Sedimentary Structures: Sole Marks -- Flute Casts & Load Casts

By Susan Celestian

As water flows over a stream bed; as flowing water pushes objects along a stream bed; as saturated sediments of differing densities are deposited one on the other; and as turbidity currents travel over pre-existing sediments, markings, grooves, and other depressions are often formed. These depressions later fill with sediment, and may be preserved. Collectively, they are referred as sole marks, as they typically display as bulges on the underside of an exposed bedding plane.

For the purposes of this article, I will consider only flute casts and load casts. The other sole marks are not terribly different than flute casts.*

FLUTE CASTS have a bulbous scooped out depression, leading into a shallower flared depression. See Figures 1-2.

FIGURE 1 Flute Casts These flute casts formed in the Jurassic Moenave Formation, and were exposed at Johnson Farm -- now the St. George Dinosaur Discovery Museum -- in St. George, Utah.

Photo by Susan Celestian

FIGURE 2 Formation of Flute Casts (A) A layer of brown sand is deposited. (B) A current gouges out a deep-shallow depression, in the brown sand. (C) A layer of pink sand is deposited over the brown sand. The rock layers are subsequently lithified. (D) The two rock layers are subjected to weathering and erosion, removing the brown sand and leaving behind a layer of pink sand, with a bulging lower surface. Normally, you will find the pink rock layer with the bulge displaying on the upper surface -- but it was originally the lower surface.

Illustration by Susan Celestian

Environmental significance of flute casts: Flute casts are very often created by turbidity currents, but they can be produced by scouring by any turbulent flow.

They can be used to determine original UP, as they occur on the bottom of a sedimentary layer. And they also indicate paleo-current direction, with the deeper, bulbous end occurring in the up-current direction. Refer to the arrow in Figure 2.

*Tool marks are depressions created as sticks or other objects are pushed, dragged, rolled, or skipped along the stream bed. Groove casts are actually very thin, low, linear doublet or triplet grooves formed by turbidity currents.

Sole Marks continued on page 2…..

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LOAD CASTS form when a dense sedimentary layer (generally sand), sags into a saturated, less dense layer -- often mud -- below. See Figures 3-4.

Environmental significance of load casts: Load casts give one a sense of the sedimentary conditions at the time of deposition. Additionally, like flute casts, they can indicate original UP (refer to the UP arrows in Figures 3-4).
### UPCOMING FIELD TRIPS

<table>
<thead>
<tr>
<th>WHEN: October 20, 2018</th>
<th>WHERE: Amethyst Hill area</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHAT: Barite, Fluorite, Amethyst, Cerussite</td>
<td>MEET: Meet at McDonalds in Wickenburg; Leaving at 9:00</td>
</tr>
<tr>
<td>OTHER: Any vehicle OK to the turn off Constellation Road; high clearance the short distance to mine (ride-share at that point possible)</td>
<td>LEADER: Stan Celestian</td>
</tr>
</tbody>
</table>

**WHEN:** October 27, 2018  
**WHERE:** Wikieup Area (another Sycamore Creek)  
**WHAT:** Lizard Stone (green, banded siltstone)  
**MEET:** 10:00; Cholla Ranch Rd (between MP 127 and 128, on Hwy 93, 70 miles north of Wickenburg  
**OTHER:** 4x4 to get to site, but will carpool from meeting area; be prepared to dig  
**LEADER:** Dave Haneline

**WHEN:** November 16-18, 2018  
**WHERE:** Yellow Pine Mine (near Las Vegas)  
**WHAT:** Galena, Kaolinite ps Orthoclase, Hydrozincite; Smithsonite, nearby Travertine [https://www.mindat.org/loc-3891.html](https://www.mindat.org/loc-3891.html)  
**MEET:** Meet site - gas station at Jean/Goodsprings exit on I-10W, at 8:30 am.  
**OTHER:** This is an overnight trip. You will need to make your own lodging arrangements. Dave and Robin will be staying at the Silverton (3333 Blue Diamond Blvd, Las Vegas). Group dinner at the Silverton on the 16th & 17th (rsvp to Dave).  
**LEADER:** Dave Haneline

**WHEN:** November 3, 2018  
**WHERE:** Payson area (Christopher Mt., past Sharps Creek Campground on Hwy 260E  
**WHAT:** Zebra chert, Peach jasper, Fossils  
**MEET:** West side of Circle K in Star Valley (just of Payson); LEAVING at 9 am  
**LEADER:** Payson Rimstones, may contact Lynne Wheeler Lynnewheeler70@gmail.com  
**OTHER:** Bring lunch, chair & wear club badge

**WHEN:** November 10, 2018  
**WHERE:** Lake Pleasant area  
**WHAT:** Calcite  
**MEET:** TBA -- Probably suitable for any vehicle  
**LEADER:** TBA

### NOTE FROM THE EDITORS

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### NEEDED: QUALITY MINERAL (or OTHER) DONATIONS WITH LABELS -- for monthly raffle prizes; and for raffle, door prizes, and sales tables at the annual show. If you have specimens to donate, please see Robin Shannon. The Daisy Mountain Rock and Mineral Club is a 501(c)(3) non-profit organization, and will gratefully acknowledge your donation with a Tax Deduction Letter. Thank You!

**WHEN:** December 15, 2018  
**WHERE:** Camp Verde  
**WHAT:** Pseudomorphs -- calcite, aragonite & gypsum after glauberite crystals  
**MEET:** 9:00 a.m. at Burger King just off I-17 at exit for Camp Verde Hwy 260. Leaving at 9:30.  
**LEADER:** Nelson Avery, Verde River Rockhounds, 928-301-7147  
**OTHER:** The road can get pretty rough in spots. Shouldn’t need 4-wheel drive, but will need high clearance. Will be required to sign a Notice of No Insurance - Field Trip Practices - Safe Practices

**WHEN:** December 16, 2018  
**WHERE:** Burro Creek  
**WHAT:** Jasper, Agate  
**MEET:** TBA  
**LEADER:** TBA

**WHEN:** January 12, 2019  
**WHERE:** Planet Mine  
**WHAT:** Specular Hematite, Chrysocolla  
**MEET:** TBA  
**LEADER:** TBA

Field Trips continued on page 4.....
WHEN: January TBA, 2019  
WHERE: Black Pearl Mine on Aguila Rd.  
WHAT: Fluorescent Minerals  
MEET: TBA  
LEADER: TBA  
OTHER: This will be an evening/after dark trip. Prior to dark, there will be a potluck. Sounds like fun!

WHEN: February 9, 2019  
WHERE: Dragon Mine  
WHAT: Tourmaline, Purple Mica, Thundereggs  
MEET: TBA  
LEADER: TBA  

WHEN: March 19, 2019  
WHERE: Peridot Mesa  
WHAT: Olivine var peridot  
MEET: TBA  
LEADER: TBA  

WHEN: April 6, 2019  
WHERE: Bullard Mine  
WHAT: Chrysocolla, Malachite  
MEET: TBA  
LEADER: TBA  

WHEN: May 11, 2019  
WHERE: Payson area  
WHAT: Zebra Chert, Pennsylvanian Fossils  
MEET: TBA  
LEADER: Ed Winbourne  

WHEN: June 1, 2019  
WHERE: Lynx Creek near Prescott  
WHAT: Gold  
MEET: TBA  
LEADER: Stan Celestian

DATES SUBJECT TO CHANGE

Stan and the field trip committee will be actively looking for productive spots for field trips. If you have any suggestions, you are encouraged to contact him at stancelestian@gmail.com

FIELD TRIP  
SYCAMORE CREEK  
SEPTEMBER 29, 2018

For some reason, most of my people pictures did not come out. But here is Stan with a pile of bright red jasper. And if you look closely, you will see the blood he sacrificed to the jasper gods.

Herds of red-orange butterflies fluttered in the breeze, as omens of a successful hunt for red rocks!

Queen (Danaus gilippus thersippus)

American Snout (Libytheana carinenta streckeri)  
Euphydryas sp. I think
Longtime Arizona rockhound, Dick Zimmerman, has a mining claim, on Constellation Road, near Wickenburg. He and Stan Celestian have been mining cerussite crystals there for 10 or 11 years. Stan led a club trip to the mine, where possible finds from the dump, or from digging in the walls, include: barite, amethyst, galena, chlorargyrite, and cerussite. The field trip was well attended, with at least 24 members there.

Stan oriented the group -- first on the hill where one can find cleavable calcite, and next with regard to the Blue Owl Mine.
UPCOMING AZ MINERAL SHOWS

October 20-21 - Sedona, AZ Sedona Gem and Mineral Club; Sedona Red Rock High School, 995 Upper Red Rock Loop Rd; Sat 10-5, Sun 10-4; Admission: Adults $3, children free.

November 2-4 - Black Canyon City, AZ High Desert Helpers; High Desert Park, 19001 E. Jacie Ln.; Fri-Sun 9-4; Admission: Free.

November 10-11 - Lake Havasu, AZ Lake Havasu Gem & Mineral Society; Lake Havasu Community Center (Rods & Relics Hall), 100 Park Av; Sat 9-5, Sun 9-4; Admission: $2, children under 12 free.

November 17-18 - Payson, AZ Payson Rimstones Rock Club; Payson H.S., Longhorn Gym, W. Longhorn Rd & N. McLane Rd.; Sat 9-5, Sun 10-4; Admission: Adults $2, children under 12 free.

November 17-18 - Mesa, AZ Apache Jct Rock and Gem Club; Skyline High School, 845 S Crimson Rd.; Sat 9-5, Sun 10-4; Admission: $3 adults, $1 students, children 12 and under free.

November 24-25 - Wickenburg, AZ Wickenburg Gem and Mineral Club; Wrangler Event Center, 251 S. Teqner St.; Sat 9-5, Sun 10-4; Admission: free.

December 1 - Cornville, AZ Verde River Rockhounds; Windmill Park, 9950 E Cornville Rd.; Sat 9-4; Admission: free

January 1-February 28 - Quartzsite, AZ Various shows: Desert Gardens, Tyson Wells; For more information go to: https://www.desertusa.com/cities/az/quartzsite.html


March 16-17 - Anthem, AZ Daisy Mountain Rock and Mineral Club; Boulder Creek High School Gym, 40404 N Gavilan Peak Pkwy; Sat 9-5, Sun 10-4; Admission: $3 adults, $2 seniors and children, children 12 and under free.

Visit http://rmfms.org/ for news about conventions, events, and associated clubs. If you are travelling, you might want to contact a club local to your destination. Maybe they have a field trip you could join, while in town.

FACEBOOK
Visit and join the club page periodically. See what is happening, and boost our visibility on the web. Go to: The Daisy Mountain Rock and Mineral Club. It is set up so you can post photos of outings or related items.

WEBSITE
http://www.dmrmc.com/
Here you will find photos highlighting field trips, activities/classes and our show, links to rockhounding regulations, newsletter archive, geologic articles, and links to geologic resources.

If you have comments, contact webmaster, Nancy Gallagher.

Officers, Chairpersons, & Trustees
President: Ed Winbourne.....ewinbourne@gmail.com
Vice President: Stan Celestian
Secretary: Victoria Peterson .................. g.victoriapeterson@yahoo.com
Treasurer: Cynthia Buckner
Publicity: Howard Roose
Membership: Tiffany Poetsch tnpoetsch@gmail.com
Editors: Susan & Stan Celestian................. azrocklady@gmail.com
Field Trip: Stan Celestian... stancelestian@gmail.com
Show Chair: Ed Winbourne
Trustees:

Meetings are held the 1st Tuesday of the month at the Anthem Civic Building, 3701 W Anthem Way, Anthem, AZ 85086. Business meeting at 6:30 pm. We do not meet in July or August.

DMRMCLUB@GMAIL.COM

Membership Dues: $20.00 Adults per Person
$25.00 Family (2 people)
$ 5.00 Additional children

Meeting Dates for 2018
Jan 2, Feb 6, Mar 6, Apr 3, May 1, June 5, Sept 4,
Oct 2, Nov 6, Dec 4