Chapter 15 **SUNK IN QUICKSAND** Mile 66-75

We pull out and splash through Lava Canyon Rapid never having looked for the extensively studied ruins of Native Americans who occupied our lunch spot hundreds of years earlier. A blast of hurricane wind hits us as it almost always does in this stretch. We are now emerging into the widest part of the Grand Canyon where the rim-to-rim distance is about 8-9 miles (Fig. 15.1).

Fig. 15.1 View northeast across the widest area in the Grand Canyon. Eight miles from Lipan Point here on the South Rim to Cape Final at the right end of the flat North Rim skyline. The great westward bend of the river is where it enters the view on the right side of the image. Unkar Rapid is just to the left of center.

When peering down from the South Rim with binoculars, it is an almost surreal landscape (Fig. 15.2).

Fig. 15.2 Telephoto view on a haze-free day from Grandview Point over a distance of 14 miles along the river and across the widest area of Grand Canyon. Furnace Flats is the white sand beach at top center where the river comes into the view.

But we are down in it where I suspect all the wind blowing northward at us results from the huge volume of air in this wide-open space funnels back into the narrow gorge behind us. The expansive vista comes as something of a relief after being so tightly confined between high walls for the past several days. The Desert View Watchtower is easily visible sticking up as an out-of-place tiny nubbin on the otherwise flat top of the South Rim. Tourist eyes are looking our direction but not seeing our boats unless they look through binoculars. Although I was just there three days ago, it seems 900 million years away. All around us are the maroon-colored argillites, sandstones, and siltstones of the Dox Formation. The thin beds slant noticeably toward us, so we descend rapidly through these strata. Surely, we will soon discover what they are deposited on. Many faults slant down through the thin layers with offsets from one side to the other rather difficult to determine because of the similarity of the layers (Fig 15.3).

Fig 15.3. Small fault slicing upper left to lower right through Precambrian sandstones and ceramic-like shales ("argillites") in the Dox Formation between Lava Canyon and Tanner Rapids. Offset beds, orientation of the fault plane, and likely age of the fault are difficult to determine because of the similarity of the beds throughout the formation. It is likely that the fault plane rises almost vertically up from the light-colored gulley and that the layers this side of it have dropped down along it. The erosional gully is reaming out the fault to make interpretations difficult from a moving boat.

Wind-driven cold spray from numerous small, splashy riffles means no dozing off in the afternoon sun today.

The river here is trending southwest and we know that the Butte Fault is running almost north-south somewhere just to our right. Surely, we are thus going to intercept it at some point--possibly before we bottom out of the Dox strata. We see ahead the great turn where the river bends sharply to our right toward the west. It will no longer flow along this side of the Kaibab Uplift. After the turn, it will head straight toward that uplifted tectonic block and go right through it. Why? There is nothing we see here that would force it to do this. No wonder Powell thought the river was already here and that the Kaibab Uplift rose straight up under it. His idea was that rivers, including this one, erode downward faster than mountains rise. It was simply like lifting a board up under a saw. Evidence later suggested the river is the youngest feature and that it somehow established its course directly across the already uplifted block. It might do this if there was a single gully on the west side that eroded itself eastward across the uplift all the way to here to form the Grand Canyon. But where do we ever find single rather than multiple gullies attacking an area undergoing uplift? And why then did it turn north after

carving straight through the uplift? One idea is that this eastward migrating gorge joined an older Colorado River that flowed to here from the northeast but then went southeast to erode out what is now the broad valley of the Little Colorado River. But where was that older river going? The Rio Grande River in New Mexico was proposed, but geologic evidence in that direction argues against the idea. Here we are at this crucial bend helpless to find any reason for this drastic change in direction that takes it head-on directly through the Kaibab Uplift. All the proposed explanations have serious problems. After all the geologic conundrums we have encountered today, my brain can't take it any longer. It is best, in any case, to ponder this issue while looking at physiographic and geologic maps of the whole region with all the professional literature at your fingertips. We also need to see what is yet to come, especially on the west side of the uplift. Maybe someone will finally offer a solution to this difficult problem.

Just as we are about to make our turn, we note the biggest sand beach in the Grand Canyon lining the inner side of the bend. It is a magnificent campsite amidst the most expansive scenery along the river. Alas, the beach is known as "Furnace Flats" because it gets the earliest sun, the latest sunset, the least shade, and the most wind of any river camp in the Grand Canyon. It is magical to camp and explore here providing the weather is cloudy, cool, and calm—which except for winter is rare or never. At the west end of the sand flats, a trail comes back up the wall to the top of a ridge jutting somewhat out into the river. It leads to an Indian ruin with a great view of the river all the way back to where we left lunch at Lava Canyon (Fig. 15.4).

Fig 15.4. View upriver toward Lava Canyon Rapid from Indian ruin near Tanner Rapid. The angle at which the red Dox Formation layers are tilted seems to change several times along the riverbank. It is likely that several mini-tectonic blocks were jostled here along local fault boundaries. This area is sandwiched between the Palisades Fault that runs left-right behind the Tapeats-capped hill of black lavas in the distance and the Butte Fault which runs ¼ mile to the left of, and parallel to, the left edge of the image. Nowhere in the overlying Paleozoic layers such as those seen in the upper right quadrant of this image do such disruptions occur. The contrast between the ancient, faulted, red Dox layers and those of the Paleozoic in a single view from here thus enhances feelings about deep time and the profound changes that can happen during its great length. Informed a bit by geology, this view which looks the same today to our eyes as it did to the eyes of the ancient ones… really doesn't.

At the start of that trail near the river, a petroglyph-covered boulder has weathered out to resemble a big, cushioned chair. On a previous trip when I camped here, a river guide speculated that it might have been used as a birthing chair (Fig. 15.5).

Fig 15.5. River runner Mary Beth Lambert sits in petroglyph-covered boulder near Tanner Rapid possibly used as Native American birthing chair.

I wanted to go back that night and sit in it in the moonlight to connect with the ancient ones as is my want. Alas, I was too tired, it was too far in the dark, -- and cloudy to boot. Maybe some other time. From here west for the next several miles, the ancient Pueblo Peoples would come down mostly in the winter from both north and south rims to farm along the river. Here is one of the few places where there are good trail routes from rim to river down both canyon walls. It was even possible to wade across the river during the annual low water flows that used to occur then. Since river floods bringing in new sand are now rare because of Glen Canyon Dam, the big sandy beaches that used to exist along here have been eroding away. As they do, buried Indian ruins have been emerging. This place was well populated by the Pueblo Peoples centuries earlier. A long stretch starting here on river-right is now off limits for landing to protect what is appearing. On top of the South Rim just southwest of Desert View there is a visitor museum at the "Tusayan" group of ruins set back less than a mile from the rim edge (not to be confused with the modern town of Tusayan). I earlier reckoned that these Native Americans farming along the river were communicating with either their neighbors or relatives who occupied the Tusayan ruins high up on the rim. After studying maps, I located a certain

vista point on the South Rim edge where I thought a fire signal might be seen by all the major ruin sites along this stretch of the river. I trudged from HW 64 cross-country about a mile through the juniper forest, and bingo--there were small rock-wall ruins set back just behind the cliff. I am sure archeology surveys have located these, but they are secrets of the National Park Service. Discovering them on my own using this reasoning was a thrill. Today, I give a wave up to that vista point and imagine what smoke signals would have looked like. Maybe one puff means "Everything is OK". Two means "Our enemies are coming." Three, "The Chief has hemorrhoids, send herbs." Or maybe I have been watching too many culturally insensitive John Wayne movies. But surely there were fire signals at night.

After rounding the tight bend, we immediately enter Tanner Rapid. This is a long, wide, shallow, fast eruption of bank-to-bank small splashing whitecaps. The Butte Fault emerges straight out of the north wall and greets us with a monumental cross section almost as spectacular as that we just left after lunch. Black lavas lie to the left and red Dox beds to the right (Fig. 15.6).

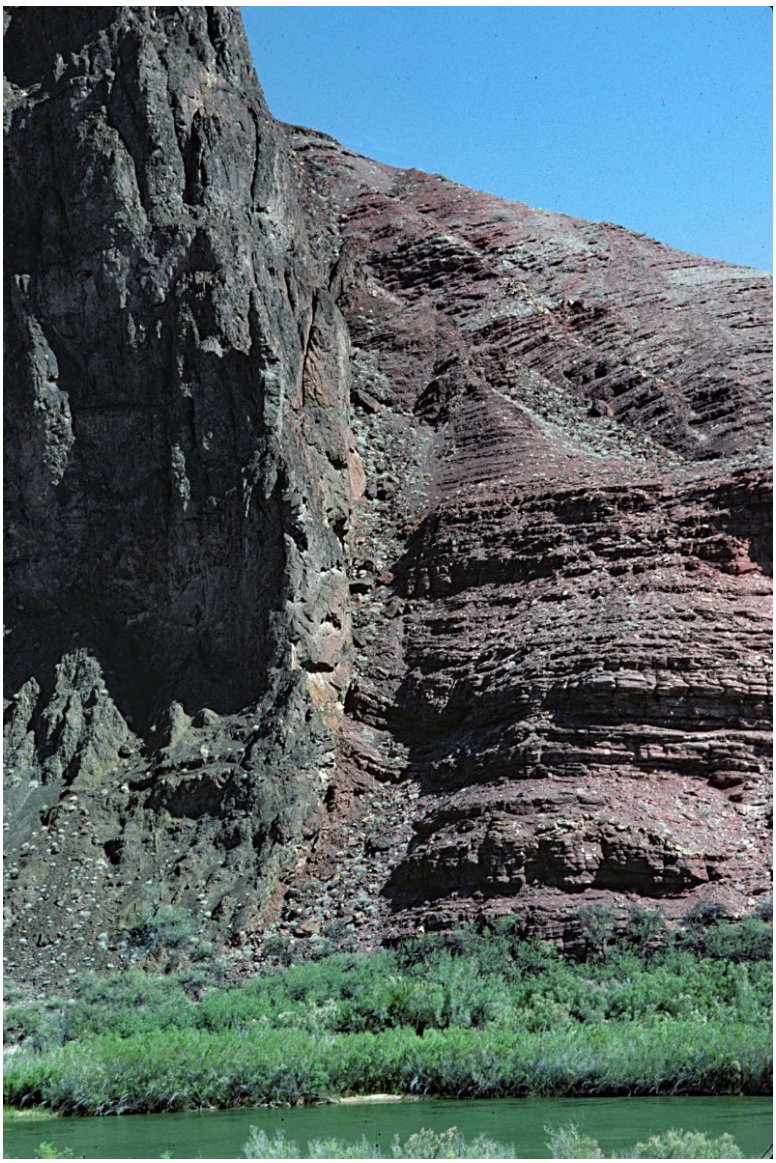

Fig. 15.6. View north at a cross section of the Butte Fault Plane where the river cuts westward through it at Tanner Rapid. Note how beds of the red Dox Formation adjacent to the fault plane that separates them from the black lavas to the left were dragged upward indicating that last movement was left side up. The lavas occur stratigraphically higher than the Dox and were brought deeply downward during Precambrian faulting. They came back up during the Laramide Orogeny starting about 70 million years ago, but they never got back up to their original position higher up.

The story is reinforced how the lava stack dropped far down on the west side of the fault in the latest Precambrian and then came back up during the Laramide Orogeny 70 million years ago. The fault zone is a jumble of crushed rocks with red layers of Dox warped upward confirming that the west side moved last. The furiously dancing whitecaps throw sprays of wind-driven cold water so fast at us that we do not notice the red Dox layers suddenly reappearing where the lavas should be. The rapid mercifully takes us past this new and unexpected complexity. A great geology stop is to land on the left just before entering Tanner Rapid and walk to a point looking directly over the river at this cross section of the Butte Fault and the strange goings-on west of it. A new fault takes off to the northwest, and we see the black lavas sandwiched between the two. The explanation is difficult without some diagrams as well as a lot of arm-waving. I have never felt an obligation to stop here to wallow in more complexity because this place is an odd example of what can happen as two fault planes approach one another at an angle. All of it with more context is clearly visible from high up at the Desert View Vista Point where you will often find a professor strutting an explanation before a bewildered geology class. Been there, done that. This is not for ears down here today. Good--because I would have to confess how this spot torments me. There must be one simple confluence of events that can simultaneously explain this turn to the west, the intersection of the river with the Butte Fault right where another joins it at an angle from the northwest, the enormous excavation to create this width, and the piles of cemented gravels I do not point out high up the south bank. Is it all a coincidence? I hate coincidence as explanations for anything in geology. I have no hypothesis. It is yet another mystery. So many questions. For us, the important thing to realize is that the downward trip through the Dox that we started after lunch did not take us out the bottom of the stack but instead here takes us sideways across the Butte Fault and back to a descent through the red layers of the Dox. Remember, everything west of the Butte Fault was brought back upward during the last movements, so here we are again. The layers are not slanted here as steeply as before, so we now descend through them at a slower rate. We are going to be in the Dox for a bit longer this afternoon.

JP and I decide not to take a wonderful campsite shortly to our left just above Unkar Rapid. This one is immersed in a tamarisk thicket that the Park Service keeps open by slashing out pathways and cubbyholes. It is the most wind-protected camp in the Grand Canyon, but the stiff wind has calmed down now that we are out of the funnel. There is a great hike up from this camp up to an Indian ruin with the most expansive view to be had inside the canyon (Fig. 15.7).

Fig 15.7. Hilltop Indian Ruin near camp at Unkar Rapid. This looks over the first and last wide-open area that raft trips pass through in the Grand Canyon.

The trail passes through a scatter of rounded river rocks of problematical origin and gives a final view of the Great Unconformity between the tilted lavas and the Tapeats Sandstone (Fig 15.8).

Fig 15.8. Telephoto view from the Hilltop Ruin of the Great Unconformity, here between the Cambrian Tapeats Sandstone and the black lavas that overly the Precambrian Dox Formation. The tectonic block the lavas are on was tilted up in the Precambrian and planed flat before the Tapeats Sea transgressed from the west. Each gets truncated by the Tapeats as you follow it up to the right. Almost 20 lava flows stacked one over the other can be counted here.

The "Hilltop Ruin" is a wonderful place, but it is still early, and we would like to get to an optimally located camp for tomorrow's planned blitz straight through the heart of the Kaibab Uplift. We go ahead and pound through fierce Unkar Rapid. It roars past a major group of well-preserved stone wall ruins that river runners with time on their hands are allowed to visit. After clearing the rapid, we overtake a group of commercial row boats, and a conversation of sorts starts between JP and the leader of the group. JP seems to know everyone on the river. These encounters typically involve a brief and often peculiar river chat that is part of a game of chicken. The goal is to delay with friendly, trivial chatter until one asks, "Where are you planning to camp tonight?" Bingo, the questioner loses. Name your camp first and you have it. In our case, our motorized boats will get to our desired site long before the rowers can make it. Also, they are a smaller group and have many good campsite options. The issue doesn't come up. We are all a bit fatigued, so JP breaks off and we continue what seems like a mad plunge into the bowels of the Earth. We notice that the slant has increased, and we are

now zooming down through the layers again at a rapid rate. The canyon begins to close, and the walls start to rise higher around us than ever before. A somewhat ominous-looking cloud deck has moved in from the west. A new set of layers appears with beds that appear thicker, more resistant, and less colorful than the Dox. A massive ramp quite unlike anything we have seen before is split by the river. The river can falsely appear to be diving downward and that this is a gate into the underworld (Fig. 15.9).

Fig 15.9. Entrance to confining high walls for the rest of a raft trip. Resistant beds of the Shinumo Sandstone are tilted down toward the viewer which can create the illusion that the river itself is plunging rapidly downward.

Indeed, from here on we enter the innards of the Kaibab Uplift. We pass into this dark portal and are tightly confined again by steep walls on both sides. Our afternoon journey in the sun through the great expanse is over. Within an anxious mile we run Neville's Rapid and the huge sand beach that is our target campsite welcomes us. It is vacant! I breathe a sigh of relief because our downstream campsite options are strongly limited at this late time of day. We will need a good rest tonight because tomorrow will be a wild ride of body and mind.

As we set up camp on the soft sand, the clouds break up a bit, but there is clearly some kind of front or weather change moving in on us. Waiting for dinner in the late afternoon

calm, I sit in a chair looking high up at the cliffs as the bright sun intermittently peeps through creating dark shadows that slant off every pinnacle and fill every little crack and side canyon. It is a universe up there that no one can soar around in. Using a telephoto lens on my video camera I pan along the spectacle as if I am a lucky bird flying way up there doing just that. No science puzzles now--just dreaming and longing. Only three days, and we have already been through a scenic and geologic experience that is generating euphoria. I am a goner already, and the others are showing telltale symptoms. But science still has it all contained. Across the river we see that giant slanting layer of tilted sandstone commanding the campsite. The Tapeats was a similar color, but this one is smooth-walled, hard, and not gritty. It is the Shinumo Quartzite that lies underneath the Dox, a sandstone we will traverse right down through tomorrow and then remarkably again in a couple of days. The next time we encounter it, there will be no Dox beds or lavas above it that we must descend through. It seems complicated that this should happen, but it will make sense when we see it.

All thoughts about geology, scenery, or anything else not existential in nature vanish when the wind starts picking up in the twilight after dinner. People conditioned by the great windstorm two nights ago scramble to pile rocks into their tents, but there will be no mercy inside tents once the sand on this big, exposed beach starts blowing hard upon us. A hot fierce wind quickly does just that. Everyone scrambles for cover. Spending a night camped in a sandstorm is not one of life's great experiences. I quickly secure a rainfly over my flapping tent in the last light and zip everything up to keep sand out. Not only is it miserably hot inside, but fine sand works its way in, congests the air, and settles on everything. I start taking off clothes trying to get cool and wind up stark naked getting covered with fine sand. Lying naked on a sandy mat is torture as you scrape around in the grit. I have a cot outside where it is cooler, so I put on shirt and pants and decide to just cover my head and let the sand have its way with me outside. Nope. A few minutes of the choking sand and dust and back into the tent I go. Life has gotten simple. All I care about now on this bank and shoal of time is to get cool and quit thrashing. I doze and wake as the tent flaps and rasps from wave after wave of blowing sand. Doze and wake again…and again. Horrible. Amidst this torture, I slowly realize the obvious again. Thinking about rocks, life, consciousness, natural history, and the universe is something surprisingly few of us can luxuriate in--certainly not now in my case; not in an abrading windstorm camped on sand. People who by the world are hungry, sad, scared, overloaded with personal and financial problems, damaged psychologically, physically ill, or racked with anxiety are not inclined or able to take the kind of self-indulgent pilgrimage I am on. What a luxury to ponder the nature of things external to our fragile bodies and screwed up psyches! There are extended interludes on the stormy seas of our existence where this may be possible. I have had many such and am now in a weeks-long one except for this outrageous sand blizzard. This will end before long. Realizing all this either soothes or exhausts my mind. Blow wind! Howl sand! Grind grit! Merciful sleep sets in on this grateful, reconciled pilgrim. In a seeming blink, the world is awash in light and no wind. Cloudy and cooler, it is morning

rebirth after sandy death. I emerge and see people with coffee cups in hand going about their business as if nothing happened. They have transformed into river veterans.

We are now about to enter a completely different world-- the Inner Gorge of the Grand Canyon. We aim to travel all the way through the heart of the Kaibab Uplift today. Hance Rapid is just a mile downstream. There we shall see what these layers and tilted layers are lying on. Despite this much anticipated entry into deepest time, we won't have much desire to ponder it, for now we are going to encounter a succession of rapids without end. It will be one ferocious frenzy after another in the heart of the Kaibab Uplift. We will get thrown around, pounded with ice cold water, scream our lungs out, shiver, whoop, laugh, throw exulting arms in the air, and clap spontaneously with joy. Some eagerly anticipate it. I—myself-- am not fond of rapids, sand, sun, or cold water. I am fond of the geologic story staging this perilous frolic, and it is my intention to expound on it when circumstances allow and when people are not giddy with the excitement of violent white-water rapids.

Breakfast and a duffel line to load the boats all done, I gather up these resilient troops still shaking sand out of their hair and march them a few hundred yards upriver into a narrow, shadow-filled canyon while the crew gets everything cinched up to their liking. We crunch gravel brought into and through this slot by violent debris flows so recently that no vegetation has grown back yet. Everyone immediately notes that each of the numerous stacked layers exposed in cross section on the walls here contains swirly convolutions we have not seen in a sandstone before (Fig. 15.10).

Fig 15.10. Remarkable structures in the Shinumo Sandstone in 75-mile Canyon. These commonly form where sand is deposited so rapidly that large amounts of water are trapped in the pore spaces between grains. As the weight increases, the pressurized water squishes upward to create this convoluted pattern. Each layer here was briefly quicksand. Stanford University geologist Donald Lowe, who wrote the classic papers on water escape structures, explains and admires them.

Most discussions that include this side canyon say that these swirls developed when earthquakes shook up the wet sands before they consolidated into hard rock. If so, we are seeing here fossil seismograms recorded and preserved in the rocks. It sounds good until we look carefully and note that the swirls in individual layers are commonly pruned off across their tops. It is clear that one or several layers got deposited and then disrupted via some process to produce all these swirls. So, it would have to be deposition, then earthquake, then deposition, then earthquake… a hundred times up the walls? It doesn't make sense. Can the guidebooks be wrong? The rapids can wait just a bit; it is time for a quick geology talk at this intriguing spot.

My own interpretation that this is fossil quicksand draws some peculiar stares. We were hit with a sandstorm last night and now we are immersed in ancient quicksand. Well, yes. The stuff is not what is shown in countless movies where a villain gets stuck and slowly sinks out of sight. You are less dense than quicksand and will float on it. This type of fluidized sediment can

occur in areas where sand is being moved in and piled up so fast that water gets buried along with the sand. The trapped water sooner or later squishes upward by the increasing weight to make the convolutions. This can be a repetitious process exactly like what we see here. So, all we can really conclude about the geology here is that the sands of the Shinumo were being moved to this area episodically and deposited much more rapidly than normal.

These are superb examples, so I always felt confident asserting that we don't need earthquakes to explain them. At this point in previous trips, some people would start looking askance because I had already presented alternative interpretations to the conventional wisdom in several other places. Am I just a contrarian goofball? I've often wondered myself, but I actually do not enjoy confronting conventional wisdom; I dread it because of the stress, the lost energy, swatting flies, and the prospect that I could be terribly wrong. In this case, although I am not an expert in these types of rocks, I had an opportunity to put the issue to the test. The world's expert who wrote the classic papers on water escape structures was on one of my trips. Don Lowe and I were assistant professors at Louisiana State University in the early 1970's. We became friends and research colleagues and went together to South Africa in 1974 to work on the best preserved of the world's oldest sedimentary rocks. Not long after our trip, I departed for Arizona State University, and Lowe later moved to Stanford but continued working on the South African rocks for over four decades. Very little was known about the world's oldest sediments at the time of our trip. Now, because of Don and his students and associates who keep going back year after year, we know a great deal. And here he stood one day and generally agreed with my interpretation. Indeed, we all got a mini seminar with him pointing out features I never noticed. Of course, the earthquake story is advanced by excellent geologists and may yet be correct--so let multiple hypotheses thrive! No matter what caused these convolutions, this is a geologic showpiece exposed with unusual clarity.

Before everyone leaves, we admire some yellow-grooved surfaces sticking out of the wall that represent grind marks along numerous small faults in this hard rock (Fig. 15.11).

Fig. 15.11. Following the development of vertical fractures, the hard Shinumo Sandstone was jostled causing adjacent blocks to grind against one another. Modern debris flows down 75 Mile canyon ripped away a block from the wall here to reveal grind marks on one of the fracture surfaces. Very little lateral displacement is required to produce these grooves. The old geologist's trick of determining which way the blocks moved relative to one another by rubbing palms along the striations doesn't work so well here because yellow mineral growths have filled most of the fractures.

We have a gentle talk about the upcoming rapids. It is about why to put on your raingear now even though it is clear and warm already. You are about to get fire hosed. Never break the driver's concentration as we approach a rapid with some question, especially not the dreaded, "How deep is the river here?" And yes, feel free to scream, exult, wave arms, and clap wildly after we make it through a rapid successfully. This is not something I need to explain much, so let's go rafting!

As is my custom, especially on this trip, I hang back as the crowd walks down the canyon and disappears around a corner onto a trail of sorts back toward the boats. No human sounds now, but not quiet. The continuous distant roar of Neville's rapid is always here. It is just me, the fossilized quicksand, and the white noise of the rapid. It is amazing how the ambience of a place changes when you go from being with others to solitude. The sure and firm-set rock walls seem almost like they are conscious but utterly indifferent to you. I see why people in a state of nature assign spirits to places, but I just cannot identify with that. The geologic history that produced this spot does connect, so I probe for some higher significance to it all.

The only thing I can hang my hat on is that this spot was the site of rapid deposition of sand into a water body and that it poured in intermittently at about the rate of subsidence, else we wouldn't have layer upon layer of convoluted sands here. A delta might have done that, but the other sediment types associated with a giant delta are nowhere above, below, or to the sides as far as know. There is a correlative unit in the Sierra Ancha mountains 200 miles to the southeast in central Arizona that has these structures, but it is not as thick, and wind-faceted cobbles (called "ventifacts") are found in the basal layers indicating that deposition there was initially in wide stream channels that regularly dried out. Did an ancient delta migrate from here to there or vice versa? If a delta, which direction was the river coming from? No clue. Just how old is this? Over 1,000 feet of the red Dox Formation sands lie stratigraphically above, and the youngest of them may be a billion years old. Someday, someone may study this unit extensively and come up with well-documented evidence. No use for me to speculate. All I can ponder here is that during rapid deposition, pore waters squished upwards in response to the weight of the sediment load. I suppose water belched up in a matter of seconds or minutes after each pile reached no more than a meter thick. A geologic instant got captured as squish marks in a rock in deep, mysterious time. This is always a thrill, and these are some of the best examples anywhere. Had I been here and walked into such quicksand, I could have sunk in a bit and then just laid down on my back and felt my legs float up in the churning, watery mass. What a crazy spa, that! Not very profound, so what about the rest? I suspect possible answers lie in those outcrops in the Sierra Ancha mountains far to the south. I look back as I walk to the boat and see only a giant question mark, impressive as the setting is. This is a strike out until we learn more. Getting to higher levels of significance requires more science than we have here. The question mark is heavy and sinks out of sight into the quicksand.