



The real dirt on parrot clay licks

By Donald Brightsmith

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Aida, are you awake yet? "Sí" she responded but I wasn't convinced. But then again why should she be? It was 4:55 AM and we hadn't had any coffee. Aida Figari, field team leader and myself were sitting with research assistant Richard Amable on the edge of the Tambopata River in the heart of the Amazon rainforests of southeastern Peru. We were waiting . . . waiting for the parrots to arrive. In the gray pre-dawn light two long thin silhouettes sliced through the cool morning air and landed in a tall tree on the opposite bank. "Scarlet Macaws two from the northeast" I announced to Aida who quickly aroused from her trance and jotted it on the data sheet. "Richard" I called, "¿Has visto ellos? Son las primeras llegadas del día, 2 Escarlatas" (Did you see those? Those are the first arrivals of the day, 2 Scarlets). The activity at the Tambopata clay lick had begun and for us, the personnel of the Tambopata Macaw Project, it was "another day at the office."

After the first arrivals things began to happen fast. The two scarlet macaws were quickly joined in the trees by a group of 8 Blue-and-gold Macaws. Then Mealy Parrots, streaming in by the dozens. Our last remnants of sleep were washed away by the frantic attempts to keep up with the arriving birds. Yellow-crowned Amazons, Dusky-headed Conures, Blue-headed Pionus, Severe Macaws, Red-bellied Macaws, White-bellied Caiques, and White-eyed Conures streaming in from all directions. We had over 20 new arrivals per minute for nearly an hour! In some minutes over 100 birds arrived and Aida fought hard to keep her hand from cramping up. We recorded the arrival of over 1,000 birds.

Richard's job was to record the number of birds on the cliff eating the clay. Carefully he watched as the numbers built up in the trees, but still they made no move towards the riverbank. Only when there were over 300 birds waiting in the trees did the action start. A group of 20 Red-bellied Macaws took flight and began to make broad circles above the lick. They were soon joined by a handful of Severe Macaws. This group flew back and forth along the nearly quarter mile long cliff face before returning to one particularly high exposed section. Here they began to make large circles. More birds joined the group and, as though their growing numbers heartened them, they flew lower and got closer to the cliff with each additional circle. "The Dance" had begun. The tension built as the hundreds of birds both perched and flying waited for someone else to be the first one to land on the lick. The pressure from above was almost palpable but still the fear of the unknown, the fear of being the first one to land was so great it kept the birds flying for nearly 10 full circles in front of the lick. The wheeling flock passed within a few feet of the lick, but still did not land. Then on the next pass it happened: three of the lead Red-bellied Macaws landed alertly on the lick. They sat fully erect scanning for the slightest sign of danger. Richard chimed up from behind us "¡ya bajaron!" [they're down on the lick!]. On the next pass another 20 Red-bellied Macaws and 15 Severe Macaws joined the three pioneers.



The morning clay lick had begun in earnest. The parrots and macaws that had been watching from the treetops now knew that it was safe to go to the clay lick. By the dozens they flew from their perches and joined the growing throng. Within ten minutes there were over 200 birds frantically eating the soil on the lick. The green of the parrots was punctuated by the scarlet, and blue and gold of the large macaws that landed in their midst. At one point it even began to "rain" Mealy Amazons. Dozens of the birds that had been perched in the trees directly above the lick, simply dropped straight down. They hardly even opened their wings until the very last minute as they swooped down to the lick. These heavy birds quickly bullied their ways in to the center of the throng, landing on top of the mini-macaws, trampling Pionus and forcing their way between other Mealies, until their bodies formed a light green horizontal band that almost completely obscured the section of river bank they perched on. Then an Amazon screamed out, his voice piercing through the din, and all 200 birds took flight in a roar of wings as a small landslide crashed down harmlessly 20 yards from where the birds were feeding. The majority of the birds wheeled in the air and returned to the lick. Some headed to the trees and were quickly replaced by others that had been waiting above. As the morning progressed the numbers on the lick slowly diminished as the parrots got their fill of the special soil and dispersed in to the vast wilderness of the Tambopata Reserve Zone and the Bahuaja - Sonene National Park. Approximately 1 hour after the first three mini-macaws had landed, all that was left of the morning pandemonium was a group of 3 White-bellied Caiques and a small flock of Dusky Conures leisurely finishing their last bits of soil in a far corner of the lick. Soon the last of the birds were gone and all was quiet. It was 7:00 AM but we had been up for nearly 3 hours and it was time to head back to our base, Tambopata Research Center, for breakfast. Richard however had other plans, he was chosen to stay for the rest of the morning to record what else came to the lick later after the early morning rush was done.

It was a beautiful morning and as we ate our pancakes we all discussed the impressive wall of living parrots that we had just witnessed. One of the lodge guests that had seen the morning activity asked me "it is all very impressive, but how can you make any sense out of all that chaos?" It was a good question. I didn't have much of an answer at the time, but with 20/20 hindsight I would say, that after hundreds of mornings at the lick we are still struggling to understand what is truly going on. In fact as I write this I am drawing on over 4,000 hours of lick observation from over 600 mornings and I am still struggling with many unanswered questions. However since I first visited Tambopata in 1998 we have learned a great deal about clay licks and the birds that use them. In this two-part article I would like to share with you some of what we know and don't know about these marvelous clay licks.

To start with we should ask, what is a clay lick? Quite simply a clay lick is a place where birds or mammals come to eat soil. In the US these sites are usually known as salt licks. In Peru they are known by the Quechua word colpa (often written collpa or ccollpa), which loosely translates to "salty earth." The clay licks we are most familiar with are the tall riverbank cliffs visited by hundreds of birds including the large macaws. But in reality licks come in all sizes. When I first visited Tambopata I was amazed to see dozens of parakeets and parrots congregating at licks deep in the forest as small as a few yards wide. I was also surprised to learn that many of the clay licks are also used by a mammals (see sidebar Who's who in the world of lick use).



Why should hundreds of birds come and eat soil from these special sites? There have been two main theories floating around about why parrots eat soil. The first says that the birds eat the soil to get minerals. Something like an avian daily vitamin pill. The other major theory is that they eat the soil to protect them from toxins in their diet. You may ask why the birds are eating toxic foods in the first place. Is it acid rain? Toxic fallout? Why should parrots eat toxic food? In reality it is totally natural it is just the lot that parrots have in life. It turns out that wild parrots eat mostly tree seeds. Many times they eat young seed before they get ripe. By eating the seed and killing it, they are not helping the plant at all. This is very different from the animals that eat fruit but carry the seed off and drop it unharmed. This is a vital help to the plant. So while fruits are made to be eaten, the seeds are not. A perfect example of this is the common apple. It has a sweet palatable fruit, but its seeds are protected by a sugar that contains toxic cyanide! As a result by eating seeds from hundreds of plants wild parrots are exposing themselves to a dizzying array of highly toxic substances every day (see People Parrots and plant toxins sidebar).

These theories were floating around for nearly a decade without much scientific investigation until a PhD student at the University of California at Davis, James Gilardi (now the director of the World Parrot Trust) came along and set his mind to trying to determine what was really going on. He found that the parrots prefer to eat soils with lots of clay. In particular the soils contain Kaolin clay, the very same ingredient that is found in the human stomach medicine Kaopectate! The very small clay particles have a negative charge and most of the toxic plant chemicals have a positive charge, a perfect match! He found that the soils did a great job of binding to toxic alkaloids (the family of chemicals that includes cocaine, opium and caffeine). These bound toxins then pass through the digestive system and are never absorbed into the blood of the birds. He also found evidence that the clay coats the inside of the digestive system and protects it from being "tanned" by the tannins and other toxic plant chemicals (See Plant toxin side bar).

Dr. Gilardi also tested the mineral concentrations of soils the birds ate and compared them to soils that they didn't eat. In this way he hoped to discover what minerals were important to the birds. Was it calcium the birds needed to make eggshells? Iron for the blood? Zinc? No. In each case there were higher concentrations of nutrients in the soils the birds didn't eat. What about sodium? Sodium, the reason we love chips, French fries and all other salty foods, the mineral we all need to maintain the water balance in our bodies and hundreds of other uses? His evidence was not clear. He found that there was slightly higher sodium in the soils the birds ate but it may have been just by chance.

Dr. Gilardi published this work in 1999 just before I headed off to Tambopata to start my new job as the director of the Tambopata Macaw Project. My main worry was continuing the work on the nesting macaws and I had not made up a detailed plan of investigation for the clay lick. By February of 2000 my crew and I were monitoring the birds at the lick on an almost daily basis. In July of 2001 a young Peruvian Romina Aramburú told me she needed to do an independent study project in order to get the field experience credit she needed for her Environmental Engineering degree at the Universidad Nacional Agraria, La Molina in Lima, Peru. After a long chat we decided that she should collect bird data and soils from the series of clay licks along the Tambopata River near Posada Amazonas Lodge. The system was perfect: 10 different exposed sections of riverbank that could all be watched from one spot on the other side of the river. A nice mix of Pionus, Amazons, conures,



parakeets, mini-macaws, and Green-winged Macaws visits the licks daily. I figured she would find the same things that Dr. Gilardi did because he studied the same species of birds only 150 miles away in Peru's Manu National Park. But as with so many things in science, the unexpected is often the most interesting. Dr. Gilardi had found higher amounts of clay in the soils the birds ate, but we did not. Instead we found that the samples the birds ate had nearly 10 times as much sodium as the samples they didn't and that the amount of clay didn't differ. Some of the clay-lick samples I analyzed had more sodium per ounce than a Whopper! The evidence was clear that the birds were choosing the "salty earth" just as the Quechua name colpa suggested.

How could this be? Gilardi and I were looking at the same species of parrots in the same area, were they really using licks for totally different reasons? Then other questions began to bother me. How come there was so much sodium in the soil? Why didn't it all just wash away, after all this is a RAIN forest and few things are more soluble than salt. To my surprise, the answers to both of these questions were all bound up together and hidden in the depths of my soil science textbooks. Irrigation farmers in the deserts of the southwest know that irrigating fields often causes a build up of salt and that this salt transforms the soil in to a hard dense slab that is impenetrable by water. But can desert irrigation really help explain rainforest parrots? It turns out that the key is in the mixing of sodium and clay. When clay is mixed with sodium the structure of the soil collapses and the soil becomes just like dense, waterproof, modeling clay. This seems to be the key for the parrots. The clay - sodium mix is waterproof, which keeps the sodium from washing away. The distinctive texture of this mix can be easily detected by parrots and other animals (including field biologists). So this textural cue may lead the parrots to the soil that simultaneously neutralizes the nasty toxic chemicals they eat and provides them with an important source of sodium. These conclusions are still tentative, and there is still much more work to be done. For this reason I am continuing to work with soil samples from a number of different clay licks to better understand how sodium and clay may work together to help the parrots.

Who's who in the world of lick use

Lots of species from all over the world eat soil from clay licks, salt licks or other sites. Many mammals eat soil including deer, squirrels, pigs, and monkeys. Soil eating is also very common among humans, especially pregnant mothers and children. Here is a list of some of the birds known to eat soil:

Africa

African Gray Parrot

North America

Carolina Parakeet (Extinct)

Crossbills

Band-tailed Pigeon

New Guinea

Sulphur-crested Cockatoo

Eclectus Parrot



Palm Cockatoo
Vulturine Parrot
Rainbow Lorikeet
Blyth's Hornbill
Pigeons
Grey Crow
Dwarf Cassowary

South America

Parrotlets
Conures (both Aratinga and Pyrrhura)
Blue-headed Pionus
White-bellied Caique
Macaws
Amazons
Pigeons
Caracids (turkey-like birds including guans, chachalacas, and curassows)

However it is important to note that many parrots do not eat soil. For instance Scarlet Macaws, Mealy Parrots, and Blue-headed Pionus in Peru eat soil, but in Central America they have never been seen doing so. The reasons why remain a mystery.

People, Parrots, and plant toxins:

Are you hooked?

Coffee? Tea? Cigarette? Choose your favorite plant toxin. Plants use a wide variety of chemicals to try and protect their leaves, seeds and unripe fruits. Some of these chemicals we have co-opted for our own uses (for better or worse).

Alkaloids are a huge group of chemicals that include a wide variety of well known and potentially deadly compounds including cocaine, opium, caffeine, and nicotine. Parrots apparently have a naturally high resistance to these types of chemicals, but they also can eat clay to help protect them from these poisons. Tannins are the compounds that make your tea dark and cause those nasty stains on white blouses. They also make tea and red wine taste dry. In high enough concentrations they prohibit the digestion of protein and can eat away the lining of the small intestine. While these are not bound by clays like Alkaloids do, the clay still forms a protective layer to help prevent the damage to the intestine. In addition the sodium in the clay lick soil helps the parrots protect themselves from the effects of these chemicals.



Pet Parrots and Clay Licks

Does your pet need clay?

The best answer to this is I don't know because it has not been studied in detail. If you feed your birds a healthy diet with sufficient minerals and few toxins, probably not. Remember most of the world's wild parrots probably never eat soil. However if there are dietary deficiencies the clay (or preferably a change in diet) could help.

Get involved

The EarthWatch Institute and Dr. Donald Brightsmith are working together to bring teams of volunteers on 12-day trips to Tambopata, Peru. Here you will join the Tambopata Macaw Project crew and collect data at wild macaw nests and the famed Tambopata clay lick. Part of your fee goes directly to Dr. Brightsmith to fund his important macaw conservation research and the data you collect helps him understand the complexities of macaw nesting and clay lick use. For more information please contact EarthWatch Institute at info@earthwatch.org or visit <http://www.earthwatch.org>.

Dr. Don Brightsmith is a Research Associate in the Duke University Department of Biology and runs the Tambopata Macaw Project in southeastern Peru. His research has focused on wild Brotogeris parakeets in Miami and Peru; natural history and conservation of Scarlet, Green-winged and Blue-and-gold Macaws in Peru and macaw reintroduction. He is also the Scientific Director for Rainforest Expeditions, the owner and operator of Posada Amazonas Lodge and the famed Tambopata Research Center. For more information on wild parrots or how to visit Peru feel free to contact him at Parrots@rainforest.com.pe