

The Natural History of Death Valley - Fall 2007

Field Trip Worksheet

Complete the following worksheet at designated stops (if questions are asked) and as we travel from stop to stop. Completion of this worksheet is mandatory and hence part of your class participation points (100 total points). Be as neat and thorough as possible and take pictures of everything (geological processes, plants, animals, people, etc.) pertinent to this class so it will help you with preparing the field journal. This worksheet will need to be turned in with your journal.

Death Valley National Park

Hottest, Driest, Lowest: A superlative desert of streaming sand dunes, snow-capped mountains, multicolored rock layers, water-fluted canyons and three million acres of stone wilderness. Home to the Timbisha Shoshone Native Americans and to plants and animals unique to the harshest deserts. Death Valley is managed by the Department of Interior - National Park Service.

Day 1 - The Southern Portion

Stop 1 (Shoshone Museum and Tecopa areas)

- Around Shoshone and Tecopa Hot Springs (primarily southward), a dozen miles east of the southeast corner of Death Valley National Park, lie white, fine-grained, eroded **lakebeds**, which are sediments from the floor of ancient **Lake Tecopa**.
- The **Amargosa River** presumably flowed right through the Tecopa Valley before **faulting** within coarse, gravelly deposits at the valley's south end created a lake basin.
- The lake-floor sediments are mainly mudstones of **clay, silt, and fine sand**, as well as shoreline **conglomerate, sandstone, calcareous tufa**, and numerous layers of **volcanic ash**.
- The uppermost Tecopa beds contain sparse remains of fossil mammals such as **horses, camels, mammoths, muskrats**, and some rodents.
- The Mojave Desert area historically had a great moisture content prior to the last **glaciation**. Now, there are only a few pockets of water left over and species suffer from high **salinity, temperature extremes, dissolved oxygen**, and reduced **water flow**.
- Tolerance for environmental extremes is a notable feature of the **Desert Pupfish** (*Cyprinodon*). But, the introduction of **nonnative** species and habitat **destruction** has threatened the fishes of the desert with many of them now protected by federal and state governments as **endangered (managed by United States Fish and Wildlife Service - USFWS)**. Unfortunately, the **Tecopa Pupfish** (*Cyprinodon nevadensis calidae*) is now apparently **extinct**.

Stop 2 (Shoreline Butte)

- Shoreline Butte offers one of the best-preserved successions of **strandlines** from the ancient **Lake Manly**. Lake Manly was at its maximum size during the **Pleistocene** period by measuring close to **100** miles in length and **600** feet deep. The lake is named after William Lewis Manly, the man who rescued a party of immigrants from Death Valley in **1849**.
- The butte, formerly an **island** in Lake Manly, was battered by **wind and waves** on all sides. The strandlines are carved in **1.5** million year old **basaltic** lava.

- Identify at least **three species of plants** and list them from most to least dominant.

1. _____ 2. _____ 3. _____

- Identify at least **three species of native animals**.

1. _____ 2. _____ 3. _____

Stop 3 (Badwater and Badwater Earthquake Fault)

- Is Death Valley's Badwater the lowest spot in the world? **No**, Badwater is the lowest spot in the **western** hemisphere but not in the world. Badwater's elevation is **282** feet below sea level.
- Identify two of the dominant plants in the area. 1. _____ 2. _____
- What are the adaptations these plants exhibit that allow them to survive this type of harsh environment?
- Note any wildlife or signs of wildlife. Describe what you observe. _____
- The name of the mountain peak to the west of Badwater is **Telescope Peak** in the Panamint Mountains, at **11,049 feet**, is the highest point within the park.
- At the base of the Panamint Mountains between Telescope Peak and Badwater is a large **alluvial** fan, called the **Hanaupah fan**. The six smaller alluvial fans to the south of Badwater are called the **Gorgeous Little Fans**.

Stop 4 (Devils Golf Course)

- Touch the rough blocks of dusty, jagged blocks to feel how sharp the tiny crystals are. Identify the crystals _____. The rugged ground here is formed by **salt (~95% table salt)** that is crystallizing and expanding.
- Beneath the Devil's Golf Course lie thousands of feet of alternating layers of **salt** and lake sediments that accumulate as the valley sinks and the generations of lakes similar to Lake Manly come and go.
- Any plants in the area? _____. Speculate on the distribution and type of plants present in this harsh environment.

Stop 5 (Artists Palette)

- The red, pink, yellow, orange & brown colors result from two minerals that commonly occur in rust.
 1. **Hematite** - a red iron oxide
 2. **Limonite** - a yellow iron oxide
- The other colors (violets & greens) are formed by the alteration of minerals found in the **volcanic ash**.

Stop 6 (Mushroom Rock and Ventifact Ridge)

- The dark, hard rocks exposed here are basaltic lavas that have been polished smooth by the _____.
- Why is the bottom of mushroom rock more polished than the upper portion? The blowing sand moves in a turbulent air layer near the **ground surface**, thus the polishing action of wind **erosion** is most effective within several inches of the **ground**.
- **Ventifacts** are rocks that have been abraded, grooved, or polished by **wind-driven sand**. These geomorphic features are most typically found in arid environments where there is little vegetation to

interfere with eolian particle transport, where there are frequently strong winds, and where there is a steady but not overwhelming supply of sand.

- **Ventifacts** can be abraded to eye-catching natural sculptures. In moderately tall, isolated rock outcrops, mushroom shaped pillars of rock may form as the outcrop is eroded by saltating sand grains. This occurs because, even in strong winds, sand grains can't be continuously held in the air. Instead, the particles bounce along the ground, rarely reaching higher than a few feet above the earth. Over time, the bouncing sand grains can erode the lower portions of a ventifact, while leaving a larger less eroded cap. The results can be fantastic stone mushrooms.
- When ancient ventifacts are preserved without being moved or disturbed, they may serve as a **paleo-wind indicator**. The wind direction at the time the ventifact formed will be parallel to grooves or striations cut in the rock.

Stop 7 (Furnace Creek Campground - quick stop!!!!!!)

- Set up campsite as quickly as possible. Make sure that no more than two vehicles (or eight people) occupy any given campsite site (we will need ~4 or 5 campsites). The cost is about \$16 dollars per site and will need to be paid as soon as possible. Be sure to display the ticket stub to show payment. As soon as each campsite is chosen, please unload your gear but do not setup tents yet. We still have three more sites to visit.

Stop 8 (Zabriskie Point)

- The soft rock layers that surround Zabriskie Point were deposited in an earlier generation of mountain **lake** basin that was similar in some ways to the present valley but that had a **wetter** climate.
- The oldest sediments here accumulated as **mud, sand, and gravel** in and around a major lake.
- Even though the landscape is beautiful, it is called the **badlands** because of its barren rugged appearance.
 - The **light colors** (yellow, tans, and browns) are mostly from _____ minerals exposed to air.
 - The **darker colors** (gray-green to dark gray) are volcanic ash and lava flows.
- Pleistocene **megafaunal** animals such as camels, mastodons, and lions, left some tracks and bones within these hills (finding these remains are helpful to geologists by establishing a timeline).

Stop 9 (Twenty Mule Team Canyon - drive through)

- The famous twenty-mule teams, which actually consisted of **18 mules** and **2 horses**, transported ten thousands tons of **borax** from Death Valley in great wagons.
- Look carefully for prospector's tunnels driven into the soft, still-eroding rocks. What do you think these prospects were for? _____
- Vegetation is almost non-existent in this badland. Reasons why there are very few plant species in this barren moonscape include
 1. little rainfall
 2. high salt concentration
 3. erosion prevents soil buildup

Stop 10 (Dante's View)

- Dante's View (elevation of **5,475 feet**) gives a superb overview of the immensity of Death Valley.

- Identify the white salt flat directly below (hint: its elevation is ~282 feet): _____
- Identify the high point of the Panamint Range to the west: _____
- The salt, mud & coarser sediments that fill the valley are estimated to be as much as **15,000 ft** thick.
- Why doesn't Death Valley fill up with sand and gravel from the surrounding mountains?
 - The valley floor is dropping (~ **6 inches** per year) faster than the flow of alluvium into the valley.
 - Geologists call this type of structural valley a _____ (German for grave).
- The steep slope between here and Badwater is the eroded face of one of the **fault** zones on which the valley is sinking and tilting toward the east.

Stop 11 (Back to camp and possible the Furnace Creek Visitor Center)

- Set up tents, head to visitor center (if open), then to dinner in Furnace Creek. If time permits, we will need to fill up with gas. Please remember that the drivers do not pay for gas. If you are a passenger, make sure you accommodate the drivers properly for gas.

Day 2 - The Northern Portion

- Up by 6:30 am (it might still be dark), break down camp and have a **quick** breakfast, we will need to fill up with gas (if we did not the night before). Please remember that the drivers do not pay for gas. If you are a passenger, make sure you accommodate the drivers properly for gas.

Stop 1 (Mustard Canyon - one way loop, we will not stop)

- The soft rock walls in this canyon are older **playa (bajada) deposits** from the same rock sequence seen at Zabriskie Point, consisting of mud cemented by **salt minerals**.
- The canyon walls are usually yellow in color, but after periods of higher than normal rainfall the dampness evaporating from the porous rocks can deposit a crust of **white salt crystals**.

Stop 2 (Salt Creek)

- Unique **plants** and **fish** have evolved along this isolated, salty stream as Lake Manly slowly dried.
- Twenty thousand years ago, populations of ancestral **pupfish** species, among other kinds of fish, thrived in the great fresh water lakes in this part of the southwest.
- The desert pupfish was the only fish to survive the **evaporation** of the lake.
 - As the climate became more **xeric** (arid) and the lakes began to shrink, the remaining pools, springs, and short stretches of running streams fragmented the ancestral populations.
 - Isolated from one another (**allopatric speciation** - induced when the ancestral population becomes separated by a geographical barrier) each population faced different selective pressures (**natural selection**) in its changing habitat, accounting for the varied forms we see today.
- Identify at least **three species of plants** and list them from most to least dominant.
 1. _____
 2. _____
 3. _____
- Identify at least **three species of native animals**.
 1. _____
 2. _____
 3. _____

Stop 3 (Alluvial Fan)

- Alluvial fans are the consequence of thousands of years of continuous **erosion** - the movement of silt, sand, gravel and stones.
- **Hanging valleys** are formed when uplift of the mountains takes place at a more **rapid** rate than **erosion** allowing the rock debris to pile up at a sharper angle.
- If no further uplift occurs, this fan will gradually extend itself farther out into the valley and its steepness will eventually **decrease**.

Stop 4 (Titus Canyon)

- Hiking up the narrow, twisting canyon you will see flood-polished rock walls with some areas of **crystal-filled cavities**, or places where fractured pieces of **dark limestone** have been surrounded by white crystalline cement.
- Flowers and plants flourish briefly in the dry stream bed after a rainstorm.
- Identify at least **three species of plants** and list them from most to least dominant.
1. _____ 2. _____ 3. _____
- Identify at least **three species of native animals**.
1. _____ 2. _____ 3. _____

Stop 5 (Scotty's Castle)

- This is a 30-45 minute stop, get a drink and/or snack/food, and shop or just relax.
- Who was **Death Valley Scotty**?
 - Walter E. Scott was reputed to have become a wealthy man by discovering a gold mine in Death Valley. In reality he was a flamboyant, and often dishonest, cowboy. In 1904 he met Albert Johnson, a wealthy insurance executive from Chicago, and in the 1920's assisted him in planning the construction of a vacation home in Death Valley. To please his wife, Bessie, Johnson financed not just a home but a castle. Scotty became Johnson's lifetime friend and was even accommodated with his own bedroom at the castle.
- Can you identify any **exotic species of plants or animals here**?
1. _____ 2. _____ 3. _____

Stop 6 (Ubehebe [U-be-he-be] Crater)

- **Volcanism** at its best - molten magma rising from deep beneath the earth's crust came in contact with shallow **groundwater**.
- The water was superheated instantly to steam, producing energy, which would surpass the power of an underground _____ **blast**.

Stop 7 (Devils Cornfield)

- On both sides of the road are clumps of **arrowweed** (*Pluchea sericea* - used by Native Americans for arrow shafts) 4 to 10 feet tall that at first glance look like **cornshocks**.

- When rainfall has been above average this area becomes a saline **marsh**, and even during long dry spells salty ground water is not far **beneath** the surface.
- Arrowweed thrives where its roots can reach water that contains 0.5% to 3% dissolved **salts**, far above the limit for **drinking** water.
- When the ground is dry, **wind** slowly removes sand and soil, leaving the older bases of the arrowweed clumps perched above the present surface.

Stop 8 (Sand Dunes)

- The changing shape of the **Valley** and the towering **Tucki Mountains** slows winds blowing through Death Valley producing the sand dunes.
- The sand dunes are composed of _____ grains.
- Moderate winds blowing predominantly in one direction from **transverse** dunes.
- Winds blowing in **several** directions produce non-migratory **star** dunes.
- The trees nestled in clumps among the lower dunes are **mesquite**.
 - The seeds from the mesquite feed **kangaroo rats**, whose burrows are common near the trees.

Stop 9 (Stovepipe Wells Campground)

- Set up campsite as quickly as possible. Make sure that no more than two vehicles (or eight people) occupy any given campsite site (we will need ~4 or 5 campsites). The cost is about \$10-12 dollars per site and will need to be paid as soon as possible. Be sure to display the ticket stub to show payment. As soon as each campsite is chosen, please unload your gear but do not setup tents yet. We still have one more site to visit.

Stop 10 (Mosaic Canyon)

- Carved into **white marble** (_____ rock) and a mosaic of recemented stream gravel, this twisting canyon through polished rock walls is only a few feet wide in places.
- Identify at least **three species of plants** and list them from most to least dominant.
 1. _____
 2. _____
 3. _____
- Identify at least **three species of native animals** observed on the hike.
 1. _____
 2. _____
 3. _____

Stop 11 (Back to camp)

- Set up tents, then to dinner in Furnace Creek. Remember - Daylight saving will occur tonight. **FALL BACK** one hour. If time permits, we will need to fill up with gas. Please remember that the drivers do not pay for gas. If you are a passenger, make sure you accommodate the drivers properly for gas.

Day 3 - West side of Park, Trona, then Home

- Up at 6 am, break down camp and a quick breakfast, we may need to fill up with gas (if we did not fill-up the night before). Please remember that the drivers do not pay for gas. If you are a passenger, make sure you accommodate the drivers properly for gas.

Stop 1 (Petroglyphs)

- A stop along Emigrant Canyon Road to observe Native American petroglyphs (possibly by the Panamint Shoshone Indians). This area has no special name, but along with the petroglyphs there is some good wildlife, plants and geology.

Stop 2 (Charcoal Kilns)

- A row of 10 large stone structures that look like giant beehives stand in the _____ pine and _____ forest high on the west side of the Panamint Range.
- In the 1870's these kilns produced **charcoal** (from Panamint Mountain trees) for silver mine smelters in the treeless Argus Range, 30 miles to the west.

Stop 3 (Trona Pinnacles)

- The **Trona Pinnacles** are located at around **2,000 feet above sea level** in the **Western Mojave Desert**.
- This unique landscape consists of more than **500 tufa** (_____ carbonate) **pinnacles** rising from the bed of the **Searles Dry Lake basin**.
- These **tufa spires**, some as high as **140 feet**, were **formed underwater 10,000 to 100,000 years ago** when **Searles Lake formed** a link in an interconnected chain of **Pleistocene lakes stretching from Mono Lake to Death Valley**.
- The **Pinnacles** were designated by the **Department of the Interior** as a National Natural Landmark in **1968** to protect one of the nation's best examples of tufa formation.
- The area is managed by the **Bureau of Land Management (BLM)** to protect its scenic values and has become a popular filming location for movies (*Planet of the Apes* - 2001 version) and commercials.

Stop 4 (Citrus College)

- **No one is allowed to leave until their van is clean.**