Data Repository Item 1

of

Burgisser, A., and Gardner. J., Using Hydraulic Equivalence to Discriminate Transport Processes of Volcanic Flows

This Electronic Supplement contains information on the sampling method, a distribution map of the Middle unit (see Fig. 1 for stratigraphy), and two presentations of data collected at Toluca volcano we used in the paper. The first presentation is GIS-based, whereas the second one presents the same data in a pdf form.

Sampling method

Samples were dry-sieved and counted in the field for the coarsest fraction [>-2 ϕ, where size (in mm) = $2^{-\phi}$], and the fine fraction was wet-sieved in the laboratory to 4.5 ϕ in intervals of 0.5 ϕ. Size distributions <4.5 ϕ were determined to 7 ϕ using a Spectrex ILI-1000 laser particle counter. The error in weight percents is estimated to 0.2% for the field-sieved fraction (weight measurements precise to ±5 g) and 0.1% for the finer sizes (measurements precise to ±0.1 g). Component data were obtained by manually separating and weighing up to hundredths of clasts for sizes >0 ϕ, and by counting 500 particles per class size with a microscope for sizes down to 2 ϕ. Conversion of particle counts to weight fraction was done using a median density of 702 ± 114 kg m^{-3} (1σ) for pumice (measurement of 148 PC_2 pumices by Arce, 2003) and assumed average densities of 2500, 2600, and 2000 kg m^{-3} for lithics, crystals, and glass, respectively (Cas and Wright, 1987). Errors on the normalized proportions are on the order of 0.1%. When calculating differences between pumice and lithic contents, component abundances were normalized to 100% for each grain size before subtraction.

Individual beds of both units are composed of, on average, 36 (±18) wt.% pumice, 26 (±8) wt.% accidental lithics, 23 (±14) wt.% crystals, and 15 (±4) wt.% glass. Pumices are angular to poorly rounded. Accidental lithics are mostly angular lavas, some of which are hydrothermally altered and slightly rounded. Crystals are mostly plagioclase, with minor amphibole and orthopyroxene. Dense juvenile clasts and accidental gray lithics are hard to distinguish, so they have been grouped together as glass. Overall, cross-stratified layers of F_1 are richer in pumice than massive subunits, with 1.43 and 0.49 pumice-to-lithic ratios for sizes >1 mm, respectively (average of 11 stratified and 3 massive samples).

Distribution of the Middle unit

The Middle unit is typically well sorted (Inman sorting σ_ϕ = 1.15) and ranges from absent up to 1.5 m thick (Fig. DR1). It features, by places, internal bedding with moderate sorting.

The well-sorted nature and distribution of this unit is characteristic of fall deposits. Local poor sorting and thickness irregularities of this unit are, however, most likely caused by the mix of fallout with some products of pyroclastic current. Such concurrence of density current and eruptive column is common (Valentine and Giannetti, 1995; Cole et al., 1999; Dellino et al., 2004), and not surprising at Toluca, as deposits just below and above F_1 are fall layers.

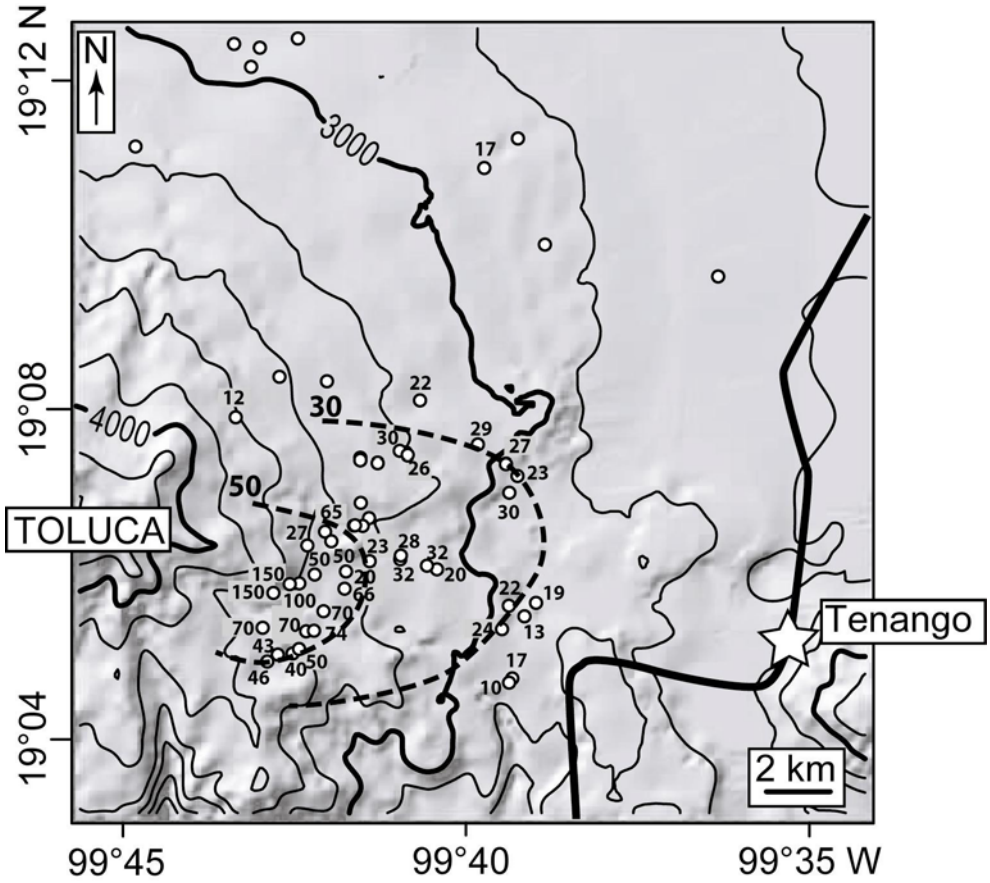


Figure DR1: Map of Nevado de Toluca, Mexico, showing the extent of the Middle unit. Circles indicate thickness measurements in centimeters, and thick dotted lines are approximate isopachs (30 and 50 cm, respectively). Thick line shows the road to the town of Tenango (star).

Data collected, GIS-based (Item 2)

The second part of the Electronic Supplement contains all files necessary to visualize a GIS-based presentation of data collected at Toluca volcano (Mexico) we used in the paper. Data include deposit thickness, stratigraphic columns or field photographs of 13 locations, and grain size and componentry of 25 samples. Alternatively, a synthesis file is also available. The unit described is the unit F_1 of the Upper Toluca Pumice (UTP).

To read these data:

1) Download the file TolucaGIS.zip on a local hard drive and extract all files into an empty directory.

2) Download and install the free GIS browser ArcReader. It is available at www.esri.com, as well as installation instructions.

3) Open the file GeneralAll.pmf with ArcReader.

General file:

Blue contour lines are thickness of deposit F_1 in meters, whereas brown contours are elevations in meters. The coordinate system used is UTM coordinates minus 40000 (add the digit 4 in front of the displayed coordinate to get UTM readings).

Using the hyperlink tool to click on a location will open a new instance of ArcReader with the stratigraphic column at that location (LXX.pmf, where XX is location number).

Location files:

When a field picture is available, the interpretation is overprinted in yellow and can be turned off by unselecting a layer in the Table of Content (left panel). The layer has a name of the form LXXUnit, where XX is location number. Note dummy coordinate systems are used in files containing stratigraphic information. Using the hyperlink tool to click on a sample will open a jpeg image of the grain size analysis with the default picture browser (ATOXXX.jpg, where XXX is sample number).

Data collected, pdf-based (Item 3)

The third part of the Electronic Supplement contains a simplified version of the complete data set above. The general map is on the first page, followed by data on deposit thickness, stratigraphic columns and field photographs of 13 locations, and grain size and componentry of 25 samples. All locations are presented with the overlying interpretation, and grain size data are next to the stratigraphic log of each location.

References

Arce, J.L., Macia, J.L., and Vazquez-Selem, L., 2003, The 10.5 ka Plinian eruption of Nevado de Toluca volcano, Mexico: Stratigraphy and hazard implications: Geological Society of America Bulletin, v. 115, p. 230–248.

Arce, J.L., 2003, Condiciones pre-eruptivas y Evolución de la Erupción Pliniana Pómez Toluca Superior, Volcán Nevado de Toluca [PhD thesis]: Universidad Nacional Autonoma de Mexico, 136 p.

Cas, R.A.F., and Wright, J.V., 1987, Volcanic successions: Modern and ancient: London, Allen & Unwin, 528 p.

Cole, P.D., Guest, J.E., Queiroz, G., Wallenstein, N., Pacheco, J.M., Gaspar, J.L., Ferreira, T., and Duncan, A.M., 1999, Styles of volcanism and volcanic hazards on Furnas volcano, Sao Miguel, Azores: Journal of Volcanology and Geothermal Research, v. 92, p. 39–53

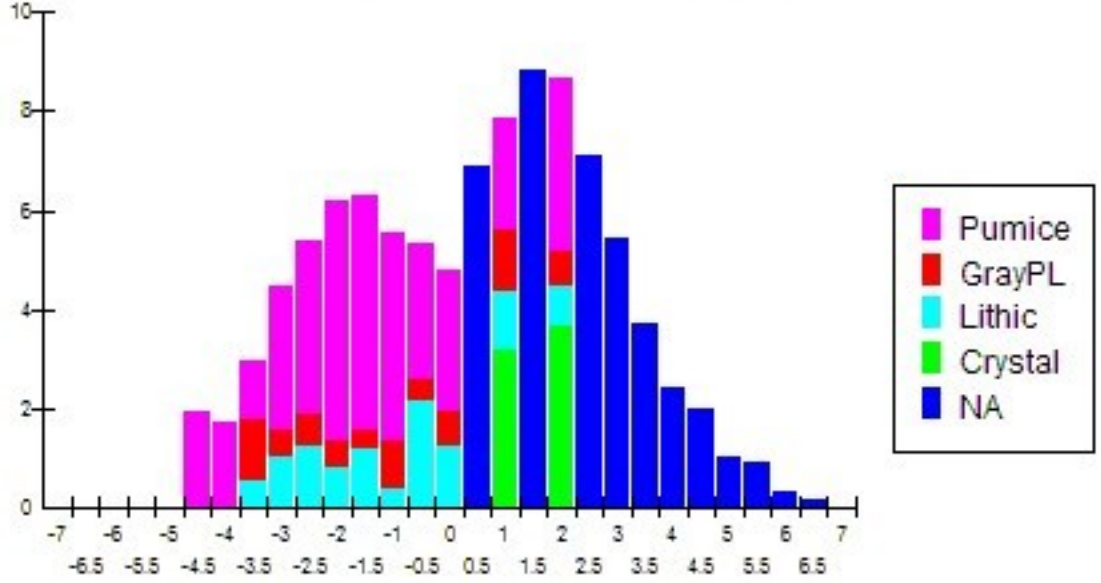
Dellino, P., Isaia, R., La Volpe, L., and Orsi, G., 2004, Interactions between particles transported by fallout and surge in the deposits of the Agnano-Monte Spina eruption (Campi Flegrei, Southern Italy): Journal of Volcanology and Geothermal Research, v. 133, p. 193–210.

Valentine, G.A., and Giannetti, B., 1995, Single pyroclastic beds deposited by simultaneous fallout and surge processes: Roccamonfina volcano, Italy: Journal of Volcanology and Geothermal Research, v. 64, p. 129–137.

Acknowledgement

We would like to thank L. Capra for kindly providing us with the digital topography.

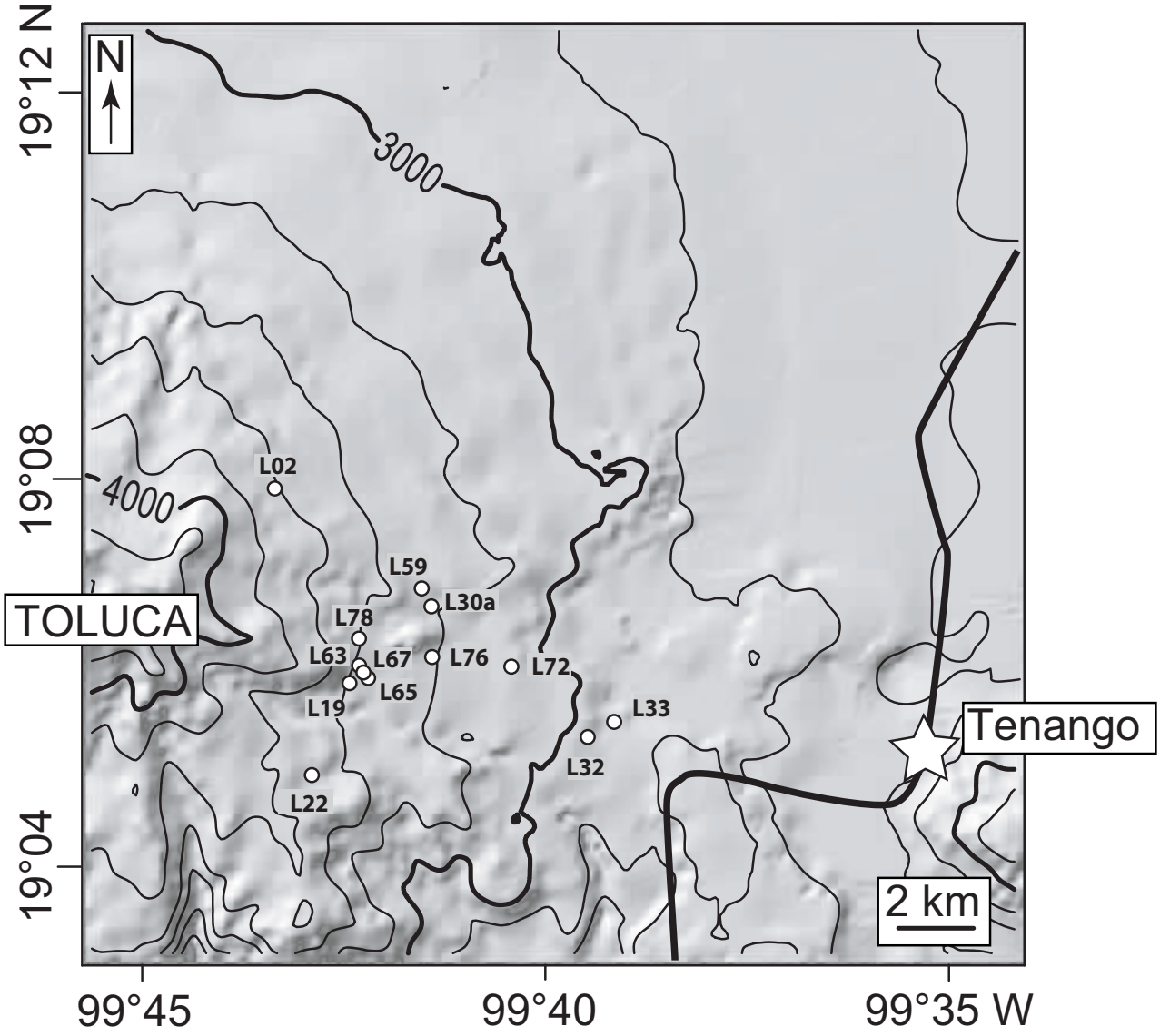
ATO105 Sieve Data

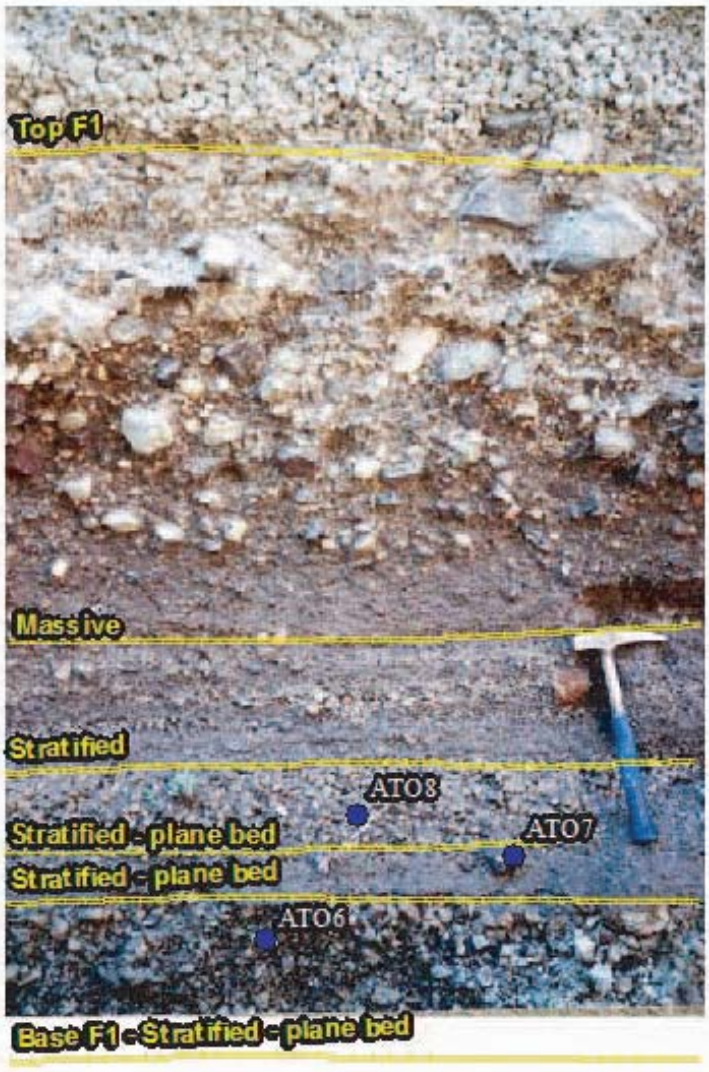


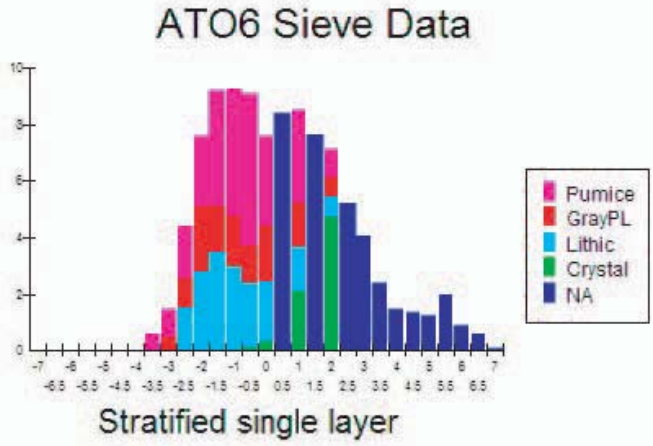
Stratified bulk sample

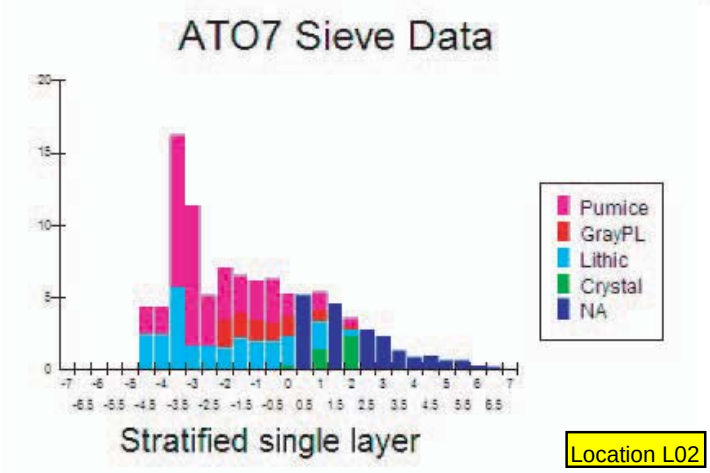
Data Repository Item 3

Map of locations. Numbers refer to localities numbers in the following pages. *Note:* Stratigraphic units labeled "Fall+Surge" or "Fall" within F1 correspond to the Middle Unit of Fig. 1. No sampling was done northeastwards because deposits thin and individual beds become undistinguishable.

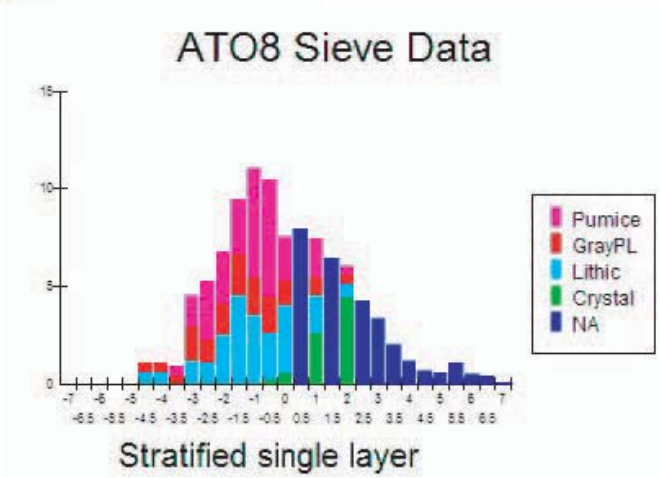


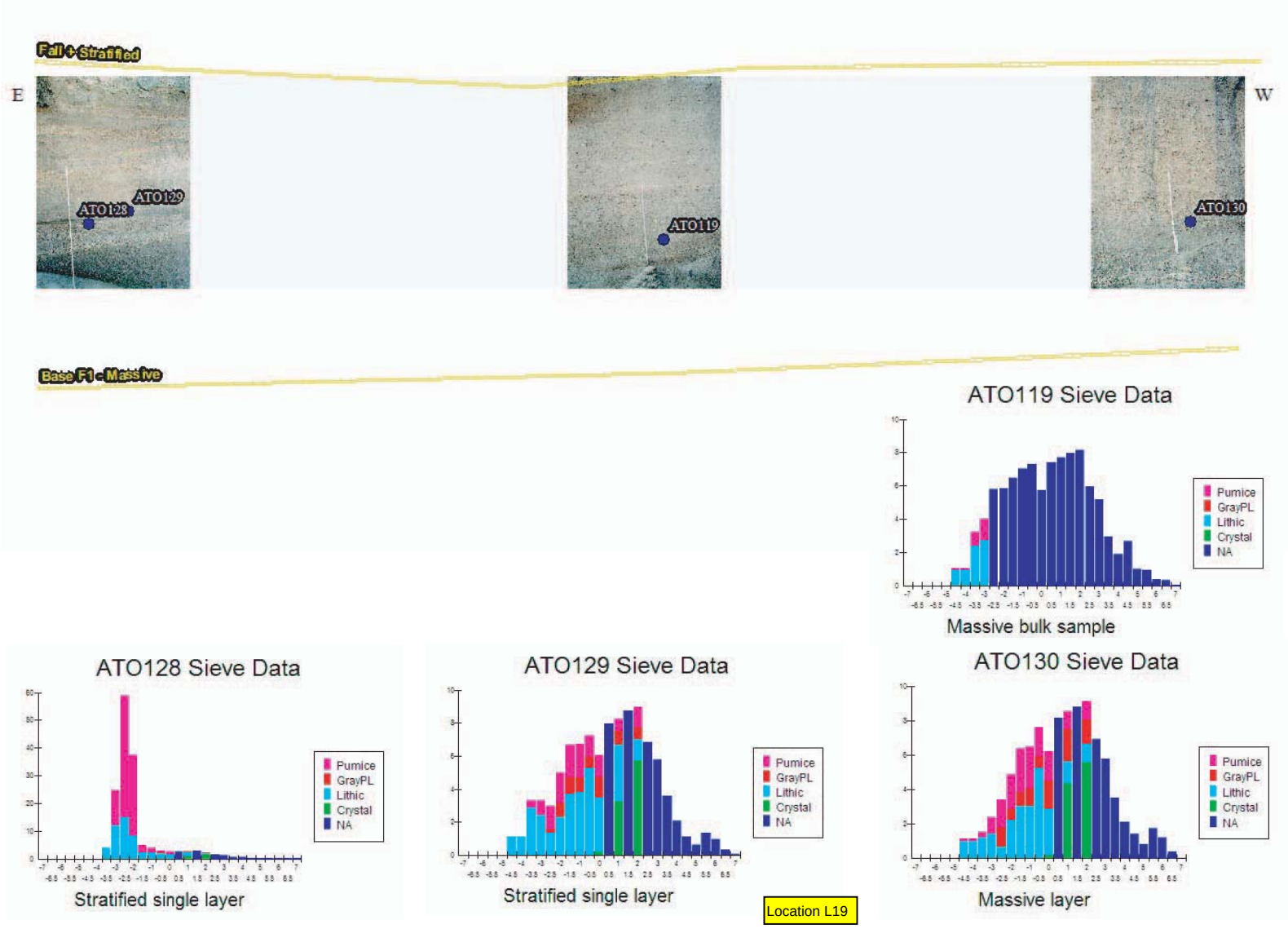


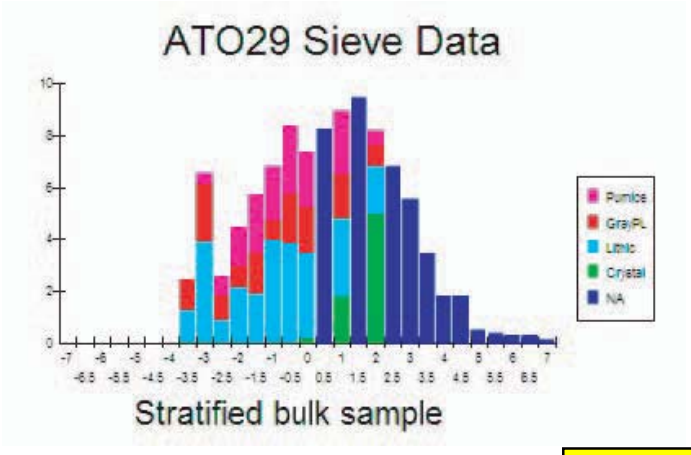


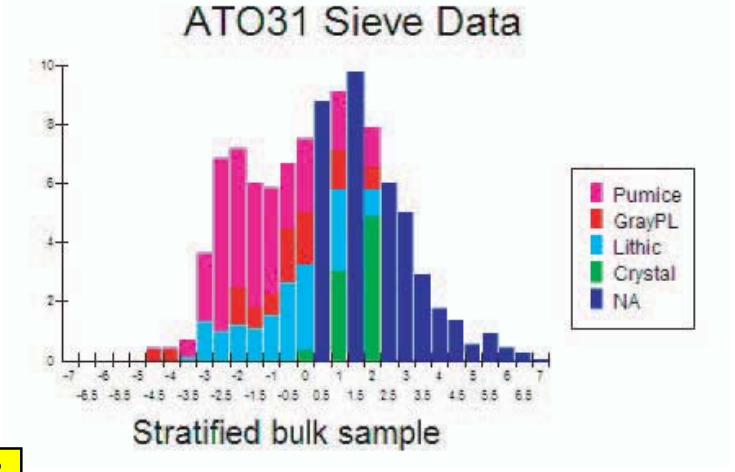


Location L02




Fall + Stratified
E
W
ATO128
ATO129
ATO119
ATO130
Base F1 - Massive
ATO119 Sieve Data
Pumice
GrayPL
Lithic
Crystal
NA
Massive bulk sample
ATO128 Sieve Data
Pumice
GrayPL
Lithic
Crystal
NA
Stratified single layer
ATO129 Sieve Data
Pumice
GrayPL
Lithic
Crystal
NA
Stratified single layer
Location L19
ATO130 Sieve Data
Pumice
GrayPL
Lithic
Crystal
NA
Massive layer





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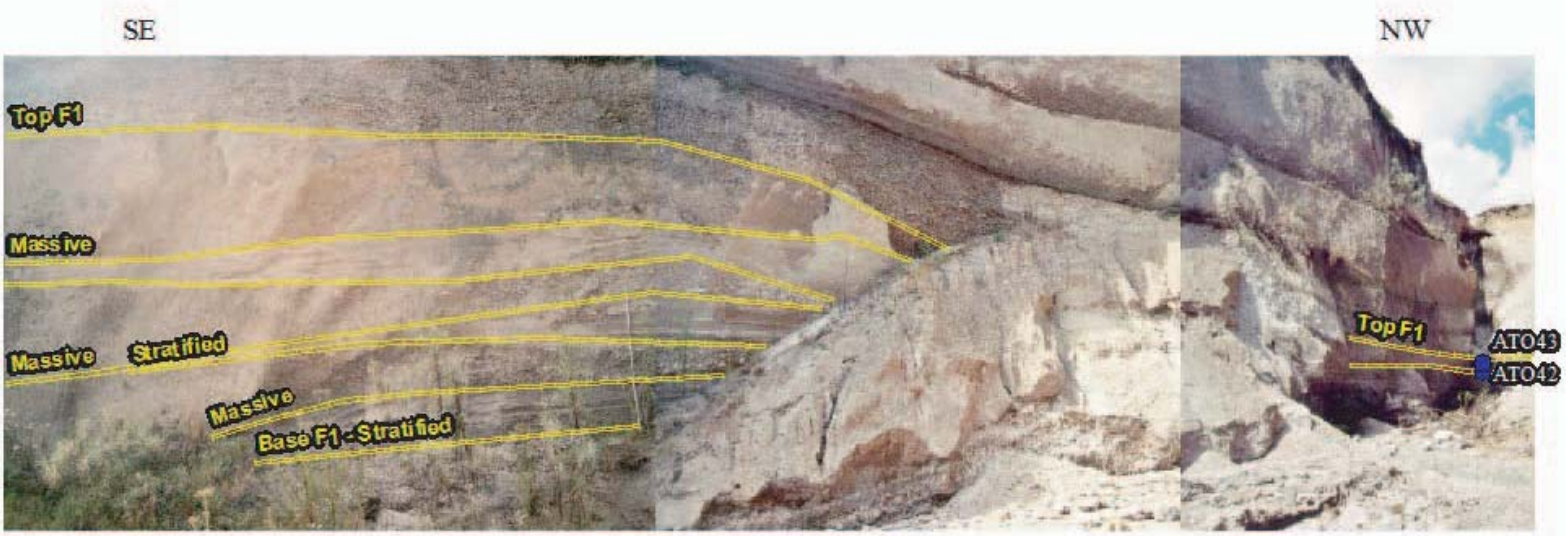

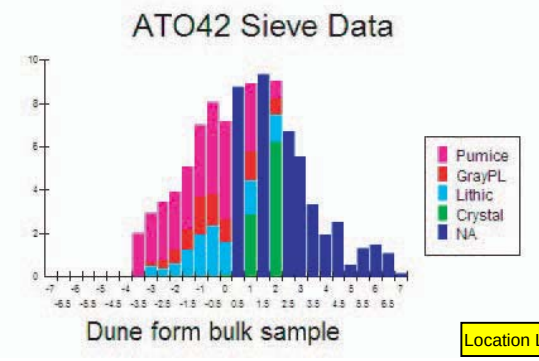

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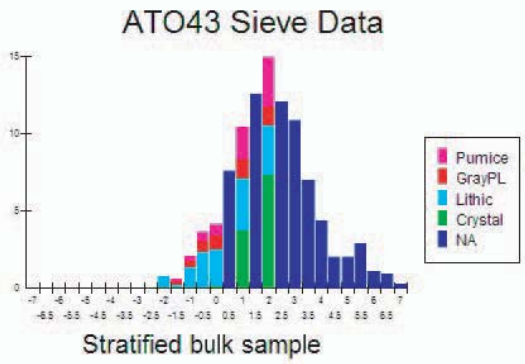
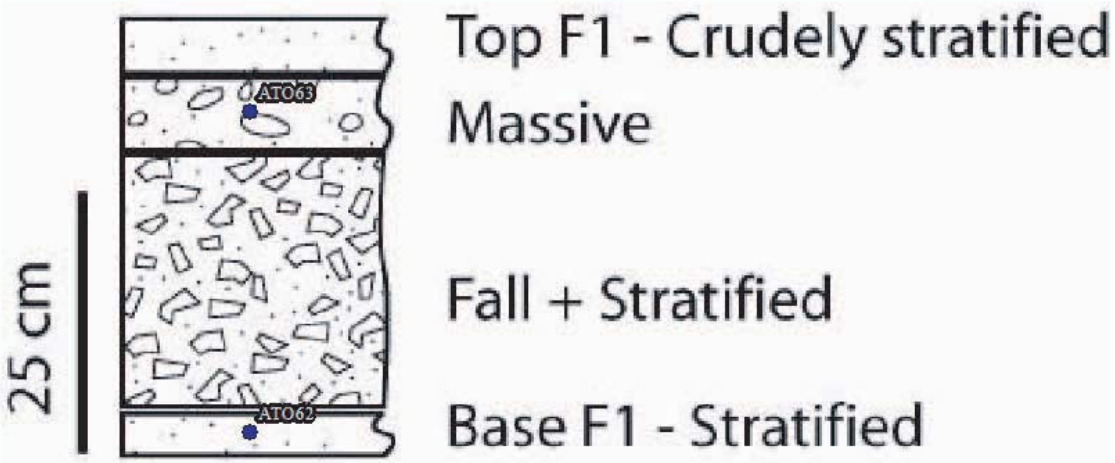
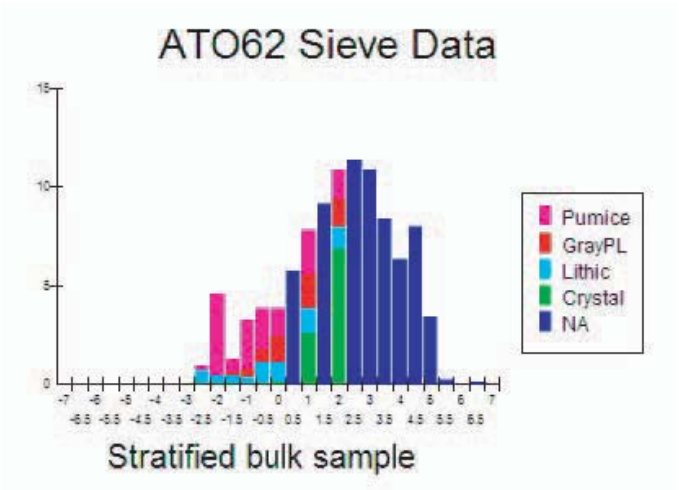
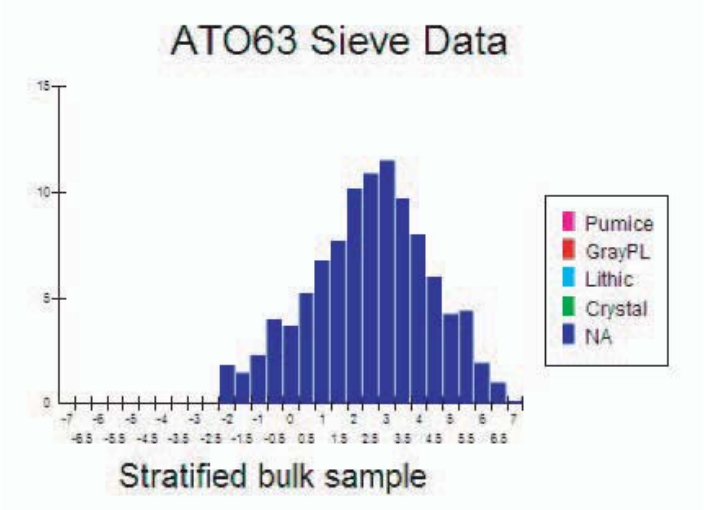


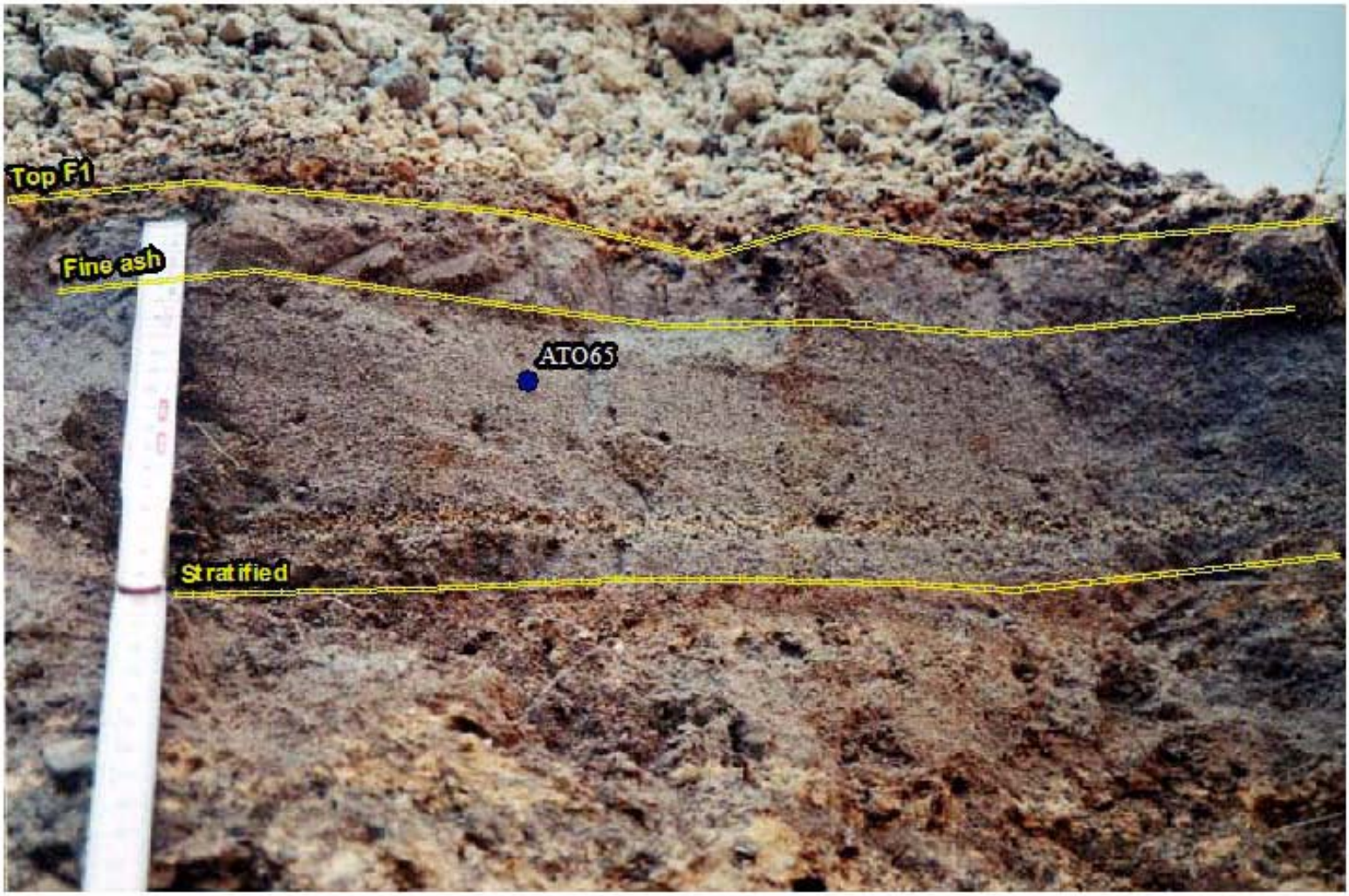


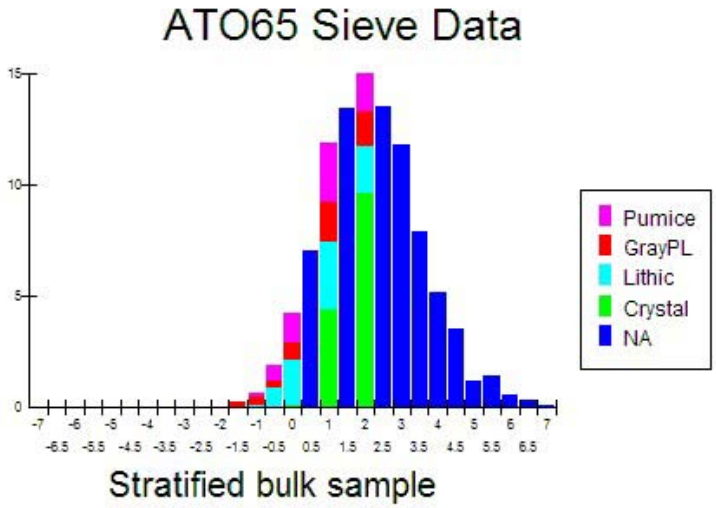




Location L32

E W





Location L33

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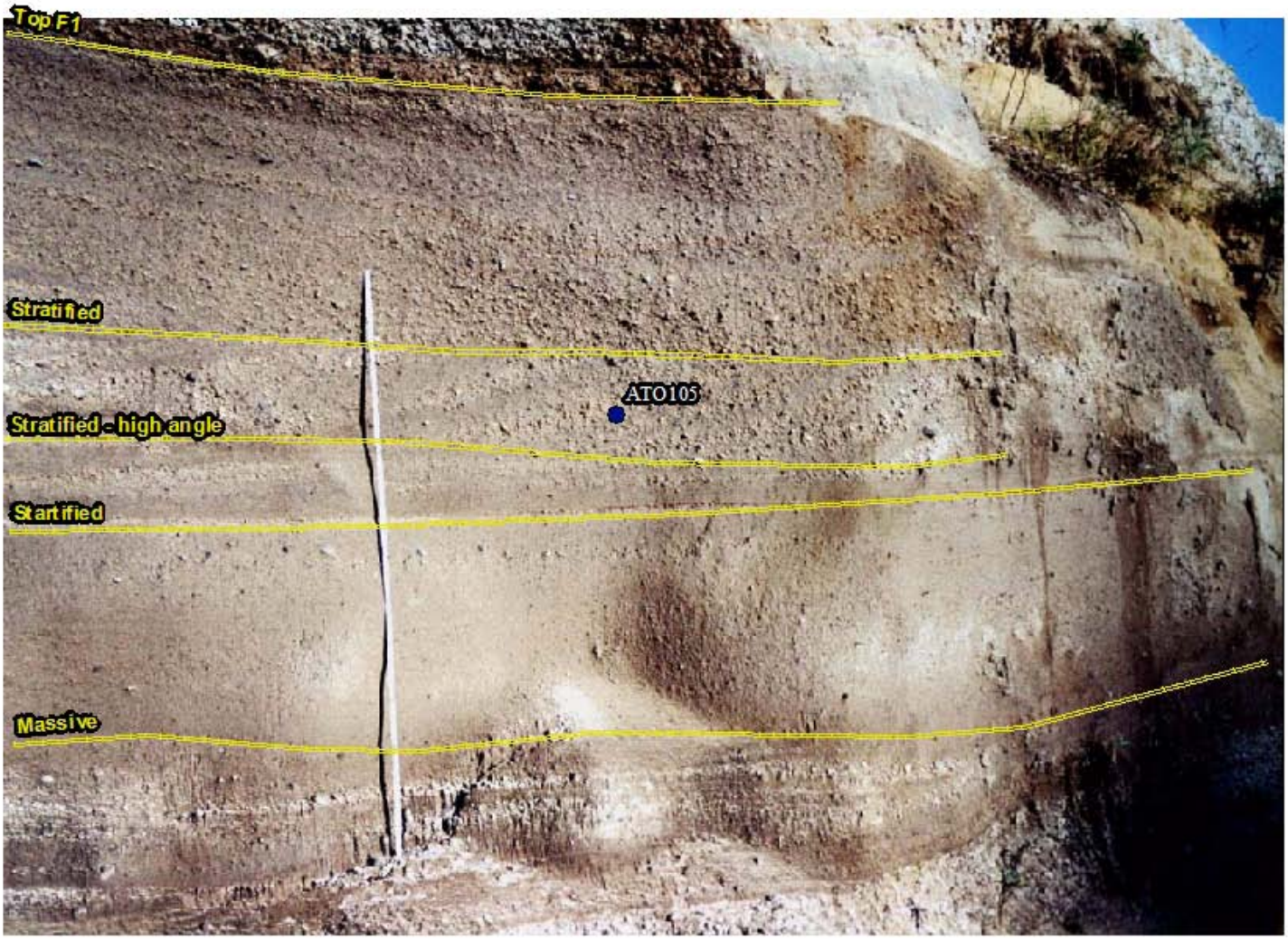

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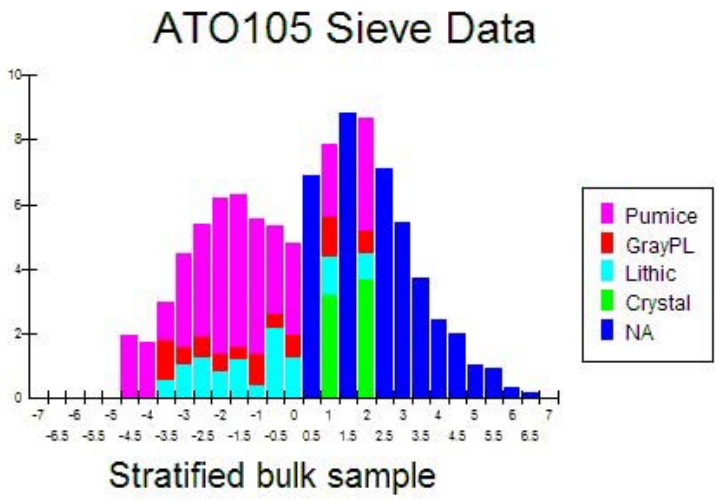
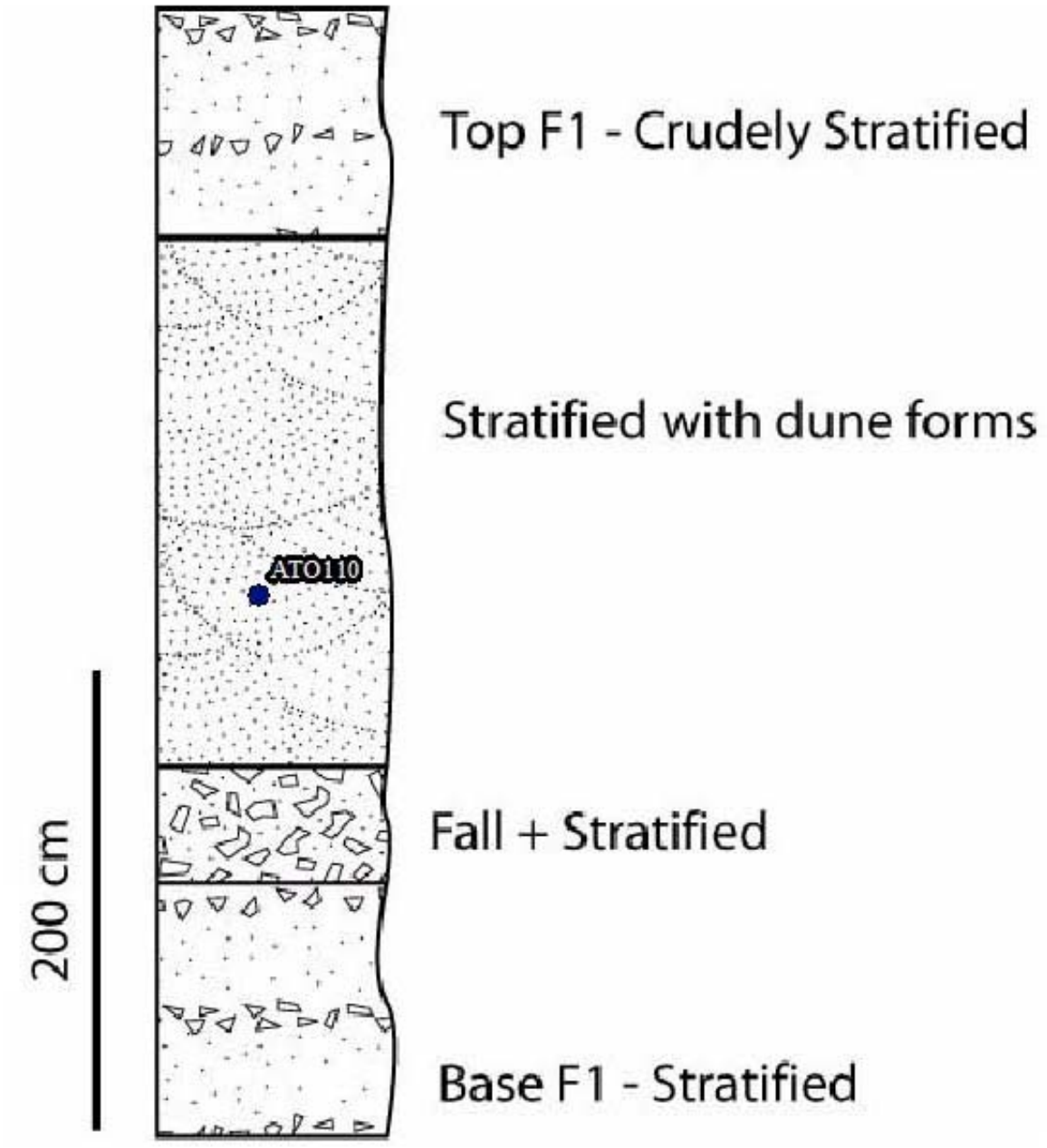
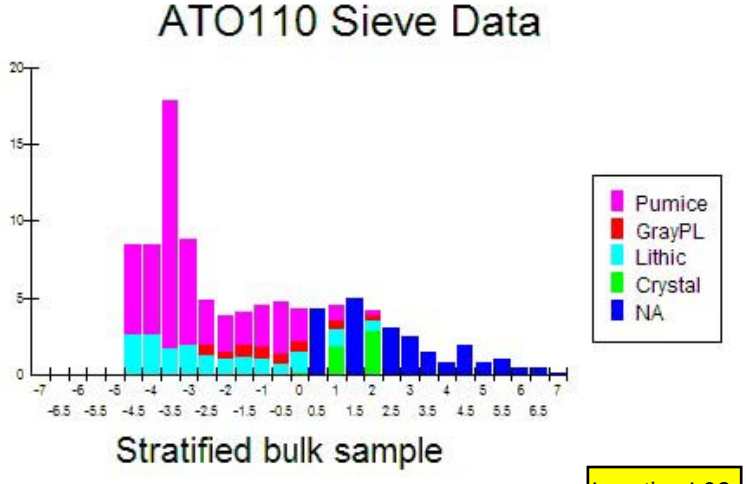


Location L59





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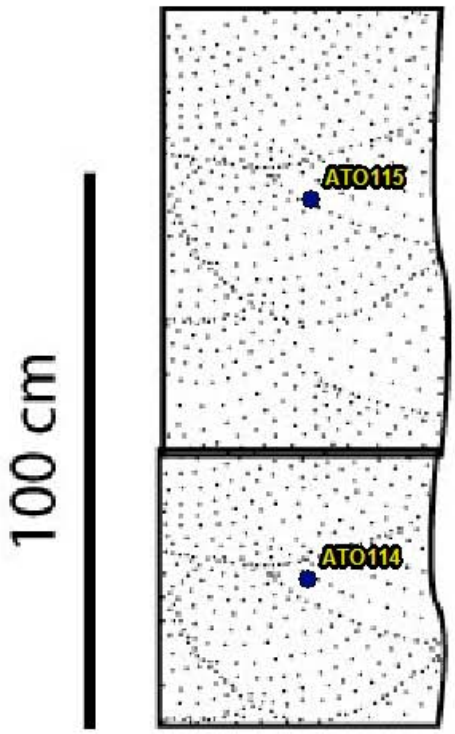
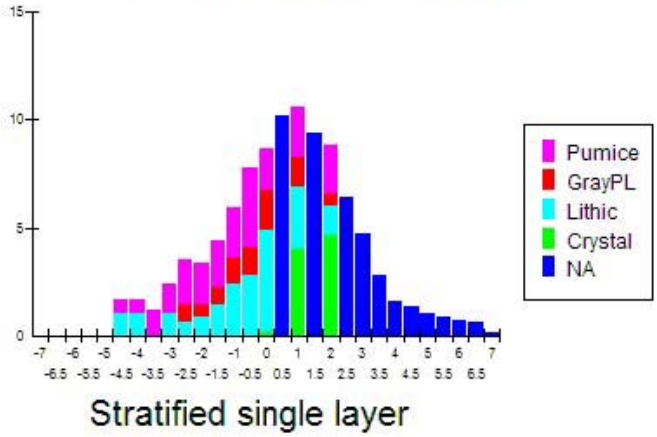


Stratified with sigmoid dune form

Stratified with dune forms

ATO114 Sieve Data



Stratified single layer

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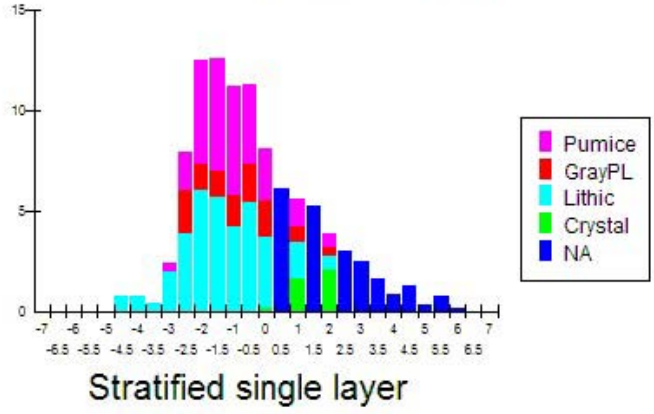
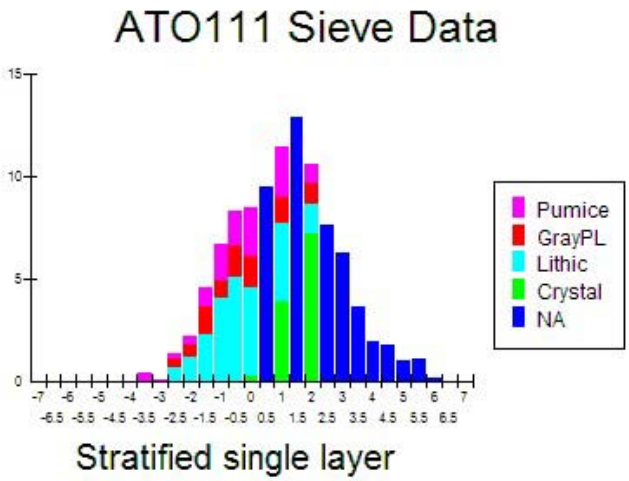


Stratified single layer

Location L65

S N



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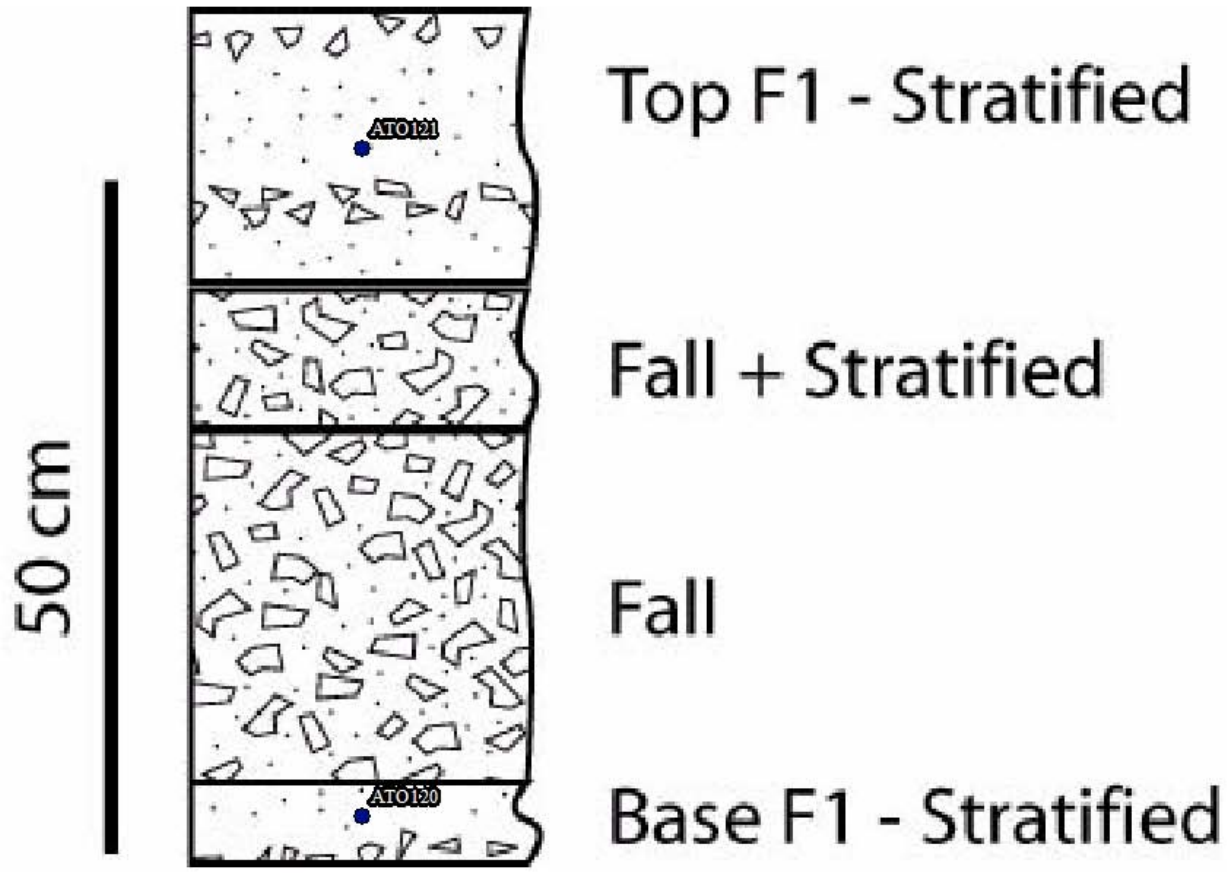
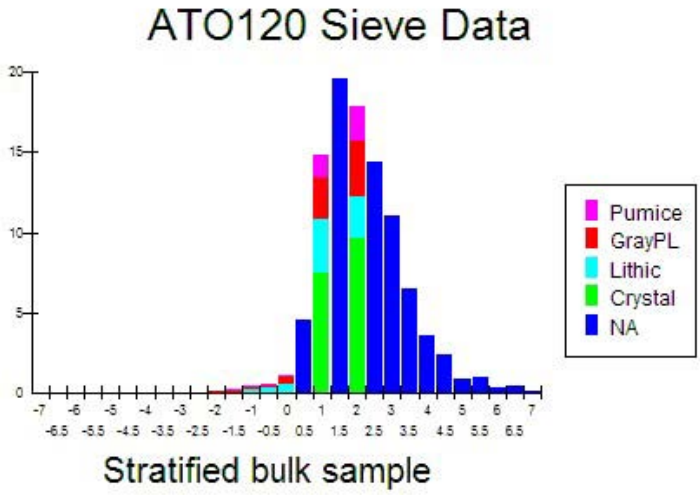
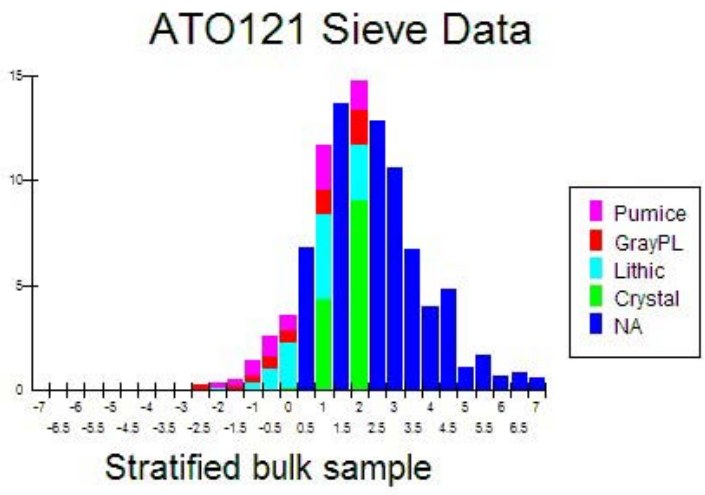
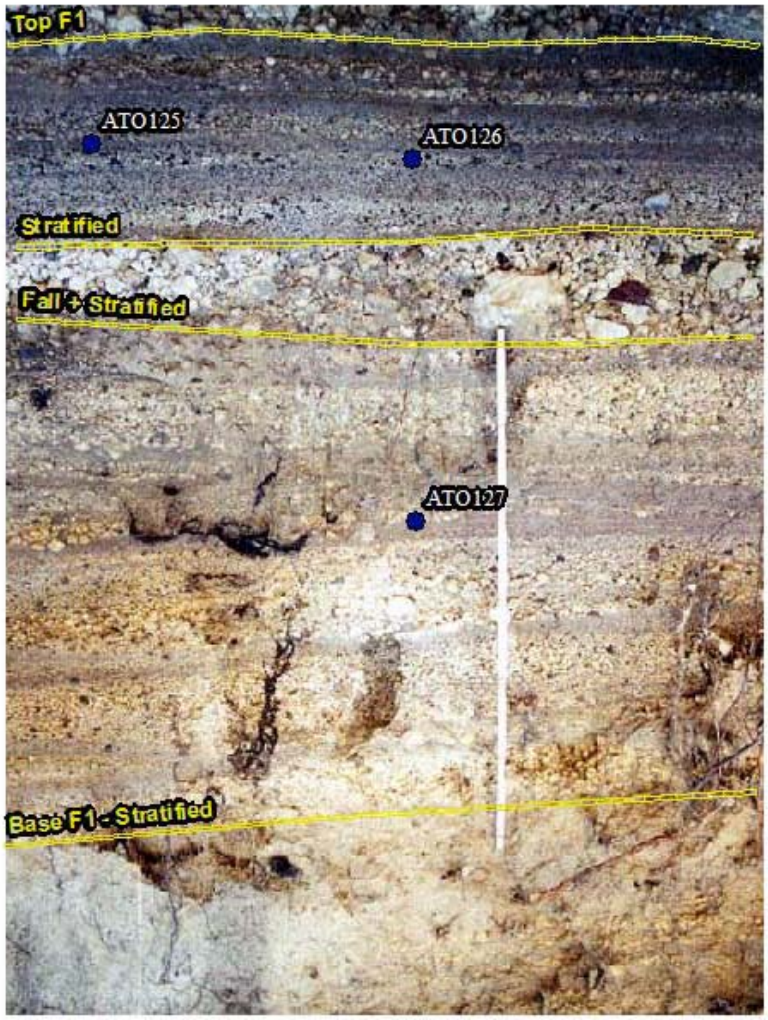






Location L72

E



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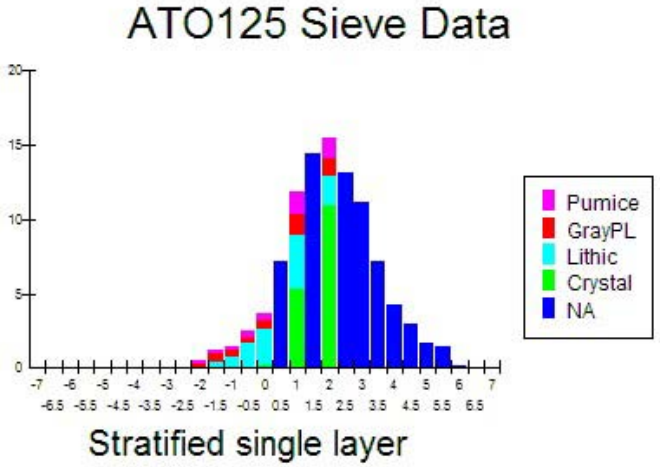
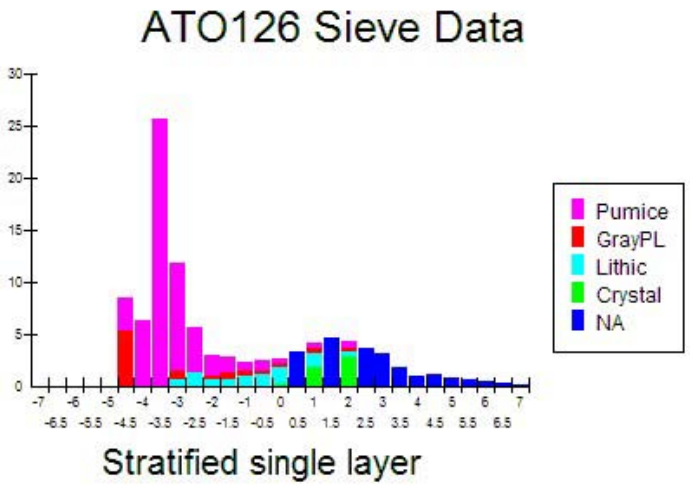
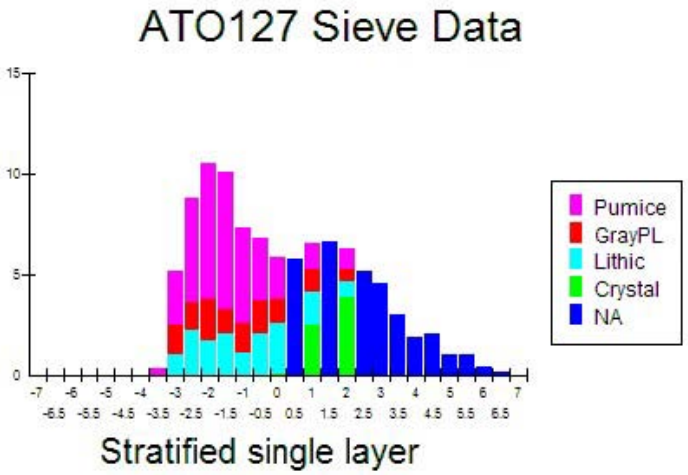
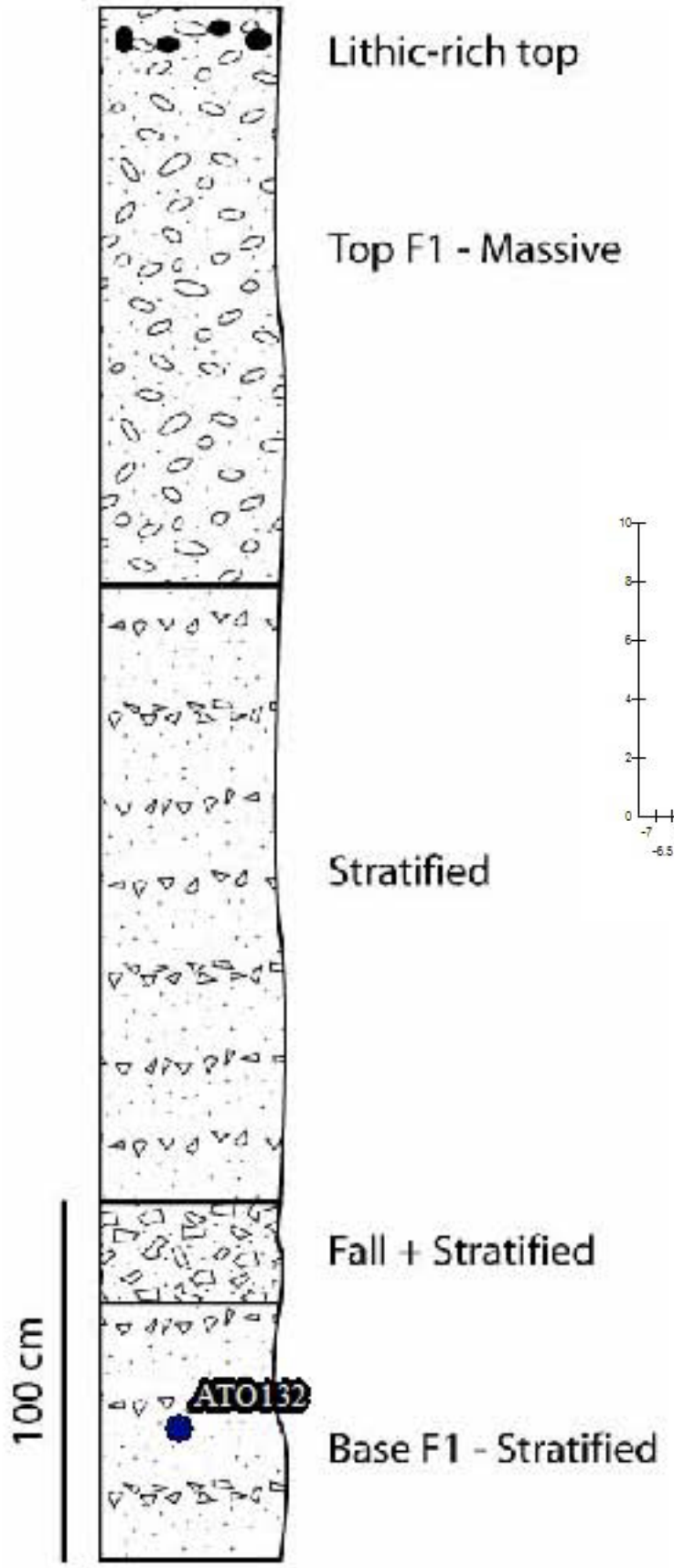
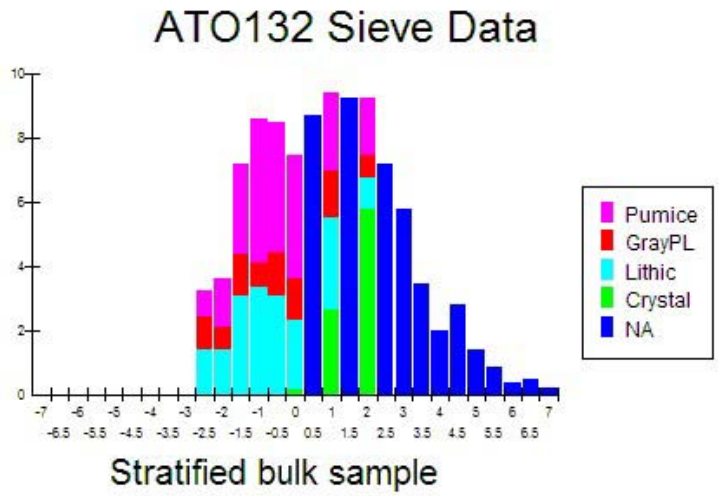






Location L76





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