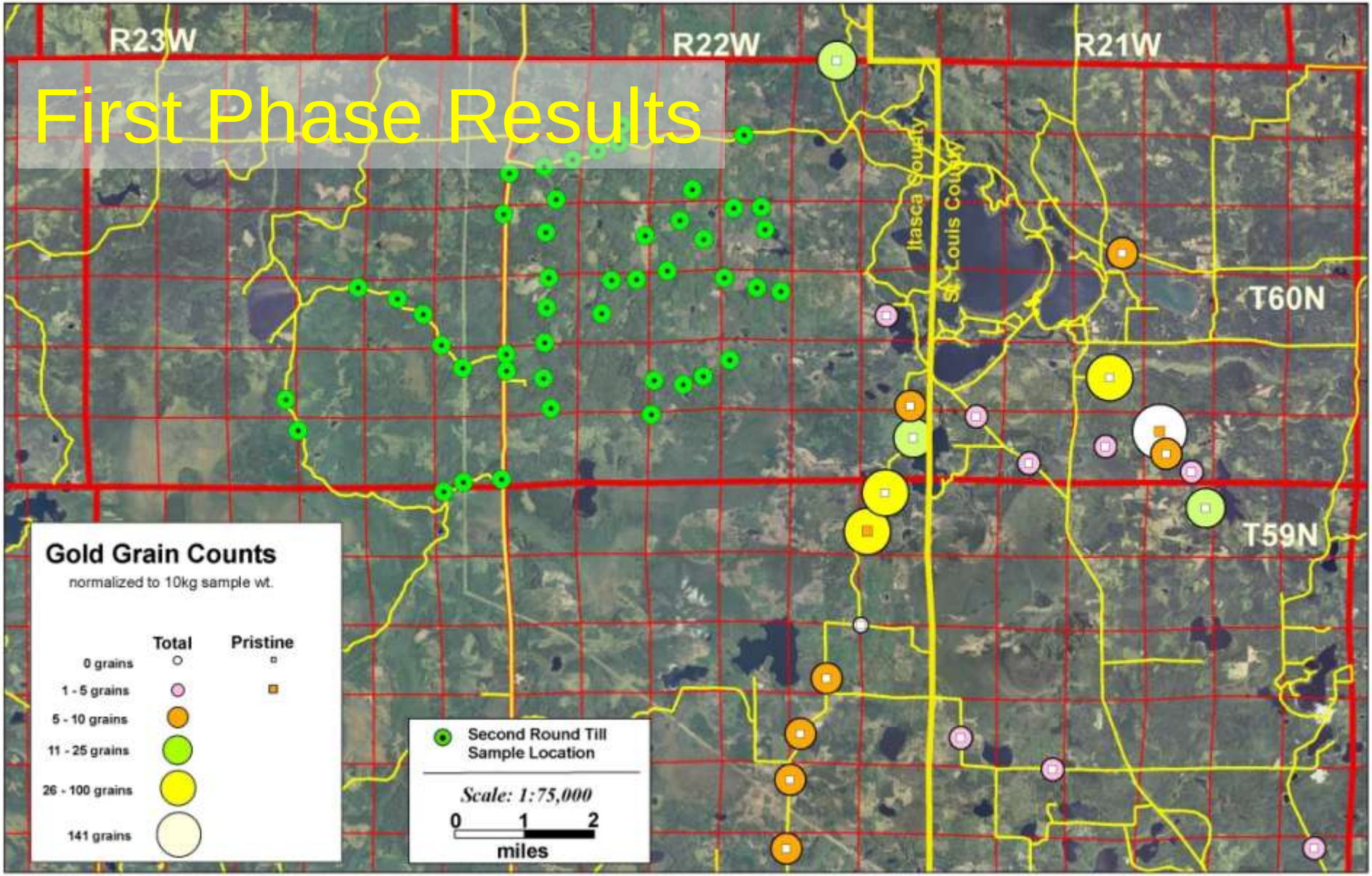


The Bigfork Greenstone Belt, located in Northeastern Minnesota, USA, is one of three areas where the MnDNR has recently conducted sampling programs for gold grains in till that overlies greenstone belts within of the Wawa Subprovince of the the Superior Province.



The Bigfork Greenstone Belt is located on the contact between Rainy Lobe and younger Des Moines lobe surficial sediments. Samples were collected from Rainy Lobe till, which also overlies the Vermilion District and Virginia Horn.

First Phase Results



The first phase of till sampling was completed primarily in St. Louis County and the eastern portion of the project area. Anomalously high total grain counts were identified in areas that have not been previously explored and lack previously identified gold prospects.

Hand-shovel Sampling of Till

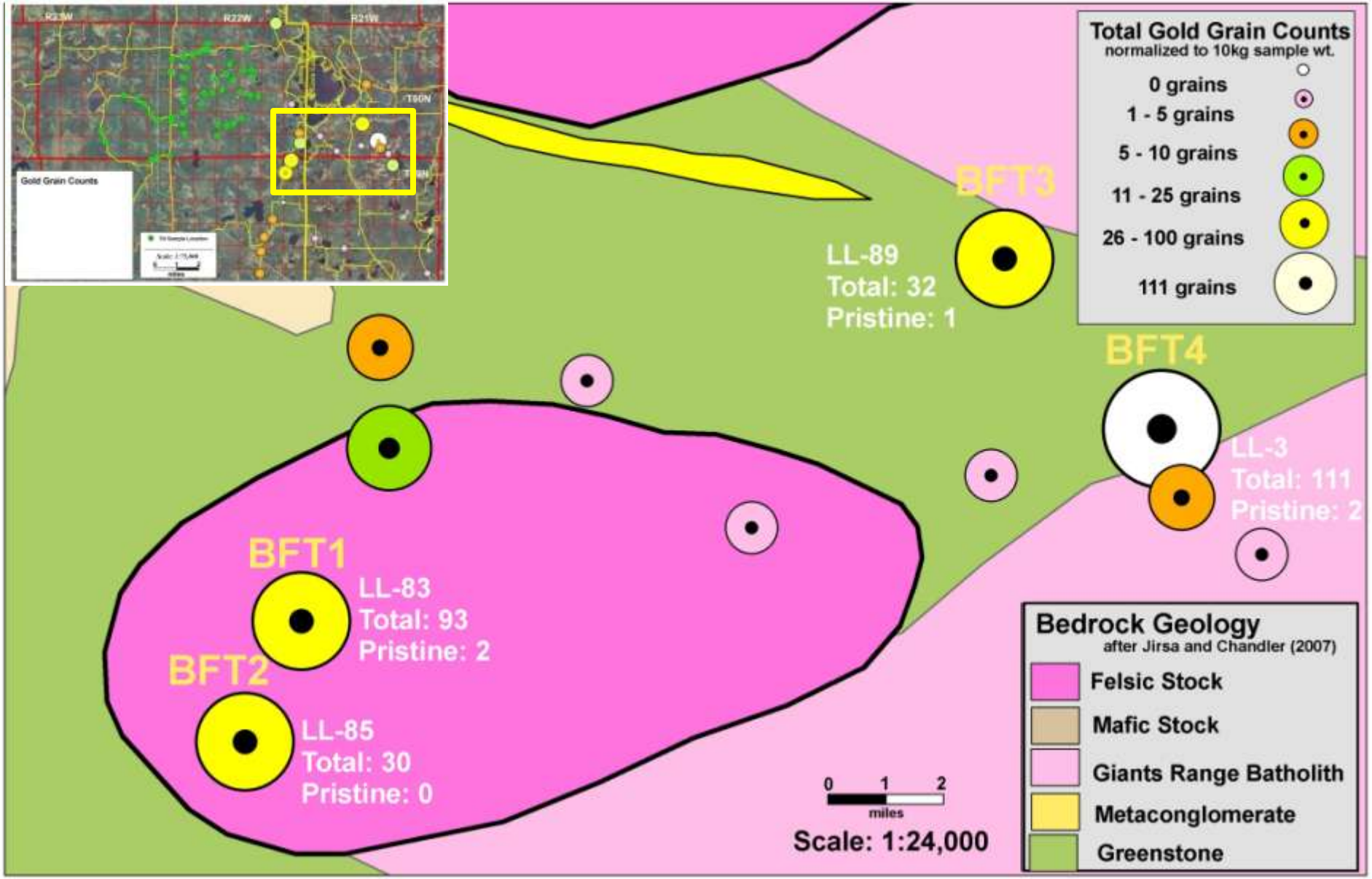
- Till samples collected at or near bedrock surface are best indicators for mineralization
- B-horizon soils in project area range in composition from outwash sands to hard-packed clay till
- Samples were obtained by hand shovel, which limits ability to observe lateral and vertical variations in soil/till composition.

Project Second Phase

- Open trenches in the Phase 1 sample locations with the highest total gold grain counts.
- Collect till samples from the western half of the project area (results pending).

Goals of Trenching Project

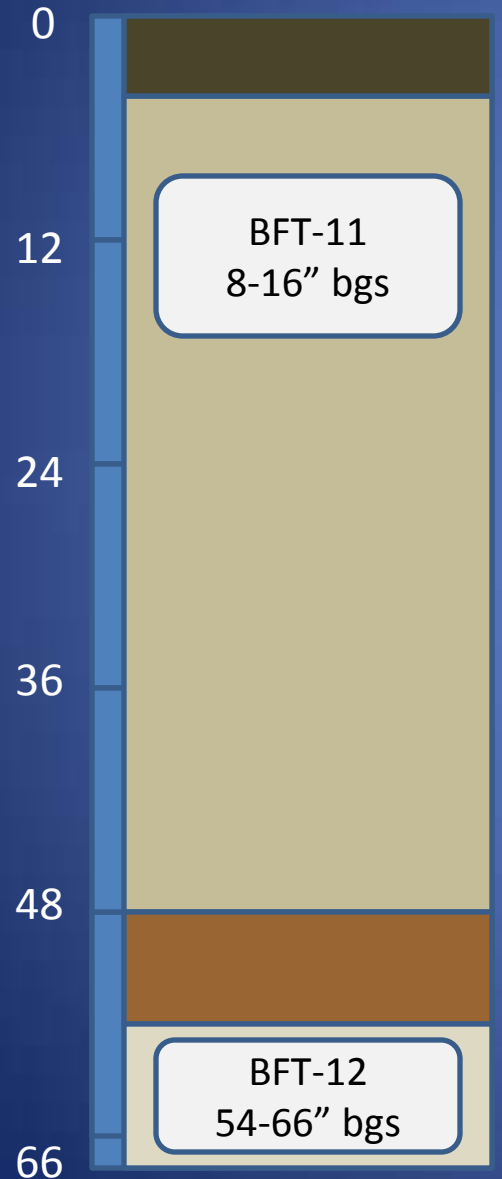
- Use a backhoe to open trenches in the four sample locations with the highest total gold grain counts.
- Characterize vertical and lateral variations in till content; collect samples from representative horizons.
- Verify first-round sampling results; evaluate possible depth or material-dependent variation.



Four sample locations with anomalous total gold grain counts were trenched. BFT1 and BFT2 overlie a late quartz-poor pyroxene syenite, while BFT3 and BFT4 overlie a greenstone unit (tholeiitic basalt flows with pillow structures).

A skid mounted backhoe was used to excavate trenches within the overburden in each of the four selected locations. Depth and lateral variations in soil/till composition were revealed that would not have been visible using hand shovel collection methods.

Trench BFT-1 Stratigraphy



0 – 4 inches: Dark brown topsoil

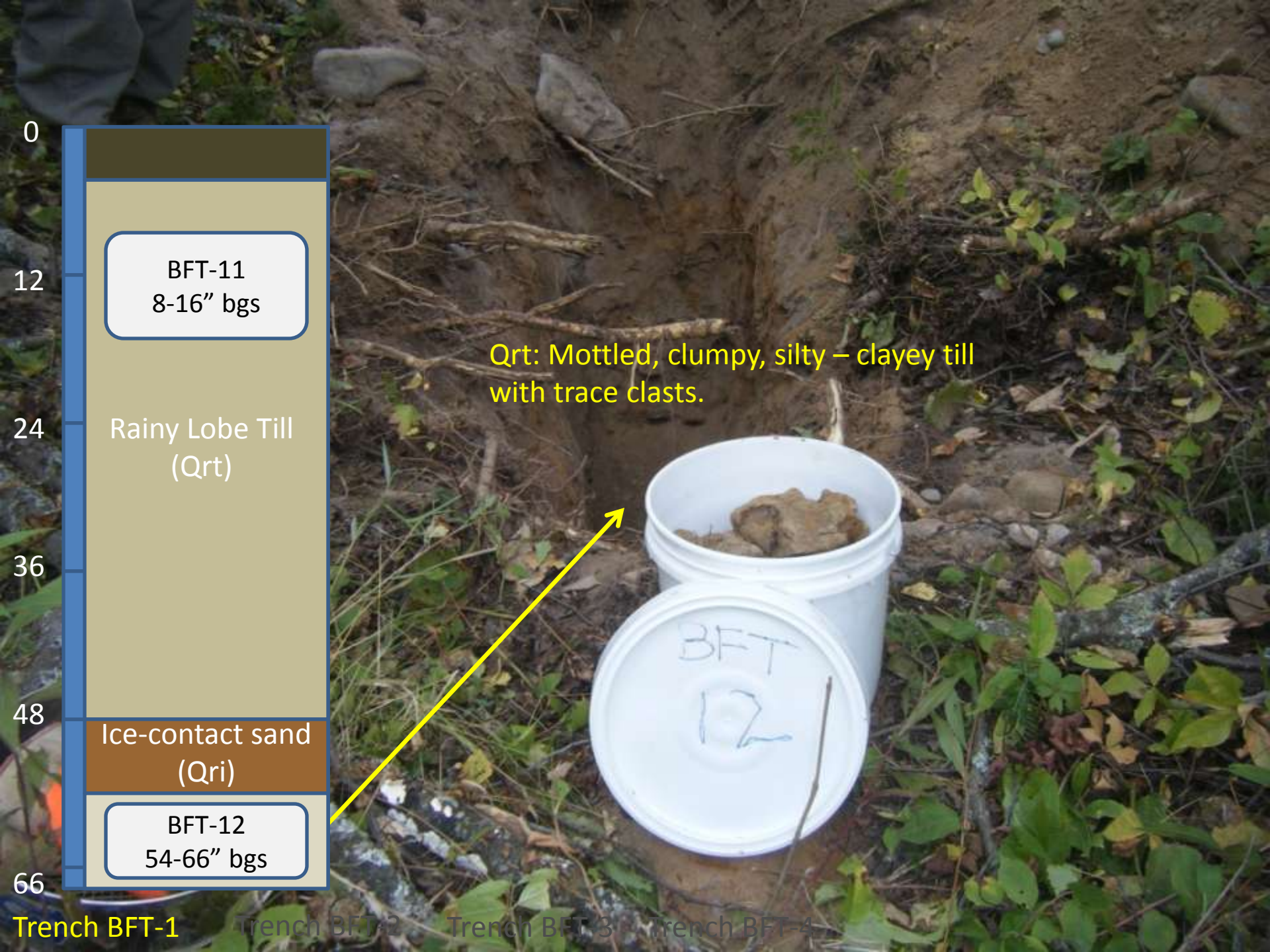
4 – 48 inches: Rainy Lobe Till (Qrt)
Light brown/orange sandy clast-rich till.
Clasts range in size from pebbles to small boulders.

48 – 54 inches: Brown fine grained sand
Rainy ice-contact sediment (Qri).

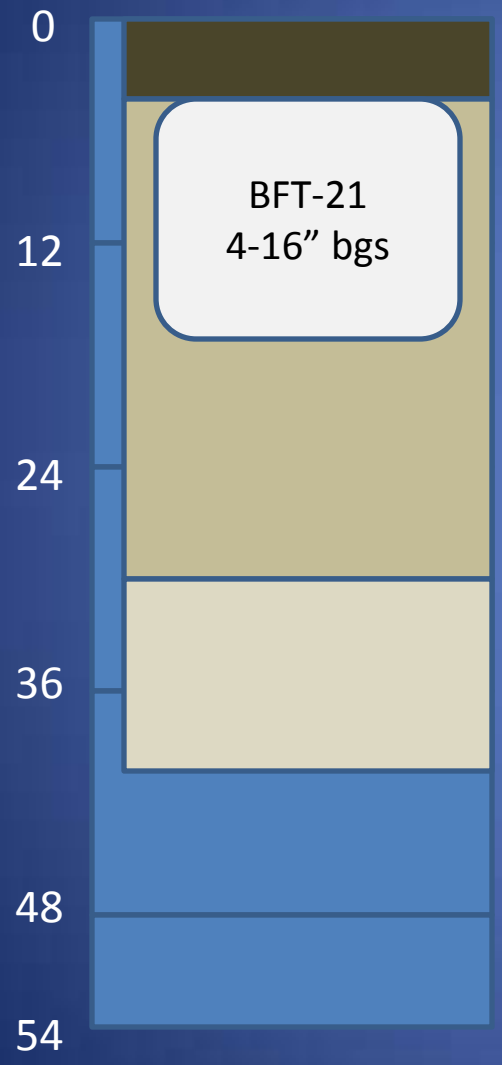
54 – EOT : Mottled, clumpy, silty – clayey till with trace clasts (Qrt).

66 inches: End of trench

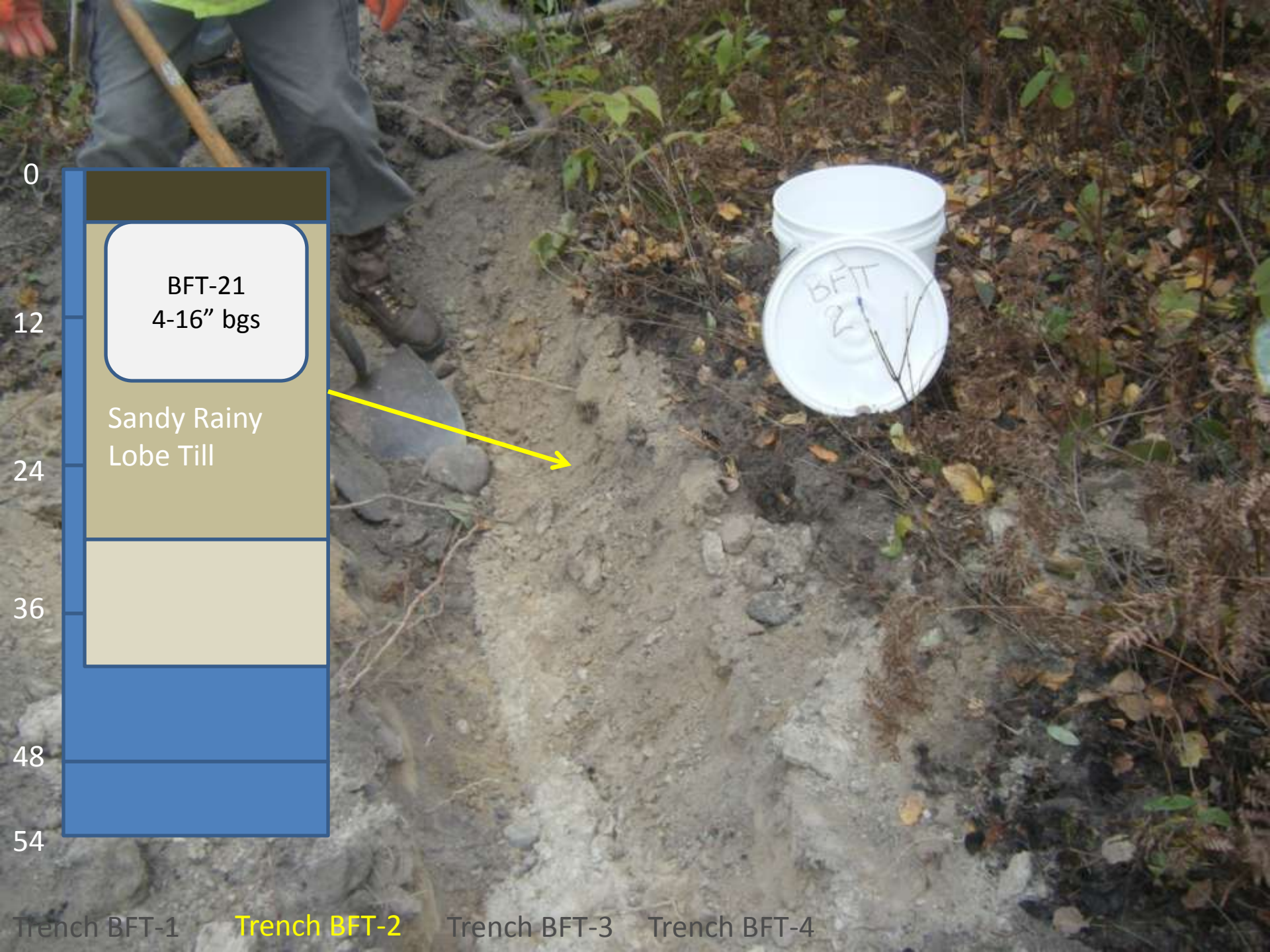

0
12
24
36
48
66
BFT-11
8-16” bgs
Rainy Lobe Till
(Qrt)
Ice-contact sand
(Qri)
BFT-12
54-66” bgs
BFT
Trench BFT-1
Trench BFT-2
Trench BFT-3
Trench BFT-4

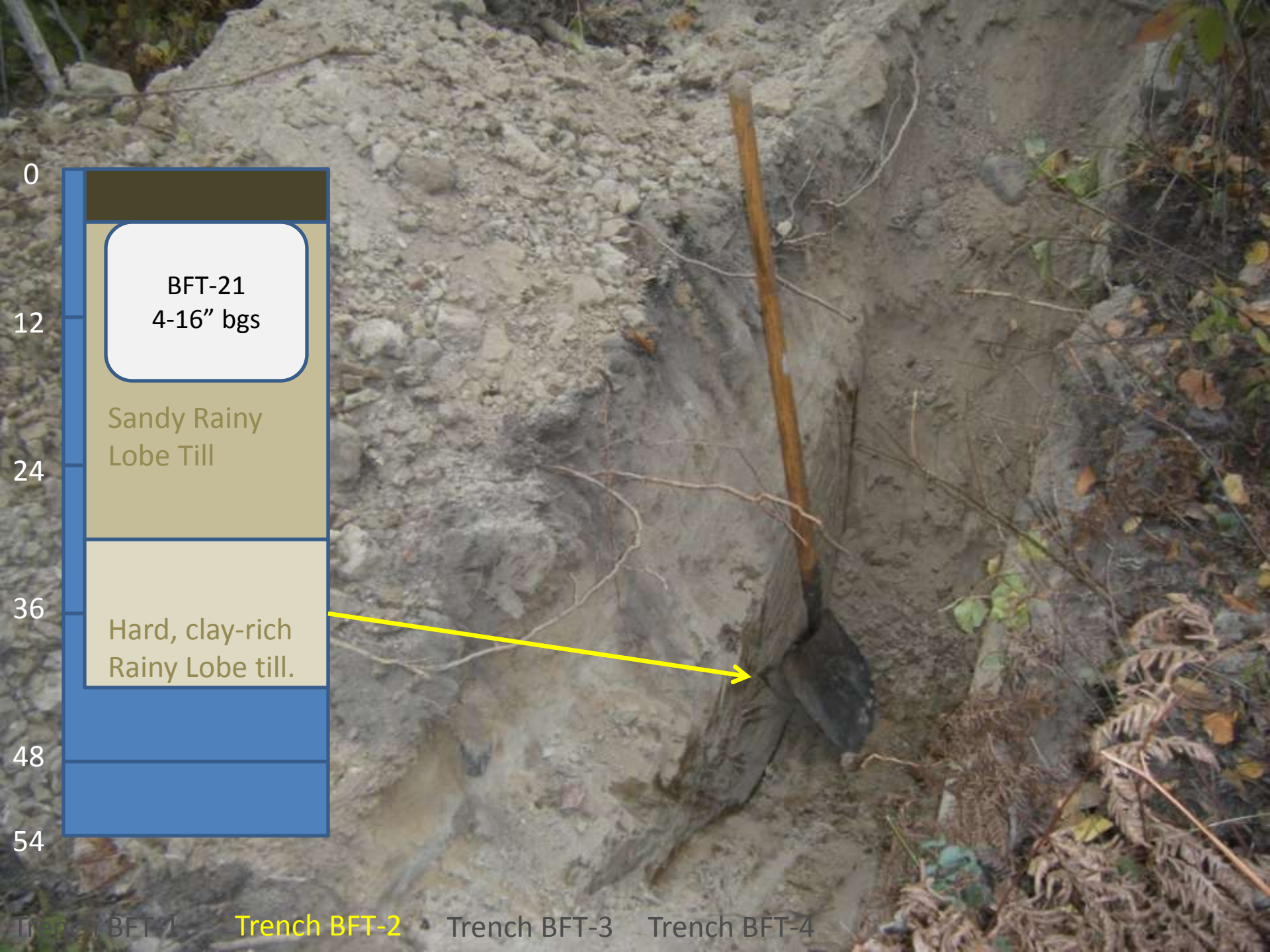

0
12
24
36
48
66
BFT-11
8-16” bgs
Rainy Lobe Till
(Qrt)
Ice-contact sand
(Qri)
BFT-12
54-66” bgs
Qrt: Mottled, clumpy, silty – clayey till with trace clasts.
BFT
12
Trench BFT-1
Trench BFT-2
Trench BFT-3
Trench BFT-4

Trench BFT-2 Stratigraphy

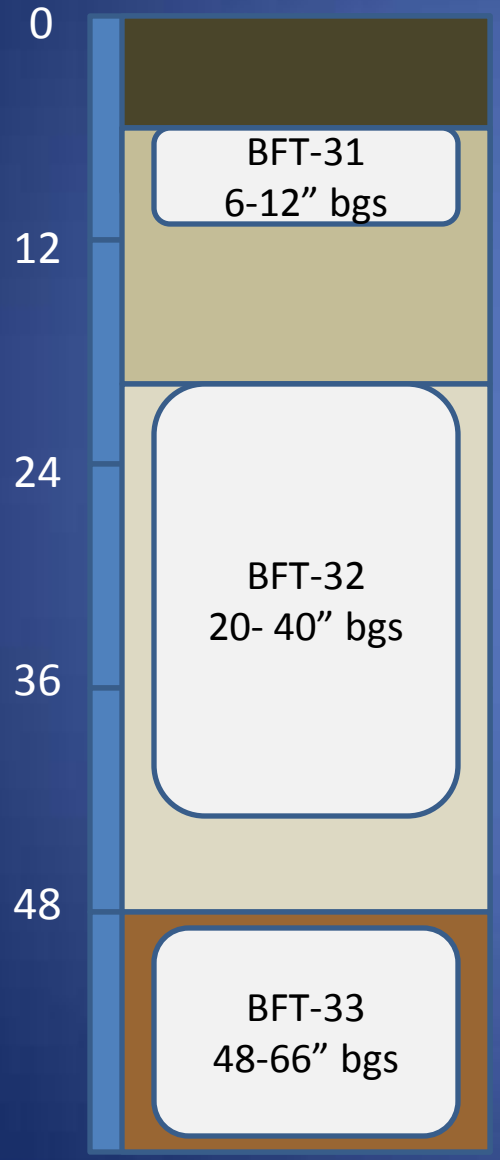


0 – 4 inches:	Dark brown topsoil
4 – 30 inches:	Rainy Lobe Till: Light brown coarse-grained sandy till. Clasts mostly pebble -sized. Small boulder at 24 inches bgs.
30 – EOT:	Qrt: Hard clay-rich till. Light brown, trace pebble-sized clasts. Can only scrape 1-2 inches per shovel pass.
40 inches:	End of trench

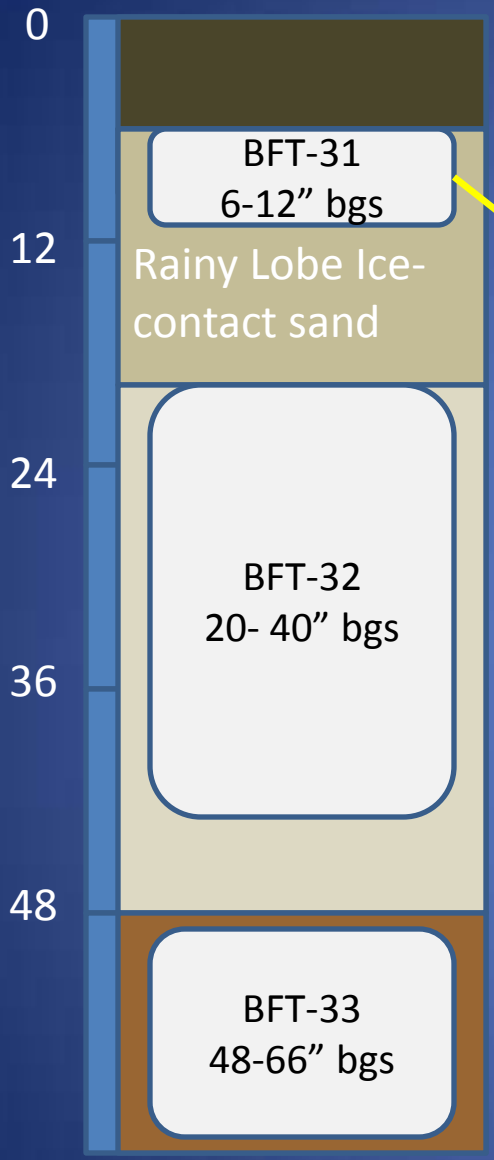

0
12
24
36
48
54
BFT-21
4-16” bgs
Sandy Rainy
Lobe Till
BFT
2
Trench BFT-1
Trench BFT-2
Trench BFT-3
Trench BFT-4

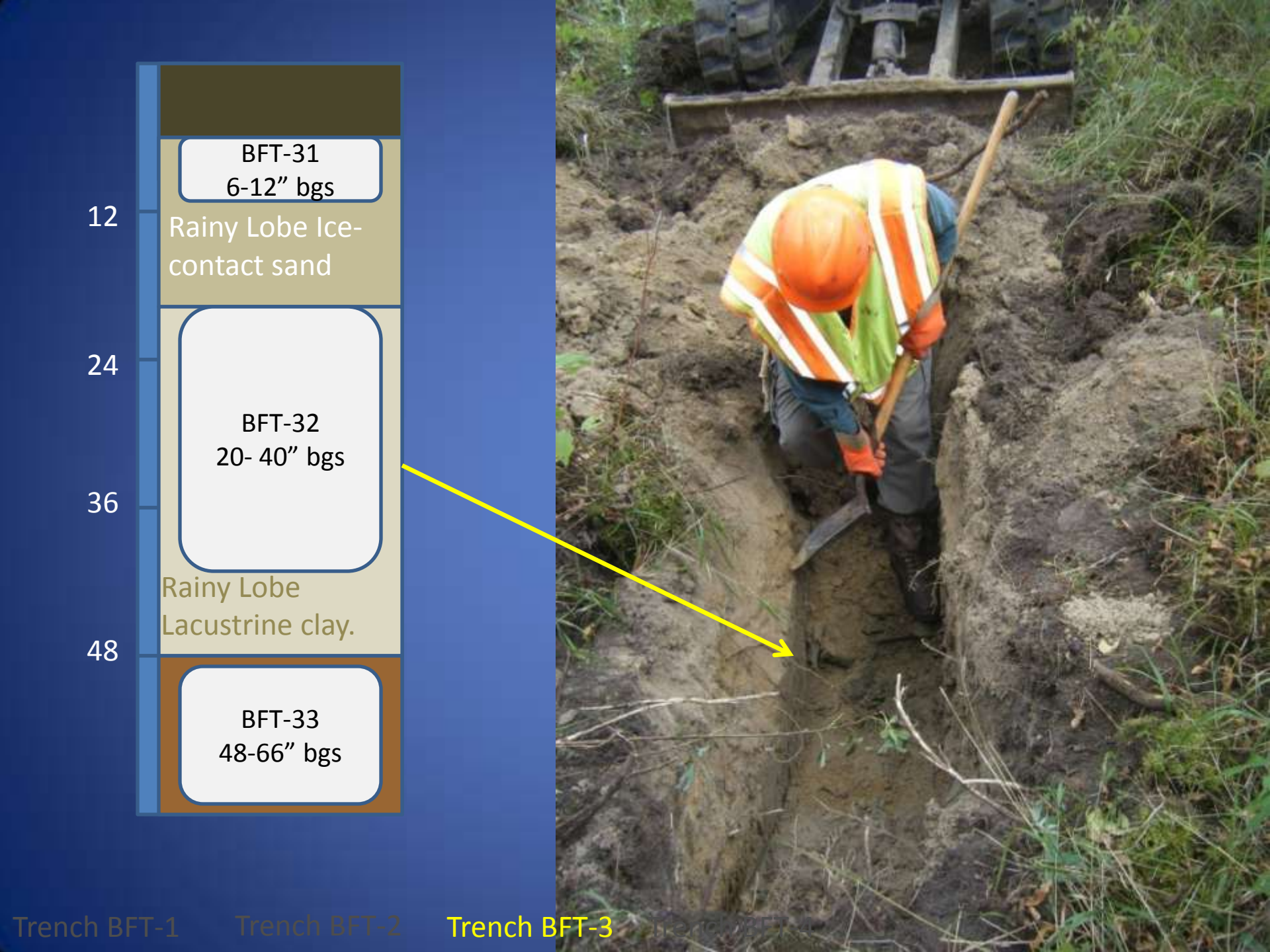

0
12
24
36
48
54
BFT-21
4-16” bgs
Sandy Rainy Lobe Till
Hard, clay-rich Rainy Lobe till.
Trench BFT-1
Trench BFT-2
Trench BFT-3
Trench BFT-4

Trench BFT-3 Stratigraphy



0 – 6 inches:	Dark brown topsoil
6 – 20 inches:	Rainy Lobe Ice-contact sediment (Qri): Tan fine-grained sand with trace clasts. Clasts mostly rounded.
20 – 40 inches:	Brown lacustrine clay. No clasts. (Qrc)
40 – EOT :	Rainy Lobe Till (Qrt) Light brown, fine to medium-grained sandy till with trace clasts. Pebble-sized angular greenstone clasts, rounded granitic clasts.
66 inches:	End of trench


0
12
24
36
48
BFT-31
6-12” bgs
Rainy Lobe Ice-contact sand
BFT-32
20- 40” bgs
BFT-33
48-66” bgs


BFT-31
6-12” bgs
12
Rainy Lobe Ice-contact sand
24
BFT-32
20- 40” bgs
36
Rainy Lobe Lacustrine clay.
48
BFT-33
48-66” bgs
Trench BFT-1
Trench BFT-2
Trench BFT-3


BFT-31
6-12” bgs
12
Tan fine-grained sand. Trace gravel
24
BFT-32
20- 40” bgs
36
Brown fat clay. No clasts.
48
BFT-33
48-66” bgs
Light-brown Rainy Lobe Till
BFT
33
Trench BFT-3

Ice-contact sediment
(Sand w/ trace pebble)

Lacustrine Clay
(No clasts)

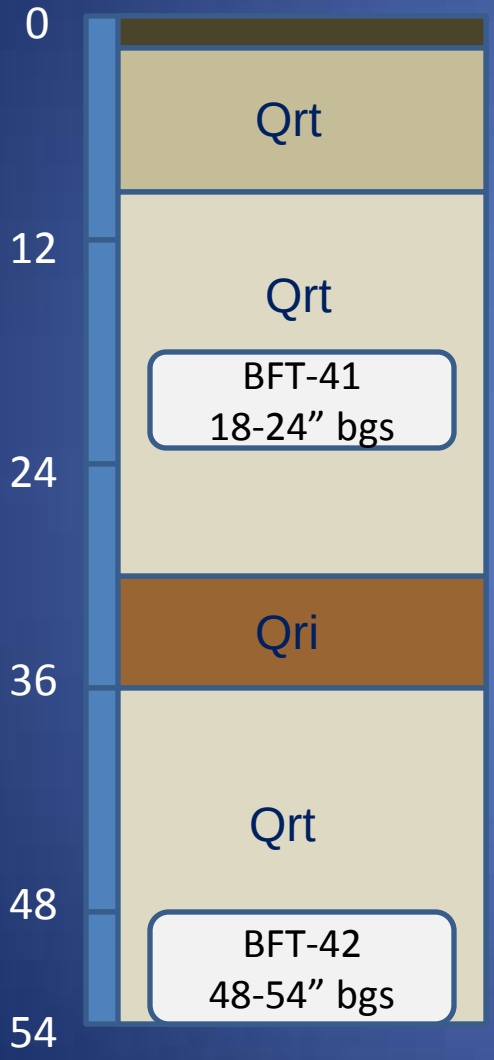
Till

Rainy Lobe Deposits in Trench BFT-3

Trench BFT-4 site

The highest total gold grain count in the first phase of till sampling (111 grains) was obtained in this location. The shovel sample LL-3 was collected from a depth interval of 3 – 9 inches, below 1 inch of topsoil and 2 inch layer of well-sorted tan sand.

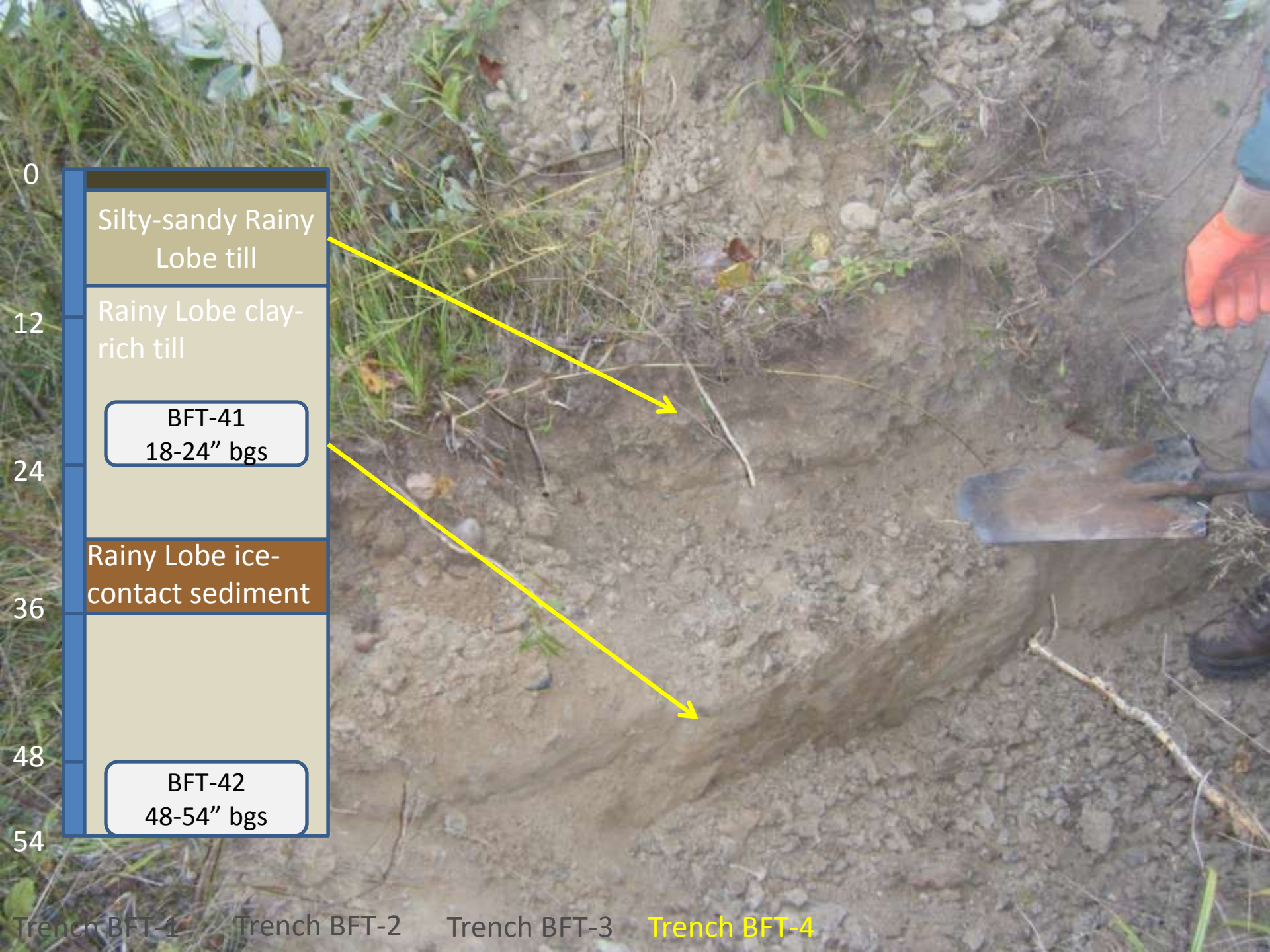
Trench BFT-4 Stratigraphy

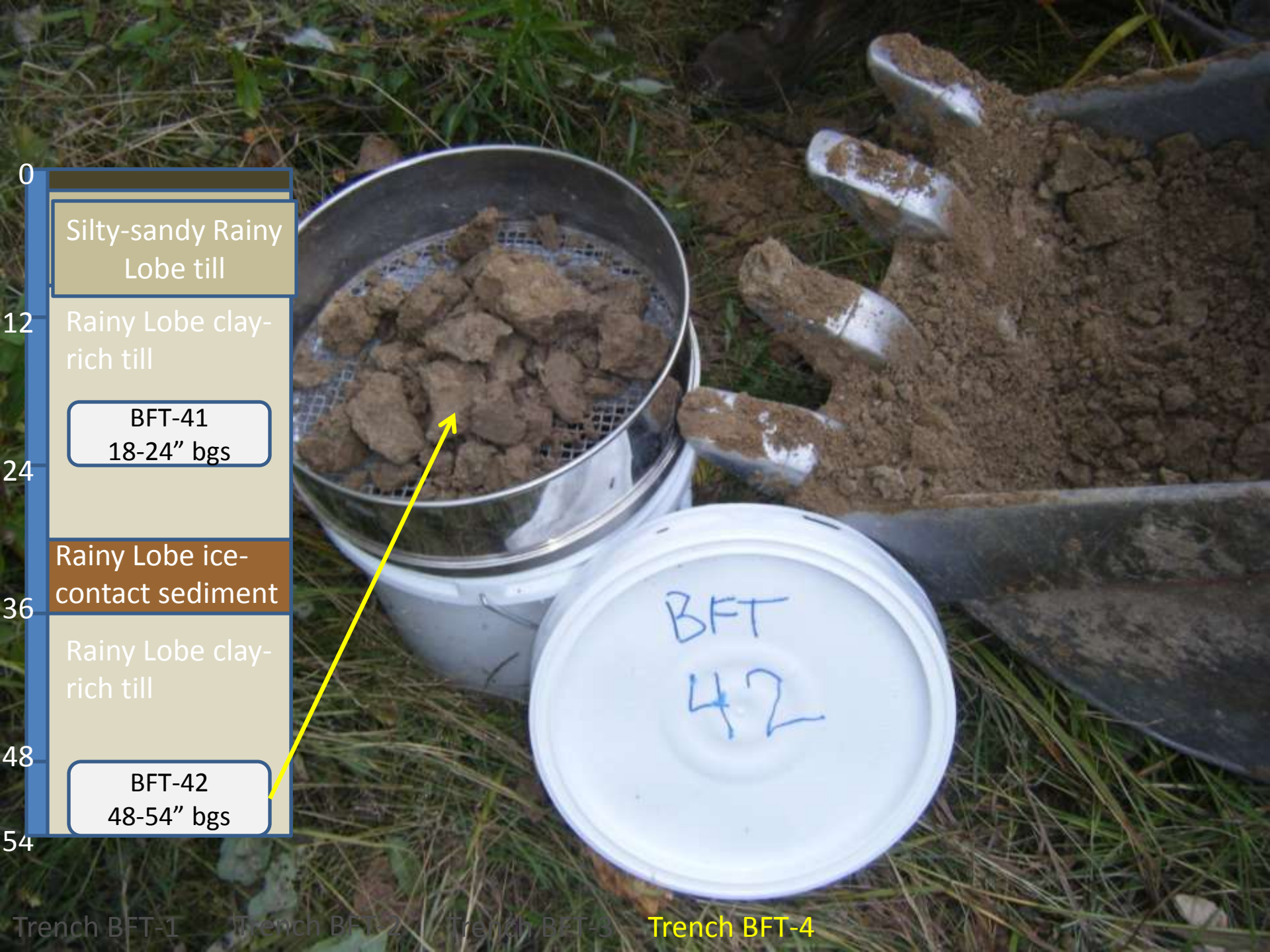


0 – 2 inches:	Dark brown topsoil
2 – 9 inches:	Rainy lobe till: Tan silt-rich till with clasts. Some larger greenstone clasts 12-18” long
9 – 30 inches:	Rainy lobe till: Brown clay-rich till with angular greenstone clasts. Dry, hard-packed, tough to push through screen.
30 – 36 inches:	Rainy Lobe Ice-contact Sediment. Brown sand layer, 3 – 6 inches thick, with minor fine gravel.
36 – EOT :	Same Rainy Lobe brown clay-rich till as above. Appears wetter than upper layer.
54 inches:	End of trench

Clast-rich Rainy Lobe Till, Trench BFT-1
2 – 9 inches beneath ground surface.

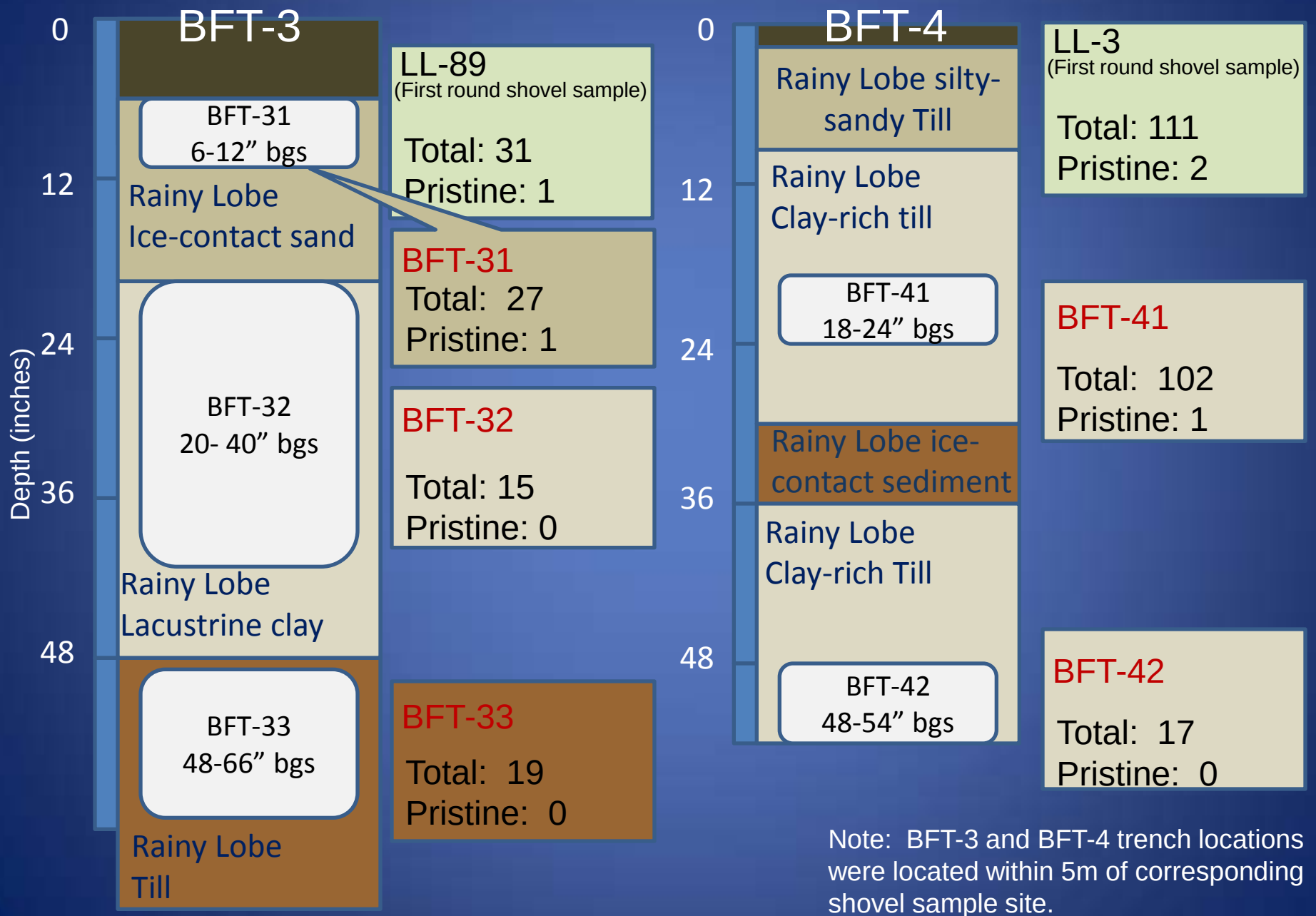
Trench BFT-1 Trench BFT-2 Trench BFT-3 Trench BFT-4


0
Silty-sandy Rainy Lobe till
12
Rainy Lobe clay-rich till
BFT-41
18-24” bgs
24
Rainy Lobe ice-contact sediment
36
48
BFT-42
48-54” bgs
54
Trench BFT-1
Trench BFT-2
Trench BFT-3
Trench BFT-4


0
Silty-sandy Rainy Lobe till
12
Rainy Lobe clay-rich till
BFT-41
18-24” bgs
24
Rainy Lobe ice-contact sediment
36
Rainy Lobe clay-rich till
48
BFT-42
48-54” bgs
54
BFT
42
Trench BFT-1
Trench BFT-2
Trench BFT-3
Trench BFT-4

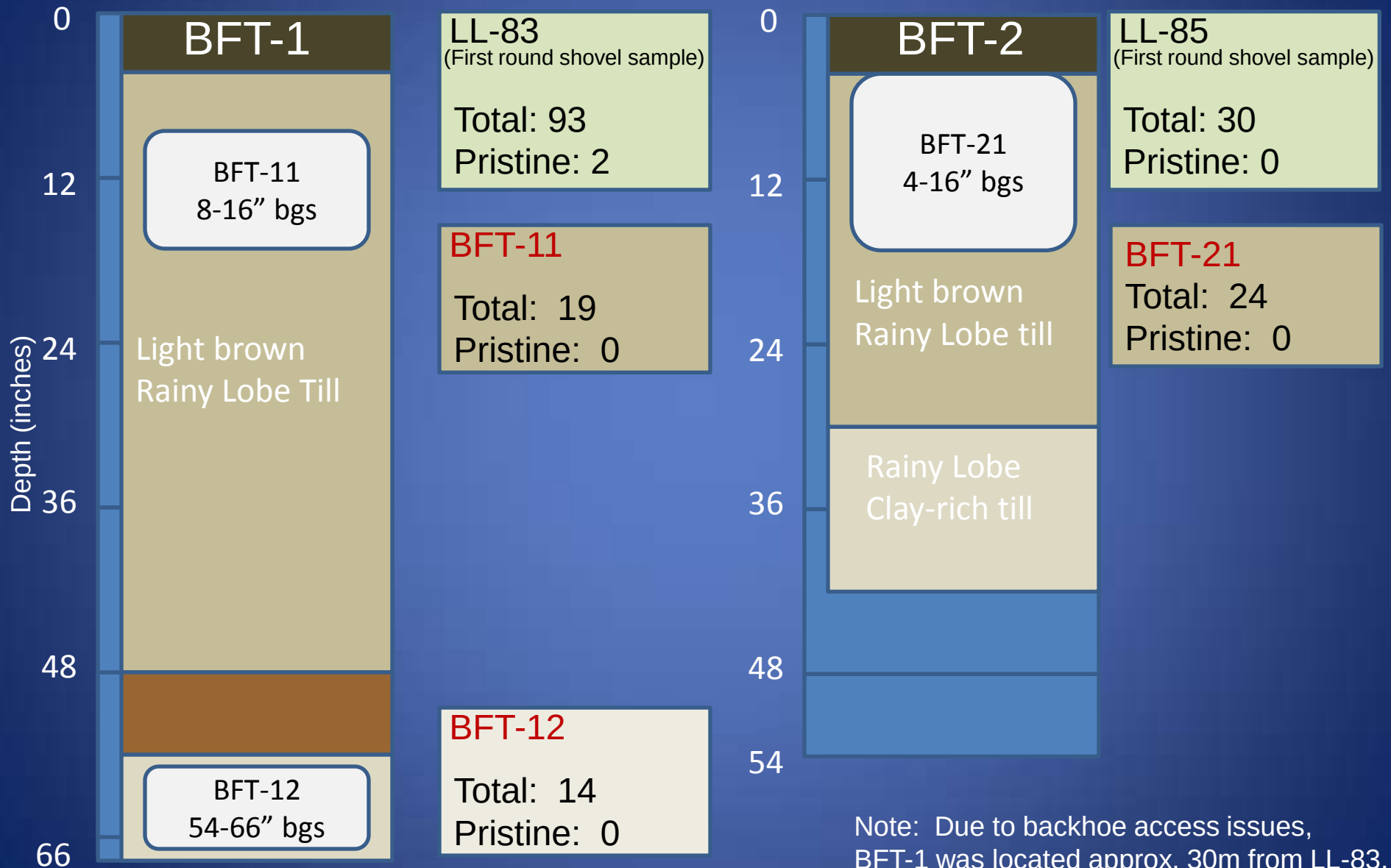
Trench BFT-1 Trench BFT-2 Trench BFT-3 Trench BFT-4

Gold Grain Counts, Greenstone Trenches



Note: BFT-3 and BFT-4 trench locations were located within 5m of corresponding shovel sample site.

Gold Grain Counts, Felsic Stock Trenches



Note: Due to backhoe access issues,
BFT-1 was located approx. 30m from LL-83.
BFT-2 was located approx. 70m from LL-85.

Observations

- Gold grain counts from trench samples confirm first round till sampling results.
- Anomalously high gold grain counts in both sand- and clast-rich “normal” till and in clay-rich, clast-poor lacustrine sediment
- Almost all gold grains are “modified” and rounded in shape.

Conclusions

- Correlation between shallow shovel samples and deeper trench samples supports shovel sample results elsewhere within project area.

For More Information:

Don Elsenheimer, Ph.D
Minnesota Department of Natural Resources
Division of Lands and Minerals
500 Lafayette Road,
St. Paul, MN 55155
(651) 259-5433
donald.elsenheimer@state.mn.us