

Ferrous Nonsnotus

Bob Moriarty

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July 5, 2005

*Gold is for the mistress - silver for the maid
Copper for the craftsman cunning in his trade.
"Good!" said the Baron, sitting in his hall
But IRON - cold IRON is the master of them all.*
-Rudyard Kipling



My long association with iron mining began in October of 1977. At the time I lived in Lakeland, Florida. I worked for a company named GlobeAero delivering small aircraft all over the world. One day the phone rang and my boss told me he wanted me to go to Van Nuys, California to pick up a Rockwell 685 for a delivery.

This particular 685 had belonged to Wayne Newton of the 25,000 Las Vegas shows. He lived in Las Vegas but his wife had a skin condition which required travel to LA a couple of times a month. Newton bought the 685 just to ferry her back and forth to LA.

The 685 was one of the worst engine/airframe combinations every made. Continental made the engines and was trying to squeeze 435 horsepower out of a geared TSIO-520 engine. It just didn't work, the engines cost about \$25,000 at the time and lasted maybe 100 hours before major problems occurred.

Even Wayne Newton couldn't afford two new engines on his plane every few trips from Lost Wages to Los Angeles so he dumped the puppy. And along came some fool from Australia who insisted on owning a twin engine plane using avgas. There weren't many high winged twins and barely used but cheap, Rockwell 685s were a drag on the market.

The real good news from my boss was that the customer had a son-in-law who was in the US and wanted to ride with me to Australia for the experience. Given the choice between a copilot and a wet soggy sandwich, I'd opt for the wet soggy sandwich in a heartbeat. The only thing worse than a Rockwell 685 to Australia would be a 685 to Australia with a passenger.

20 hour legs from Oakland to Honolulu were common with me. And there just wasn't much room in a small plane, even a twin. Given the fact that sitting with someone in a cockpit the size of a large telephone booth was painful at best, I groused at the idea. After many minutes of my whining, he agreed that the choice was mine and should the experience prove too

painful, I could dump my excess baggage (the passenger) at the closest airport.

I needed some idea of how the plane handled with weight so I filled the internal ferry tanks about half full in Van Nuys. My passenger was about 25 and just thrilled to be making a ferry trip. I wasn't quite as thrilled to be flying the son-in-law of the 2nd or 3rd richest guy in Australia. Copilots are a pain in the ass, rich copilots weren't even worth considering.

We left Van Nuys after sitting patiently for a week for the final touches to be done to the plane. When you have time to spare, go by air proved a wise statement. But on a beautiful sunny October day we set out.

I climbed up to about 15,000 feet, the plane was not only turbocharged, it was pressurized and I needed to make sure the fuel transfer system worked. As I came back on the power to a standard cruise setting I noticed the mixture control only worked one way. When I came back on the lever to lean the mixture, it worked fine, but when I moved the lever forward to make it slightly richer, the lever had no connection to the engine. So by adjusting the mixture, all I had done was to shut the engine down. I promptly feathered the engine and told Greg that we would be declaring an emergency and returning to Van Nuys to do a single engine approach. Mentally I thanked the trim gods because I could have been doing the same thing at 130% of normal weight over San Francisco Bay at night time. Thank God for small favors.

I went to guard channel, 121.5 and declared a Mayday. Once that iron butterfly became a single engine, it also turned into a submarine over water and a ditch digger over land. I wasn't even going to be able to maintain level flight, all I could do was come down at a controllable rate. My calmly modulated Mayday was sufficient to convince Air Traffic Control to clear the airspace back to Van Nuys.

All this time, my passenger is being very quiet. He asked if he could help and I told him silence would help more than anything. And once we were on the ground, to get out and clear of the aircraft as soon as possible. Actually I suppose that if you want to know how someone will be as a copilot, an overweight, single engine landing is a great way to do it.

I kept the power up on the operating engine and circled over the field to lose altitude. Basically as long as you understand that there is no waving off a single engine approach, an approach with one engine tarred and feathered is no different than that of an approach with both engines working. (It got tarred, so I feathered it).

Even though I was heavy, I landed right on the numbers and the plane came to a smooth stop. I looked out the right side of the cockpit and noticed a fire truck keeping pace with the aircraft as we slowed down. That confused me more than just a little. I shut the left engine down but here is a fire truck looking as if he wants to hose down the right engine. Mighty confusing it was.

The nice fellow on top of the fire truck kept motioning me to shut down the right engine by making a cutting motion across his throat. Since he seemed to be quite serious, I went ahead and shut it down and we jumped out of the plane. As we stretched our aching muscles, the fire truck driver came over and told me they would watch the right engine for signs of fire but I could walk back to the flight line.

I scratched my head and asked him why he was so concerned with the right engine, it was the left engine we had the problem with. In response, he dragged me over to the right side of the plane and he pointed at the now visible exhaust stack which had broken a clamp and had been throwing all the hot exhaust inside of the engine compartment. I blanched as I realized we were only a few seconds from having a fire in the right engine compartment.

I was loving this trip more by the minute.

We wasted another week in Van Nuys before finally setting out again. Van Nuys to Oakland went smoothly, Oakland to Honolulu was a comfortable 14 hours. Most of the time it took 20 hours and more to cover the 2200 NM between California and Hawaii in the single engine planes I was more comfortable with.

I couldn't complain about Greg, he turned out to be a pleasant companion. If I didn't know he was married to the richest woman in Australia, I couldn't have guessed it from his behavior. He was a nice guy and kept his stuff on his side of the cockpit.

Honolulu to Pago Pago proved uneventful and after a good night sleep we pressed on to Nandi in the Fiji Islands. By this time, Greg was actually proving useful and he fueled the plane as I filed our flight plan for Melbourne. We took off on what should have been our last leg and he turned to me as we went through maybe 1500 feet in our climb.

"Just how much of an oil leak is a serious oil leak?" he asked calmly. Not as calmly I responded, "If you can see an oil leak, it's a serious oil leak." He flew the plane as I looked out the right side and sure enough, oil was pouring from the prop seal. Again I declared an emergency and made a forced landing. It seemed to me that Nandi had a long runway, about 12,000 feet and with us being 30% over gross and it being a damned hot day, we used it all.

As we taxied in, I made a radio call to Qantas to ask that they send a mechanic out to look at the plane. If it was something easily fixed, I wanted to get it fixed and be on our way. My timing wasn't the best. It seemed that all the ground staff were on strike and all of the Australian staff and mechanics were pulling double duty trying to keep Qantas in Fiji flying.

When they told us that there wasn't any way any of their mechanics were going to be available in the next month or so, Greg surprised me and asked to use the mic for a minute. In surprise, I nodded and turned it over to him.

Wow, my calm unassuming, mild-mannered copilot turned into a wild man. He demanded the Qantas Station Manager meet us at the aircraft when we shut down. Taken equally by surprise, the Qantas supervisor on the radio just said, "OK."

I knew we were screwed. When you are on a lonely South Pacific island 2,000 miles from the nearest mechanic, you don't demand anything. If anything, you kiss a lot of ass and throw \$100 bills around until someone deigns to pick them up and you hope he knows which end of a screwdriver goes in the little slot thingie.

The Qantas Station Manager was standing tall next to our parking place as we pulled up and

he looked as mean as a cross between a Marine Sergeant Major and a junkyard dog. Greg pulled on my arm and insisted that he be allowed to do all the talking. That was fine with me, I wanted to practice saying, "Me no speeka de English." Stupidity was my last hope.

Greg positively puffed up and I began to see the rich kid in him. He introduces himself to the Qantas guy as Greg such and such, the son-in-law of so and so. He completely ignored me, it was as if I was just along for the ride. Which was fine by me. And he insists to the Qantas guy that he call the Qantas Chairman of the Board because he personally told so and so and Greg that if they ever needed anything from Qantas just to call.

I thought it was a great pitch. I especially liked the part about being ignored. I had a lot more flights planned through the Pacific in the future and for certain I didn't want Qantas pissed at me.

Alas, the Qantas Station Manager called Greg's bluff and he smiled as he escorted us into his office and dialed Australia. A few connections later he was talking to the CEO of Qantas. Then it was his turn to turn white. All I could hear was his side of the call, "Yes, sir, yes, sir. Of course sir. Right away sir. It sort of sounded like he was being given instructions to shoot us. Oh, well, it was a good try on Greg's part.

He pounded down the phone finally and turned his attention to us. "OK, " he said, I only have three mechanics but they are yours until our plane arrives this evening."

The Chairman of Qantas was on a first name basis with so and so and instructed the Nandi Station Manager to do everything in his power to get us airborne and there would be no charge. It took longer than I hoped, we had to fly a new prop seal in from Sydney but in it came three days later.

Greg was as good a company on the beach as in the air. If money brings that kind of clout, I'm all for it. If it had been me on my own, the plane would be sitting there still.

Finally the plane was ready, we took off for La Tontouta and then Melbourne and everything went smoothly. Except for the dead battery and the frozen directional gyro but it was a 685 and I already said I hated those planes.

By now the average reader may well have concluded that Moriarty has finally lost the very last of his marbles. Because while the story is quite interesting, if I say so myself, just what does it have to do with any association with the iron business?

I'm glad you asked that question because as luck would have it, I made this flight in 1977. A short 25 years before a fellow named Lang Hancock was flying with his wife from Nunyerry in Western Australia to Perth. It was 1952 and they flew in a tiny 145 hp Auster airplane. Storm clouds were building and they were forced lower and lower until Lang spotted the Turner River valley running through the Hamersley Range.

As they flew through the valley safe from the ravages of the storm overhead, Lang looked around. He was in a valley of iron, miles and miles of the highest grade iron ore every discovered. The deposit went on for 70 miles. It was enough iron ore to feed world demand

for hundreds of years.

But it wasn't worth staking. Australian "experts" remained convinced Australia didn't have much in the way of iron reserves so it was forbidden to export iron ore. So it wasn't worth staking.

Lang Hancock returned to the Hamersley Range dozens of times taking samples which proved richer than any iron ore known. It was the largest iron deposit ever found. And not worth staking.

Lang lobbied the government for the next eight years before convincing them to relax the ban on international shipment of ore. When the ban was lifted, he immediately staked all the property he could afford to stake. And it took years more before he managed to convince Rio Tinto to mine the ore. In the end Rio agreed to mine the ore and Lang Hancock got a 2.5% NSR on the richest iron mine in the world.

As he grew older, he passed on half that NSR to his daughter, Gina, now the richest woman in Australia, with 1.25% of 78 million tons of iron ore a year.

And again, you may be wondering just where I'm going and what the heck does an interesting story about Lang Hancock and [Gina Rinehart](#) have to do with me?

It's easy, you see. The daft bugger in Australia who insisted on a high wing twin so he could look out for iron deposits was Lang Hancock and he didn't give a damn about the price. And Greg, my newfound friend and copilot was married at the time to Lang's daughter, Gina.

It may be wrong to dismiss out of hand serendipity as a useful method of discovering giant mineral deposits. It worked for Lang Hancock in Australia and it looks like it may well work for **Cardero** in Peru.

Since their experience in the Baja with IOCG targets, Cardero has tended to focus on giant, company making projects. They have a company making project in the Baja but their partner, Anglo, has had great difficulties getting drill permits for the IOCG target in San Fernando in the Baja and surrounding Alisitos IOCG belt. In three months all they have managed to accomplish is some very inventive excuses. If there was a master list of mining problems ordered in priority of difficulty, getting a drill permit in the Baja would be sitting right about the bottom just above chewing gum. But it has been a giant problem for the staff at Anglo in Mexico.

Back to Cardero and company making projects through the use of serendipity. Months back someone approached Cardero with the idea of Cardero investing money in a joint venture in Arizona processing magnetite out of sand. Henk Van Alphen, President of Cardero sent two of his top people to Arizona to study the project. It's one of those projects which has been around 50 years and everyone has looked at it and no one can figure out a way to make it pay at any price of iron.

Lorne Hunter and Carlos Ballon from Cardero looked over the project and reviewed the data. The magnetite content of the sand was about 5%, there were giant environmental issues and

there were expensive problems with getting the iron to the west coast for shipment overseas. The project just didn't make sense for Cardero to invest in.

But their work provided them with a valuable baseline. At least they knew what magnetite sands looked like and had a basic understanding of the problems associated with processing sand for iron recovery. Some months later, when the pair were in Peru conducting a drill program at [Pampa de Pongo](#) [PDP], they saw familiar looking sand dunes covered with the telltale black lines of heavy magnetite. But these were no wimpy 400-foot dunes, these are dunes over 6000 feet high, the highest sand dunes in the world.

(click on images for big pictures)



The dunes had the same look as those in Arizona but were creased with even more black banding indicating layers of concentrated magnetite. They took samples throughout a 250 square KM area. The tests came back showing the sand contained magnetite averaging between 7.7% in about 100 square kilometers and about 11% in the larger 150 square kilometer zone. The sand also contained 4-6% titanium oxide and vanadium.

It was pretty much the equivalent of Lang Hancock flying down the Turner River in 1952. Except separating the magnetite from the silica is a whole lot cheaper than drilling and blasting and mining hard rock iron. And moving magnetite through a slurry pipeline 40 KM to the deepest port in Peru is a whole lot cheaper than building hundreds of miles of track through the Australian desert. And prices for feed for iron mills and steel are a lot higher than they were 50 years ago.

But every silver lining has its cloud. Magnetite sand deposits were [discovered in New Zealand](#) as early as 1841 and a dozen or more efforts were made to produce iron and steel with no success. Great sums of money were spent and companies set up to produce iron only to run

into the problem of how to separate the [titanium](#) and vanadium from the iron. It took until 1972 for the professionals in New Zealand to devise a way of producing iron and removing the titanium and vanadium.

From the gitgo, Cardero understood they needed to know not only the grade of the magnetite but also the metallurgy issues. Once the grade proved positive Cardero [staked the entire 250 square kilometers](#). A large bulk sample was taken and shipped to Midrex in Charlotte, NC. Midrex is a subsidiary of Kobe Steel and is considered in the industry as being the experts in direct reduction iron making.

Midrex released [their results on June 23](#) and they were positive. They could achieve separation of the titanium and vanadium from the iron. Interestingly enough, the slag contains about 21% TiO_2 and over 3% V_2O_5 (vanadium pentoxide). And in New Zealand, they have devised a way of [processing the vanadium from their slag](#). This is an area Cardero intends to study in the future to increase the value of the deposit but they have not taken any values into any of their equations. But the reader should be aware that at current prices, a ton of slag containing 3% vanadium is worth about \$1500 in vanadium pentoxide though the price is up more than 10 fold in the last five years. Even \$150 a ton for the slag would provide a valuable contribution.

When it comes to numbers, this deposit gets exciting and problematical at the same time. If you demand an idea of what sort of tonnage they have on their hands, they stammer a lot. For a back of the envelope calculation, 250 square KM with an average depth of 100 meters gives 25 CUBIC KM or about 50 billion tons of sand. If you like a figure of an average of 10% magnetite, you come up with about 5 billion tons of magnetite. In comparison, the nearby Marcona mine operated by Shougang Hierro Peru only quotes resources of 1400mt of iron. Cardero's sands project is enormous by any measure.

And measuring it by standard methods is going to be a problem. The tallest sand dune is 6850 feet or 2078 meters above the desert floor. For sure it's not 100 meters deep so you can throw out the 50 billion tons of sand figure. It's bigger, maybe much bigger.

The sand is a very fine grained, almost powder type of sand so it lacks friction. Geos use a term meaning the angle of dangle but they call it the angle of repose. Every substance has a certain friction and a mass of that material will settle at a certain angle. The angle of dangle for the sands is in the neighborhood of 40 degrees. You couldn't get a vehicle of any sort on many of the natural slopes because the vehicle would simply float down the sand. It may be necessary to use satellite or subsurface radar to attempt to measure the total sand.

I stood at the bottom of one of the sand dunes and I'm going to tell you trying to measure the total FE content of those sand dunes is pretty much a waste of time. Those flipping dunes are so big they scared the hell out of me and I was at the bottom looking up, not at the top looking down. Jesus Christ and all his helpers couldn't mine that deposit out in the next 50 years.

Lorne Hunter's back of the envelope figures showed the extraction of 21.75 tons of basic magnetite sand with a 80% recovery would produce 17.4 tons of sand with 1.74 tons of magnetite with a 60% FE content. When introduced into a furnace using the Midrex process would reduce to 1.04 tons of concentrated FE which would reduce to 1 ton of pig iron

containing 94% FE in 15 to 25 KG billets to be used as feed for Basic Oxygen or Electric Arc furnaces.

As with Palladon Minerals, adding value to the product to increase profit makes a lot of sense. Using standard industry figures, I came up with a \$308 million dollar total cost to build the plant and equipment to produce 1 million tons of pig iron per year. The magnetite would be separated from the waste silica sand at the dunes using simple drum magnetic rollers, then passed through 40 KM of pipeline as a slurry to either Puerto San Nicolas or the Bay of San Juan just to the south of the Marcona mill.

Once on the coast, Cardero would add about 450,000 tons of imported coal to produce 1 million tons of pig iron. Since you have to ship the coal to the pig iron processing site by boat, it makes more sense to process the pig iron where the coal lands than to ship the coal inland. Using a figure of \$100 a ton for coal delivered to Peru and \$340 for the finished pig iron billets, back of the envelope calculations show a cost about \$140 per ton in operating cost to produce a million tons of pig iron worth \$340 million per year. The SWAG (Stupid Wild-Assed Guess) ROI works out to about 65% per year which beats a red hot stick in the left eyeball.

The physical proximity of Cardero's other iron project in Peru, Pampa de Pongo, and the Marcona Iron mine/mill to the iron sands projects creates some interesting issues; and either problems or opportunities depending on how you look at it. So far what I have written about Cardero is your bog standard rags to riches junior mining company scenario. Junior mining company grabs the brass ring, the stock goes to the moon and we all retire rich. But this story has a kicker because of the Pampa de Pongo and Marcona location.

Rio Tinto owned and drilled Pampa de Pongo in the 1990s and estimated a 1 billion ton resource of iron ore averaging 52% FE content. Since the project is pretty much similar to that of being a red-headed step child, Rio Tinto optioned the property out and Cardero picked it up for a total payment of cash and shares of about \$500,000 by the beginning of 2008. Cardero drilled PDP earlier this year and [came up with pretty much the same results as Rio Tinto](#). The main ore body is close to 300 meters deep but appears to contain about 800 million tons of high grade iron ore.

Again, using back of the envelope figures, Cardero believes they could sink a shaft and mine the 800 million tons of ore using the block caving technique for roughly the equivalent cost of open pit mining. But with Marcona mine with 1.4 billion tons of iron ore located only 40 KM to the NW, the only logical way to mine the ore is to use it as feed for the Marcona iron mill. But why should the Chinese (who own Marcona) mine PDP in a JV with Cardero when they have their own mine closer to the mill?

Here's where we really get interesting. PDP is an orphan without a JV with Marcona but the Chinese have no real reason to deal with Cardero since they have their own iron mine. Let me fill you in on the history of Marcona and the wild gyrations the mine/mill have been through.

A US company named Utah International opened the Marcona iron mine and mill in 1953 as a state of the art representative of the best and most up to date iron facility in the world. By 1975, the Peruvian government had better ideas.

Now you need to know something about Peru. It's a dangerous country to visit. Thieves haunt

the entire country and every hotel or small business will have their own armed guards. Pickpockets are everywhere. Including in the government. They have a real socialist slant and on a regular basis will nationalize the productive fruit of other's labor and capital. By 1975 Utah International had built Marcona into one of the best iron mines and mills in the world, producing over 7.5 million tons of iron ore and pellets a year. So the Peruvian government seized the company and went into the iron business.

You can guess the result. It took 20 years for the government of Peru to admit governments don't do a very good job of running any business. So they did the next dumbest thing, they sold the mill and mine to a Chinese company called Shougang International.

Now I am a big fan of the Chinese and I admire them for a whole variety of reasons but frankly their mining methods and technology don't export well. Shougang took over around 1995 and the first thing the Chinese government did was try and execute the CEO of Shougang for corruption. That had a chilling effect on the tendency of overseas executives for Shougang to make decisions and basically the company has been going downhill ever since. Estimates by industry experts show production of iron ore and pellets to have decreased from 7.5 million tons in 1975 to maybe 4.5 million tons today.

While Shougang has no particular reason to work with Cardero based on PDP, they are faced with a critical decision to make when you throw in the iron sands project. Cardero can produce and ship iron ore or pig iron a lot cheaper than Shougang can. It doesn't cost much to process sand and smelting costs don't vary a lot.

Construction of a 40 KM slurry pipeline might cost about \$15 million, those sort of pipelines cost about \$400,000 per KM. Shougang can get into bed with Cardero and get all the benefits of Canadian mining management and easy access to capital markets or they can sit and watch as Cardero eats their lunch in business. Cardero has nothing to lose either way, they have what may well turn into being the swing producer for magnetite in the world. It's a no lose deal for Cardero but Shougang must lead, follow or get out of the way.

Adding to the confusion, the government of Peru is pretty much committed to turning Puerto San Nicolas into what the political parties are calling a Superport. The port is the deepest port in Peru and plans are being made to run a road and maybe a rail line from San Nicolas over the Andes into the Amazon Basin. Such a port would open the entire Amazon Basin and most of South America to goods from China and allow shipping of food and raw materials to what will certainly become the most significant port in the world.

Naturally the government of Peru wants to expand their tax base as much as possible. It is in their best interest to assist Cardero in their development plans in conjunction with the planned Superport. Peru may gain an additional but more efficient iron producer or it may end up with one iron mining giant/ steel mill at Marcona in partnership with Cardero. In either case, the government and people of Peru will be measurably better off.

Cardero is in the driver's seat with the strategically located Pampa de Pongo 800 million ton deposit and multi-billion ton iron sand deposit. The reached for the brass ring and grabbed it for the second time. That's rare in any business but the management and staff at Cardero are first class all the way.

I have waited patiently for 15 months for Anglo to begin drilling. I went way out on a limb over a year ago and predicted a major, world-class IOCG deposit at San Fernando. Alternatively, I suggested it might only be highly magnetic [elephant snot](#) in a giant pool. I want Anglo to drill because I want to say, " I told you so." I want the bragging rights which rightfully go with the successful prediction of a giant body of elephant snot.

But I, too, have grabbed the brass ring for the second time. I got to visit and write up another world class IOCG deposit for Cardero. But this time I don't have to depend on Anglo. I took a non-magnetic pan and hand magnet of my own and took my own samples. And I can assure you it is magnetite and there is a boatload of it.

Cardero has carried two burdens over the last 15 months. One, of course, the most obvious one, is the "Waiting for Godot" drilling approach by Anglo and the other is a more prosaic "Too good to be True" belief held by many investors. There are a lot of investors who believe if a company announces good results again and again, the results must be false, it must be some sort of Bre-X with the resources increasing by an order of magnitude every two weeks.

You have my permission, you don't have to believe me, you can go down, take a copper or plastic pan and your own magnet and do your own sample. It's iron you will find in your pan, not elephant snot.

Don't let the towering dunes scare you. Think of them as being piles of money. And you can come back 200 years from now and the dunes will be the same. Except they will be about 11% lighter by weight.

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Bob Moriarty

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