Figure A3-01

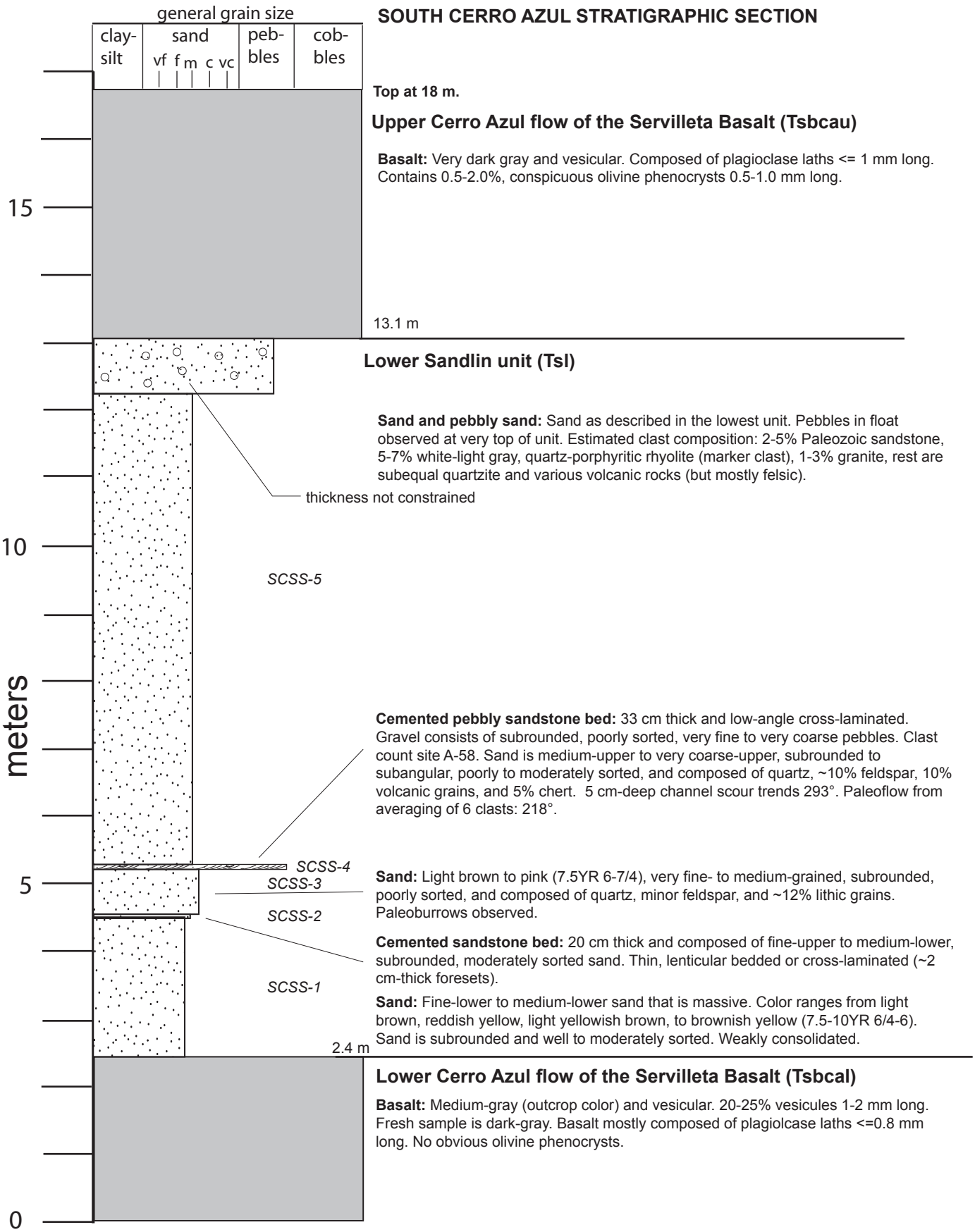
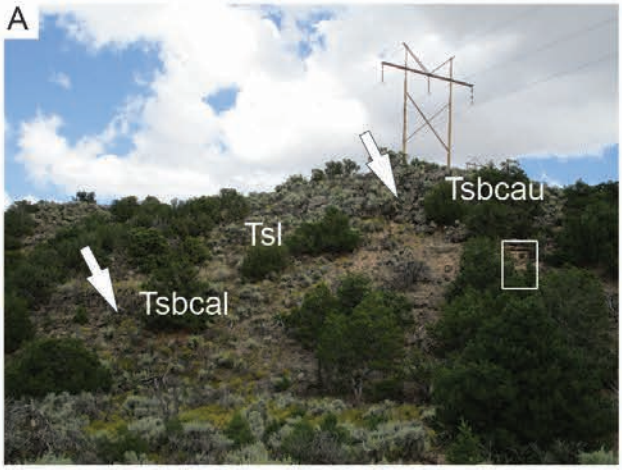


Figure A3-01. Annotated graphic column for the south Cerro Azul stratigraphic section.

Figure A3-02 (next page). A) Outcrop photographs where the south Cerro Azul stratigraphic section was measured. Arrows denote bases of the lower and upper Cerro Azul flows (Tsbcal and Tsbcau). White box approximates the area of photo in D. B) Upper Cerro Azul basalt flow at the top of the section. It is 5 m thick and has 0.5-2.0% conspicuous olivine phenocrysts 0.5-1.0 mm long. C), Lower Cerro Azul basalt flow at the base of the section. It has no obvious olivine phenocrysts and is 2.4 m thick. Rock hammer for scale. D) Middle part of the section, where two cemented beds and an intervening sandstone are exposed. Stratigraphic section units are labeled. Most of the lower Sandlin unit is sandy, but stratigraphic section unit 4 corresponds with a cross-laminated pebbly sandstone. Paleoflow from this bed is 218°. E) Close-up of stratigraphic section unit 3, which is a very fine- to medium-grained sandstone and has a paleoburrow.

Figure A3-02



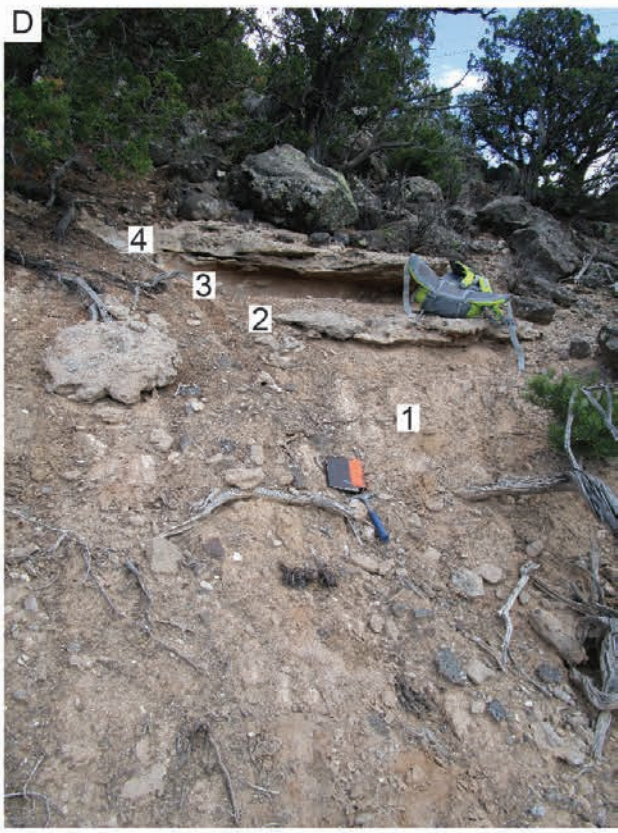
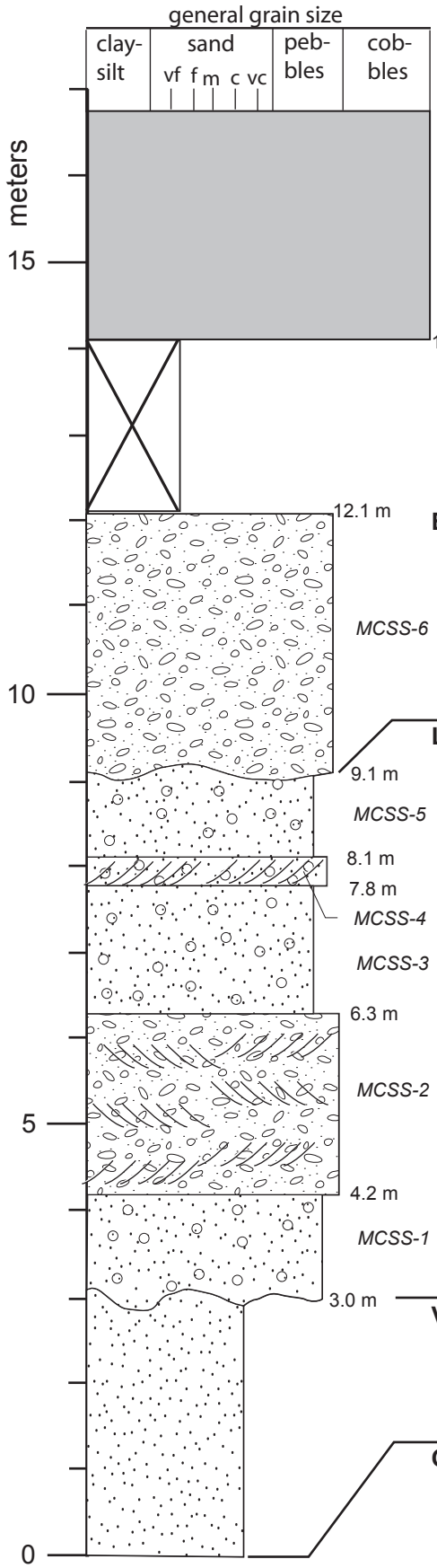


Figure A3-03



MIDDLE CERRO AZUL STRATIGRAPHIC SECTION

18.1 m

Top not shown

Upper Cerro Azul flow of the Servilleta Basalt (Tsbcau)

Basalt: Dark gray. Highly vesicular (15-20% vesicules up 0.5-1.0 cm long, with some up to 2.0 cm). Composed of plagiolcase laths (<=0.2 mm, minor up to 2.0 mm long). Phenocrysts consist of 0.5-1.0% green olivine phenocrysts 0.5-1.5 mm long (mostly 0.5-1.0 mm long). 4.0 m thick.

14.1 m

Not exposed: Sandy. May possibly be lower Sandlin Unit speparated from Unit 6 by a buttress disconformity.

12.1 m

Basal part of upper Sandlin Unit, inset into 4.8 Ma basalt (Tsui)

Sandy gravel: Very thin to thin, tabular beds of grain- to clast-supported very fine to very coarse pebbles and 1-3% cobbles. Gravel are subrounded & moderately to poorly sorted (within a bed). Clast count site GTM-752a. Clast imbrication averags 220° (n=19). Sand is mostly coarse- to very coarse-grained, subrounded, poorly sorted, and composed of volcanic lithic grains. Minor fine-upper to medium-upper sand that has more abundant quartz and feldspar. 5% strong CaCO3 cement in basal 1.5 m; otherwise, weakly cemented and moderately consolidated. Scoured lower contact.

Lower Sandlin Unit (Tsl)

Pebbly sand: Pebbly beds are 10-30 cm-thick, have scoured bases, and weakly to strongly cemented. Pebbles are very fine to coarse and subrounded to subangular. Sand is tanner than below, fine-upper to very coarse-upper, subrounded, poorly sorted. One olivine-phyric basalt clast at top.

9.1 m

MCSS-5

8.1 m

7.8 m

Sand and pebbles: Laminated to very thinly bedded, tabular to cross-stratified. Pebbles: very fine to very coarse, subrounded, & poorly sorted. Sand is fine-upper to very coarse-upper, reddish yellow (5-7.5YR 6/6), poorly sorted. Sharp and wavy lower contact (~2-4 cm of scour relief)

MCSS-4

MCSS-3

Orangish pebbly sand: Reddish yellow (5-7.5YR 6/6). Uncemented grains are orange-stained. Clast and sand composition grossly similar to underlying unit. Lower contact not exposed.

6.3 m

Sandy pebble conglomerate: Beds are very thin to medium and low-angle cross-stratified. Mostly very thin, lenticular to planar beds. Pebbles are very fine to very coarse, subrounded, and poorly sorted. Clast count site GTM-752. Clast imbrication averags 207° (n=31). Sand is light gray (10YR 7/1-2), mostly medium- to very coarse-grained, subrounded, to subangular, poorly sorted, and composed of quartz and plagioclase with 10% orange-stained quartz (& possible Kspar) and 15% volcanic + mafic grains. Strongly cemented in lower part, but degree of cementation decreases up-section. Sharp, scoured(?) lower contact.

MCSS-2

4.2 m

Pebbly sand: Weakly consolidated. No obvious bedding. Sand is pinkish gray to pink (7.5YR 6/2-3; 7/3), medium- to very coarse-grained, subrounded, and moderately sorted. Locally strongly cemented at base. Scoured lower contact.

MCSS-1

3.0 m

Vallito Member of Chamita Formation (Tcv)

Sand: Pink (7.5YR 7/3), fine-upper to very coarse-grained sand (mostly medium- to coarse-grained). Massive to vague, thin to medium, tabular beds. Locally, 1-3% very fine to fine pebbles of felsic volcanics, Paleozoic sandstone, and granite. Sharp, planar lower contact.

Ojo Caliente Member of Tesuque Formation (Tto)

Sand: Pink to very pale brown (7.5-10YR 7/4) fine-upper to medium-lower sand coarsening downward to medium-grained sand. Massive. Sand is subrounded, well sorted, and composed of quartz, ~10% orangish grains (quartz and feldspar), and 10% mafics-lithics. Weathers to white.

Figure A3-03. Annotated graphic column for the middle Cerro Azul stratigraphic section.

Figure A3-04 (next page). Photographs of the Sandlin unit in the middle Cerro Azul section. These correspond to the lower Sandlin unit except for stratigraphic section unit 6, which correlates to the basal, inset gravel of the upper Sandlin unit. A) View of the stratigraphic section, looking northwards. Stratigraphic unit numerical labels are shown in black numerals. Various lithologic units are shown via white text: Tto = Ojo Caliente Sandstone of the Tesuque Formation, Tcv = Vallito Member of the Chamita Formation, Tsl = lower Sandlin unit, Tsui = basal, inset gravel of the upper Sandlin unit, Tsu = upper Sandlin unit. B) Cross-stratified sandy pebble conglomerate of the lower Sandlin unit (stratigraphic unit 2). Pebbles are predominately felsic volcanic clasts and Paleozoic sedimentary clasts (29% and 20%, respectively), with lesser quartzite (13%), Tertiary intermediate volcanic clasts (12%), granite (10%), basalt (8%) and very minor Pilar slate, epidote-rich metamorphic, and gabbroic rocks (Table 2). Paleoflow is 207° (31 imbricated clatsts). Hammer and 15 cm-long ruler for scale. C) Middle part of section, showing stratigraphic section units 3-6. D) Close-up of stratigraphic section units 3-5. Note the reddish color of the pebbly sand in unit 3, which is not common in the Sandlin unit. E) Scoured contact between stratigraphic section units 5 and 6. Note the abundance of cobbles in unit 6, consistent with what is observed to the south in another exposure of the basal, inset gravel at the base of the upper Sandlin unit. F) Close-up of the basal, inset sandy gravel of stratigraphic section unit 6. 15 cm-long ruler for scale. This gravel contains abundant felsitic volcanic gravel (59% at this site) and minor quartzite and basalt clasts (14% and 12% at this site, respectively). Sparse cobbles and boulders of locally derived Servilleta Basalt are present, one such cobble is noted by the white arrow.

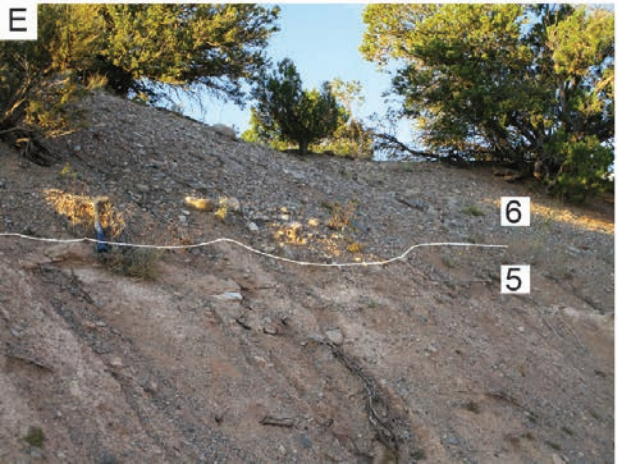
Figure A3-04


A
Ortega Quartzite
Tsu
Tsul
Tsl
Tcv
Tto
1
2
3
4
5
6


B

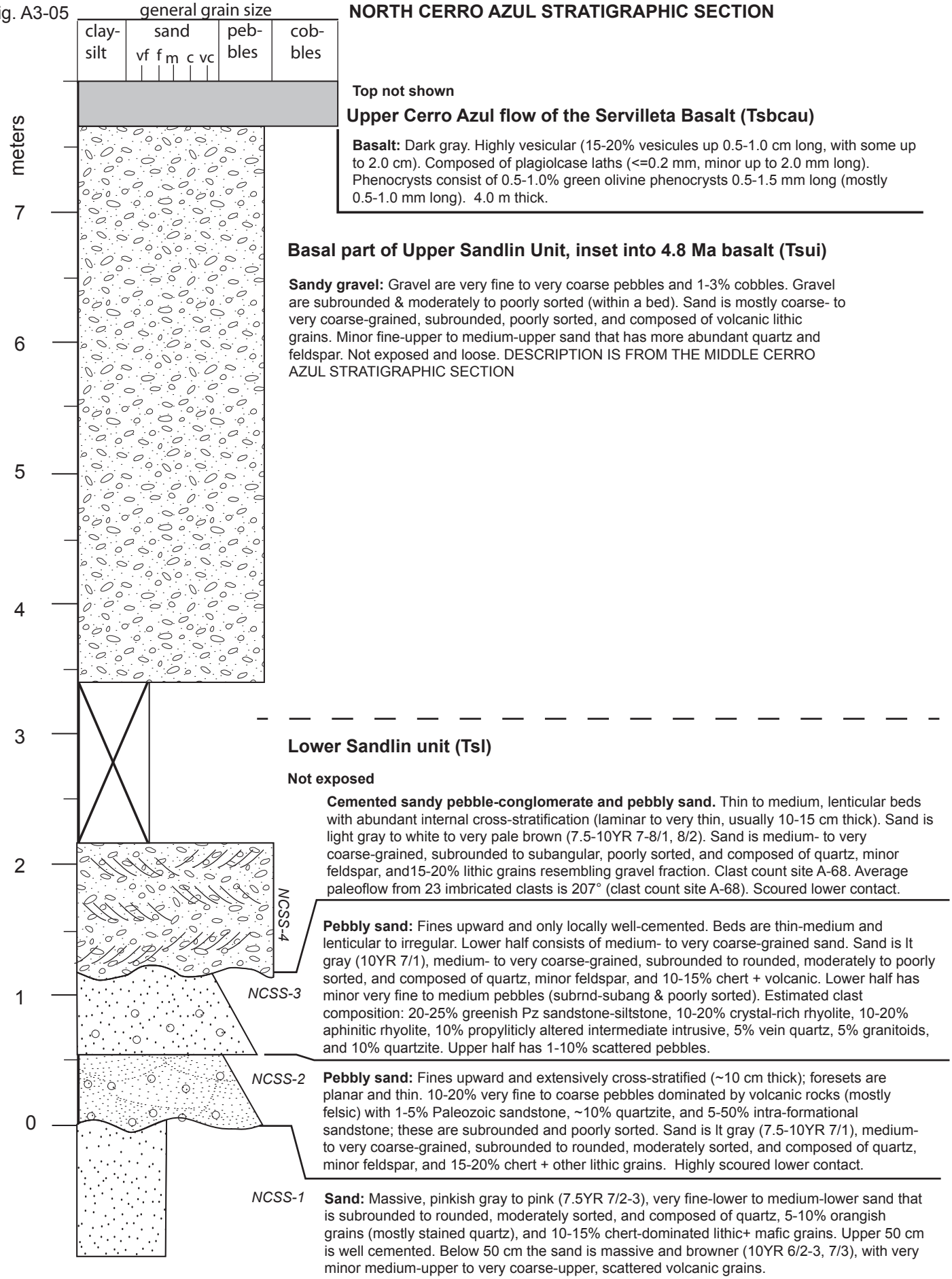

C
6
5
4
3


D
5
4
3


E
6
5


F

Fig. A3-05



NORTH CERRO AZUL STRATIGRAPHIC SECTION

Top not shown

Upper Cerro Azul flow of the Servilleta Basalt (Tsbcau)

Basalt: Dark gray. Highly vesicular (15-20% vesicules up 0.5-1.0 cm long, with some up to 2.0 cm). Composed of plagiolcase laths (<=0.2 mm, minor up to 2.0 mm long). Phenocrysts consist of 0.5-1.0% green olivine phenocrysts 0.5-1.5 mm long (mostly 0.5-1.0 mm long). 4.0 m thick.

Basal part of Upper Sandlin Unit, inset into 4.8 Ma basalt (Tsui)

Sandy gravel: Gravel are very fine to very coarse pebbles and 1-3% cobbles. Gravel are subrounded & moderately to poorly sorted (within a bed). Sand is mostly coarse- to very coarse-grained, subrounded, poorly sorted, and composed of volcanic lithic grains. Minor fine-upper to medium-upper sand that has more abundant quartz and feldspar. Not exposed and loose. DESCRIPTION IS FROM THE MIDDLE CERRO AZUL STRATIGRAPHIC SECTION

Lower Sandlin unit (Tsl)

Not exposed

Cemented sandy pebble-conglomerate and pebbly sand. Thin to medium, lenticular beds with abundant internal cross-stratification (laminar to very thin, usually 10-15 cm thick). Sand is light gray to white to very pale brown (7.5-10YR 7-8/1, 8/2). Sand is medium- to very coarse-grained, subrounded to subangular, poorly sorted, and composed of quartz, minor feldspar, and15-20% lithic grains resembling gravel fraction. Clast count site A-68. Average paleoflow from 23 imbricated clasts is 207° (clast count site A-68). Scoured lower contact.

Pebbly sand: Fines upward and only locally well-cemented. Beds are thin-medium and lenticular to irregular. Lower half consists of medium- to very coarse-grained sand. Sand is lt gray (10YR 7/1), medium- to very coarse-grained, subrounded to rounded, moderately to poorly sorted, and composed of quartz, minor feldspar, and 10-15% chert + volcanic. Lower half has minor very fine to medium pebbles (subrnd-subang & poorly sorted). Estimated clast composition: 20-25% greenish Pz sandstone-siltstone, 10-20% crystal-rich rhyolite, 10-20% aphinitic rhyolite, 10% propyliticly altered intermediate intrusive, 5% vein quartz, 5% granitoids, and 10% quartzite. Upper half has 1-10% scattered pebbles.

Pebbly sand: Fines upward and extensively cross-stratified (~10 cm thick); foresets are planar and thin. 10-20% very fine to coarse pebbles dominated by volcanic rocks (mostly felsic) with 1-5% Paleozoic sandstone, ~10% quartzite, and 5-50% intra-formational sandstone; these are subrounded and poorly sorted. Sand is lt gray (7.5-10YR 7/1), medium- to very coarse-grained, subrounded to rounded, moderately sorted, and composed of quartz, minor feldspar, and 15-20% chert + other lithic grains. Highly scoured lower contact.

Sand: Massive, pinkish gray to pink (7.5YR 7/2-3), very fine-lower to medium-lower sand that is subrounded to rounded, moderately sorted, and composed of quartz, 5-10% orangish grains (mostly stained quartz), and 10-15% chert-dominated lithic+ mafic grains. Upper 50 cm is well cemented. Below 50 cm the sand is massive and browner (10YR 6/2-3, 7/3), with very minor medium-upper to very coarse-upper, scattered volcanic grains.

Figure A3-05. Annotated graphic column for the north Cerro Azul stratigraphic section.

Figure A3-06 (next page). Photographs of Pliocene strata in the north Cerro Azul stratigraphic section. A) Photograph of the lower, well-exposed part of the North Cerro Azul stratigraphic section. Stratigraphic units are labeled and delineated by white lines. B) Scoured contact between stratigraphic units 2 and 1. Unit 1 is a very fine- to medium-grained, massive sandstone. C) Stratigraphic unit 2 is a cross-stratified, pebbly sandstone that fines upwards. Pebbles are dominated by felsic volcanic rocks along with 1-5% Paleozoic sandstone, ~10% quartzite, and 5-50% intra-formational sandstone (visual estimates). D) Scoured contact between well-cemented, sandy pebble conglomerate of stratigraphic unit 4 and underlying sandstone of stratigraphic unit 3. 15 cm-long ruler placed at the contact. Unit 3 fines upward and is in thin to medium, lenticular to irregular beds. Visual estimation of pebbles in the lower part of stratigraphic unit 3 gives: 20-25% greenish Paleozoic sandstone-siltstone, 20-40% rhyolite, 10% propyliticly altered intermediate intrusion, 5% vein quartz, 5% granitoids, and 10% quartzite. E) Cemented sandy pebble-conglomerate of stratigraphic unit 4, which has abundant cross-stratification. Average paleoflow from 23 imbricated clasts is 207°. Clast count site A-68 is located ~10 m north of here (Table 2).

Figure A3-06