

Old and New Sapphire Rushes in the Bemainty Mining Area, Madagascar



by Rosey Perkins

with special thanks to the Association Française de Gemmologie
and Lotus Gemology

This report is written to support a presentation on Madagascar Sapphires at the Rendez-Vous Gemmologiques de Paris on 12/06/2017 at the kind invitation of the Association Française de Gemmologie.

A “rush” that produced world class sapphires close to the village of Bemainty, in the wet forest in eastern Madagascar, reached it’s peak some time after October 2016. Some of the sapphires were similar to the highly-prized Kashmiri sapphires and laboratories were misreporting their origin (Krzemnicki, 2017). Vincent Pardieu gained access to the site in February 2017 to collect samples. Results from his preliminary study show that both high and low iron sapphires can be found in the Bemainty area, and that accurate origin determination for sapphires from this area is not easily made using basic laboratory techniques such as inclusion scenes and trace element chemistry (Pardieu, 2017). From 6/5/2017-8/5/2017 I gained access to CAZ and revisited the Bemainty mine now known as “Tanarive Carrier” and documented it’s expansion and evolution, as well as two new sites called Sahambato and Ambodipaiso. I estimated there were 1 000 miners in the Tanarive Carrier area, but tens of thousands in the newer sites. I also collected samples for Lotus Gemology’s research on origin determination.

Background

In October 2016, I was in Antananarivo (Tana or Tananarive) the capital city of Madagascar and heard of the sapphire rush near Ambatondrazaka from Marc Noverraz, a Swiss gem merchant. The news of large blue Burmese-type sapphires at Bemainty had aroused the interest of gem traders across Madagascar and in the capital I met several Sri Lankan traders who were on their way to Ambatondrazaka, the nearest town to the new mine. Foreign traders were not allowed at the mine site but since I did not intend to trade, I walked in and was fortunate to gain access for three nights. The journey from Ambaondrazaka was an hour by motorbike and then a ten hour walk. The night before I arrived, the President of Madagascar had declared the mining activity there illegal because it was inside the Ankeliheny-Zahamena Corridor (CAZ) which is an area protected for conservation under the management of Conservation International. There was a sense of frenzy, camaraderie. Fine quality blue sapphire in sizes up to 50g and desirably coloured pink-orange sapphires reportedly mined at Bemainty were shown to me in Ambatondrazaka.

Madagascar has been known as a source of gem quality corundum since 1994 (Hughes, 2017) and there have been many rushes in the eastern wet forest (Tamatave, 2011, 2017; Didy, 2012; Zahamena, 2015). The rush at Bemainty (2016) has been referred to as the most significant rush in Madagascar for the last 20 years, based on the quality and the size of the sapphires found there. According to Sri Lankan gem merchants I met in Madagascar, the price of rough sapphire was so elevated by the influx of international traders that in December 2016 the price of rough blue sapphires in Tananarivo, Madagascar was believed to be the highest in the world. In February SSCF issued a trade alert, warning the trade of sapphires reported as Kashmiri when they were Madagascan. There was a need for origin research on these sapphires and Lotus Gemology needed samples. Meanwhile, the story had also attracted the attention of the mainstream media concerned with wildlife in the protected area (Carver, 2017; Jones, 2016; etc).



Image 1: 100c sapphire at Crown Color at Tucson, 2017.
Photo: Rosey Perkins

The Journey

The mining area is 160km north east of Antananarivo and 35km east of Ambatondrazaka, in an area of wilderness protected for conservation called Corridor Ankilaheny-Zahamena, which serves as a corridor for the movement of wildlife between three neighbouring national parks. In May, the journey there started with an eight hour drive of rom Antananarivo to Ambatondrazaka, where we were given permission to enter CAZ by the Prefecture D’Ambatondrazaka, Direction Regionale de L’Environnement De L’Ecologie et de Forets and the Bureau du Cadastre Minier de Madagascar. The gendarme permitted our team four days inside the area and gave us two policemen as security guards.



Image 2: Map showing the gem rich areas and recent rushes. Courtesy of Vincent Pardieu.

We set off by “*taxi moto*” (a motorbike taxi) to Ansevabe, which is a one hour journey, and under the Gendarme’s instruction we rested there overnight. Just after dark a miner was brought into the village on a make-shift stretcher, a blanket slung between the branch of a tree and carried by two men. They had taken 24 hours to walk the 25km journey from mine. Their patient had suffered seizures throughout, his eyes rolled back and black liquid spouted from his mouth. We put him in a 4x4 truck and sent him to Ambatondrazaka hospital and heard people blame the locally made alcohol.

On 6th May 2017 at 5:00am our team started climbing the path that leads out of the village and the wilderness rose up on both side of us. The last time I had walked it, I had crossed paths with 1000 people but this time I passed less than 50 travellers. One was a lady from Fianarantsoa who had spent six months at the mine and was on her way back there, having sold some stones in Ambatondrazaka and had stocked up on supplies such as sugar and salt to sell to the mining community. We walked alongside each other and arrived at *Depot 1*, a row of about 35 shops, where there had been none seven months before. After a sweet coffee we continued on through mud, which several times claimed our plastic (jelly) shoes. The gendarme and some of the miners wear these, if they have footwear at all.



Image 3: Plastic “jelly shoes” for sale in Ambatondrazaka. Photo: Rosey Perkins

We passed the “*Vato Masina*”, a sacred rock where it is customary to make an offering, as shown in the GIA film “*Vato Masina: Sapphires rush in Bemainty, Madagascar.*” Our team left a fresh orange with a prayer and our Gendarme donated some money. At around 12:30pm we reached “*Depot 2*”, a pit stop near an old but reopened mine called “*Maladialina*”. Some of the shacks that



Image 4: Our team at the start of our walk. Photo: Rosey Perkins

lined the path there were cafes selling “zebu” (beef) and rice; others sold groceries and medicines such as anti-inflammatories and painkillers. There were also bottles filled with murky water. Later we passed a tree stripped of its bark. The bark of the Moarapamelona tree, which is known for its stimulant properties, was boiled and bottled in old “Au Vive” water bottles to sell to tired travellers. Though there were many more shacks than I’d seen on my last trip, most were now abandoned. In February, three months earlier, Pardieu described how many local people had taken advantage of the rush to set up shops while waiting for the short, late rains but they had since left to harvest their



Image 5: Map showing Ansevabe, the mining area around Bemainty. Mahefa Ramangalahy

rice. We passed a family who had built a hut 15m from the path and had a pit two metres deep, where they had found apatite, tourmaline, garnet and some small yellow, blue sapphires behind on the southern side of some larger rocks (indications of a secondary deposit).

Ambodipaiso: A New Rush Site

At *Ambodipaiso* (-17°98'75"N 48°68'14"E), a stretch of the valley 1 km long and 400m wide was being mined by approximately 10 000 people. They were reworking an area previously mined in 2012 but when sapphires were found there at the beginning of May, miners arrived from other older rush sites and it can be expected to have grown further, since the day before we visited, there had been a discovery of a 26g sapphire.



Image 6:
Aerial view of
Ambodipaiso
Photo: Zanaky Ny
Lalana

Image 7:
Stones from
Ambodipaiso.
Photo: Rosey
Perkins



Image 8:
Panning for gold
at
Ambodipaiso.
Photo: Rosey
Perkins

Pits were up to three metres deep and stones were green, blue, polychrome, fanta or colourless.

That section of the valley was wide and it hadn't been much undergrowth to clear, though activity had extended several meters into the trees on the eastern side, from where people were returning with rice sacks of gravel. The river was being panned for gold and many groups were washing gravels by hand as well as with motor pumps.

Accommodation was a mixture of tents and make-shift huts with tarpaulin roofs set up along the footpath that runs parallel to the river. The shops were well stocked with meat and vegetables, T-shirts and medicine. We even saw a sign for a "*Massage Parlour*".

Tananarive Carrier

The valley that heaved with tens of thousands of people in October became known as "*Tananarive Carrier*" (-18°00'00"N 48°67'83"). "*Tananarive*" which is the capital city of Madagascar refers to its size and "*carrier*" is Malagasy for "mine". Though it was still a wide valley carved by pits, by May 2017 only about 500 miners and 1000 people in total remained. The southern end had been almost abandoned and work was concentrated in the central and northern, more productive area, where old pits two to three metres deep were being reworked. Many of the miners had left due to illness, lack of funding or to return to their previous job. Ambatondrazaka is known as "the rice basket of Madagascar" and once the rainy season arrived, the local farmers would have returned to harvest their rice. There was a high street made from split wood running from the Gendarme's hut towards the mine and then across the clearing to the valleys more recently explored: *Maladialina* (17°98'82"N 48°68'32") *Milliard 1+2*, (17°59'18"N 48°40'52"E) *Milliard 3* (-17°98'44"N 48°67'85"E) and *Milliard 4* (-17°98'37"N 48°68'37"). We relied on the miners to distinguish the boundaries and it seemed that *Milliard 1+2* referred to the same area, thus we took one recording that referred to both. Note: Pardieu took one recording for each (Pardieu 2017).



Image 9: Tananarive Carrier from the main footpath. Photo: Rosey Perkins



Image 10: Cinema at Tananarive Carrier.

Families were living in one or two story huts, many had tents on the first floor with shops beneath. Shops were stocked with beer, local rum, vegetables and plenty of meat. The community was much smaller but clearly more established than when I had last visited. There was a hut for gambling, a cinema with a projector and a board of power sockets offering electricity to charge mobile phones. There were two Anglican churches and a mosque but no school. We did see that one old lady had opened a nursery and she sat in the middle of the mine entertaining four toddlers. Much more meat was visible than six months ago but rice was the same price as it was in the capital city.



Images 13 + 14: Tananarive Carrier. Taken from the north end in October 2016 (left) and May 2017 (right). Photos: R Perkins.



Images 11 + 12: Tananarive Carrier taking from the north end October 2016 (left) and May 2017 (right). Photos: R Perkins.

Business At The Mine

In October 2016 trading was carried out with discretion. Traders were recognisable because they were less dirty than miners, they carried shoulder bags and they stood on the valley sides to gain a good vantage point. In May traders sat in wooden huts that formed a high street, their torches (a sign of a trader) lay next to them. Trading was done openly and the Gendarme were relaxed.



Image 15: Map of Mines and stopping points near Bemainty Village. Photo: Mahefa Ramangalahy



Image 16 (Top) The steep valley sides of Maladialina with evidence of mining.

At the start of the rush there were many independent “co-operatives” but in May 2017 most were from other mining areas in Madagascar, such as Diego Suarez, Sakahara and Fort Dauphin. Mining activity was mainly sponsored by businessmen from the major cities. They financed another “sponsor” who stayed at the mine and hired men in groups, provided their food and equipment in exchange for first refusal on the stones they found. At Tananarive Carrier I met an independency sponsor who explained his set up. He had 16 miners, eight security guards and a woman who cooked their meals. His miners formed two groups and shared the use of a pump. He supplied the equipment for digging, the fuel for their motor and food for the men. He said he spent approximately \$35 per week on rice and meat for the miners and expected to sell a sapphire with 30%-40% profit for.

Health and Security At The Mine

There was still no sanitation and the most common complaint we heard from the miners was of bad water, which is believed to have caused the death of four or five people before Christmas. They also said “fever” could kill at the mine. A doctor had stayed for a week in November and the Gendarme thought a permanent doctor was needed again. The Anglican priest held regular services with live and amplified music. In February he had sponsored 24

men but that had dropped to eight by May. There was a sense of calm, certainly not of violence. In October, there had been more than nine Gendarme and this indicated lower security in the first few months of the rush. A Malagasy trader I had met at the site in October told me he had only made one more trip to the mines before deciding that the security risk was too high for him to return. By February there were only four Gendarme (Pardieu, 2017) and that figure remained in May. The only unrest came from the drunken brawls at night and the Gendarme had dealt with that by moving their hut further away.

Exploring Carrera Be

Carriere Be was a collective terms for *Tananarive Carrier* (the main valley) and mines in several valleys which extend from it: *Maladialina*, *Milliard 1, 2, 3 and 4*. “Milliard” means “billion,” and stones worth a billion Malagasy Ariary were found in each mine. Fewer stones were found there than at *Tananarive Carrier*, which raised the financial risk and miners began to leave in February. By May, the valleys were mostly abandoned 1000 miners collectively remained.

Maladialina was a long thin stretch of the valley, it’s steep sides give it its name meaning “night falls quickly”. We followed a path between flooded pits, only a few of which were being pumped dry for digging. Shreds of blue tarpaulin attached to the top of poles marked abandoned claims and



Image 17. Men at work in *Milliard 1+2*.

though the skeletons of previous huts still stood, they were barely noticable on the valley sides.

Maladialina lead on to *Milliard 1 and 2*, which was previously two areas that seemed to have merged. Fallen trees, lay across the valley, at the end of which were about 20 huts. Some had solar panels on their roof and a few were selling “*mofo gasy*” (Malagasy deep fried donuts) and cigarettes. We met a group of miners who had been there for two months and were yet to find a sapphire (image 17).

At *Milliard 3* a group of five men were disassembling their metal sieve from the frame and preparing to leave. They left having found nothing in three months. Morale was low in these valleys.

We walked back to *Milliard 1+2*, climbed up the valley side, along its crest and over another into *Milliard 4*. We had to walk down the trunks of several large trees to navigate the valley that had been carved up by pits up to about two metres deep. Only one group of young men remained. They were independent miners and said they had been digging for three months. They wouldn't leave until they found a stone but that that many miners had left the valley in February to explore other mines.



Image 18: Haza Masina, the tree saved from felling and wrapped in cloth : Photo: Rosey

We passed trees saved as a mark of respect for the forest. There were several in each valley and some had bottles of rum at their base, which had been left as an offering of thanks for the sapphires.



Signs of regrowth were already evident. It was surprising to see how little litter had been left and heartening to see how quickly the forest could grow back. It looked like a flood had passed through the valley.

Image 19 (left): Abandoned section of Milliard 3. Photo Mahefa Ramangalahy



Image 20: Sapphires at *Tananarive Carrier*. Photos: Rosey Perkins

Sapphires at The Mines

At *Tananarive Carrier*, sapphires were found in gneiss that formed in the archaean era by metamorphic processes (Ashwal & Tucker, 1999). They were also colourless, “au vive” (light blue), fanta (orange), green, polychrome and occasionally pinkish purple. Many were milky and considered suitable for heat treatment and they were seen in sizes 0.1g to 5g. We were told that greenish yellow stones in larger sizes (image 26) were typical of *Milliard 1*.

The sapphires at *Ambodipaiso* were similar to the sapphires at *Tananarive Carrier*. Though many were milky, they may respond well to heat treatment.

Sahambato was another new rush site we were able to visit. There were fewer fine blue sapphires by proportion, most had green as the dominant colour with greenish blue in the centre. They were not particularly attractive and are not expected to respond well to heat treatment. Large sizes (such as the green stone on the front cover) had attracted many miners, though the mining population seemed fluid and many miners from *Sahambato* had left for *Ambodipaiso* in the week before we had arrived.



Image 21 (Right): Sapphires at *Tananarive Carrier*. Image 22 (Below): Sapphires from *Sahambato*. Photo: Rosey Perkins



Image 23 + 24: (Above left and right): Sapphire and a miner at *Tananarive Carrier*

Image 25 (Above) Sapphires from *Tananarive Carrier*. Image 26 (Right): Sapphires collected by a sponsor at *Tananarive Carrier*. Image 27 (right corner) 1.33g Sapphire from *Milliard 3*. Photos: Rosey Perkins.



Another Route, another rush: Sahambato

Miners travelling from Ansevabe to *Carriere Be* might have stopped at the river near *Sahambato* (-17°95'44"N 48°65'10"). Some did, and when they had dug test pits, they found sapphires. A community of miners were active along a stretch of river that would take three hours to walk, we were told. We left *Tananarive Carrier* at 5 am on our way to Ambatondrazaka and we decided to take a longer route via Sahambato, a new rush site. Fortunately, an 18 year old miner we met en route, agreed to guide us to Sahambato.



Image 28: Black-and-white ruffed lemur in the trees near Sahambato.

The forest was thick and quiet except for the lemurs. It took one hour to walk to *Sahambato* from *Ambodipaiso* and in that time we crossed paths with fewer than 15 miners. Though about 150 houses still stood in the clearing called *Sahambato Village*, half were inhabited. It seemed that many had moved to *Ambodipaiso*. Noone we spoke to would put a figure on how many miners were there. It seemed that the communities were very fluid and people rarely walked the whole length. We did not have the daylight to explore the full length of *Sahambato* so returned to Ambatondrazaka and noted that almost all of the miners we crossed paths with on our return were aiming for *Sahambato* or *Ambodipaiso* rather than “*Carriere Be*”.

Trading in Ambatondrazaka

In Ambatondrazaka we witnessed no violence but a Malagasy trader told us that security was a great concern of his and business was carried out in cars or hotel rooms. It was more discrete than at the mines. Synthetic stones were plentiful we were told and he had lost money on two occasions by buying rough sapphires which were later reported as synthetics by the Institut de Gemmologie de Madagascar. We saw no foreign traders - they seemed to have been evicted entirely. There was also much talk of a ruby rush in Tamatave, near an area previously worked in 2012, and some traders left to investigate that.



Image 29: Abandoned huts at *Sahambato* Mine. Photo Rosey Perkins

Potential in Eastern Madagascar

At the times of writing, production in the area around Bemainty is reported to be slow. Whether these rush sites are exhausted or not, this is not the last of corundum in eastern Madagascar. None of the sites around Bemainty we visited had been explored because of any theory. They were found while panning for gold or by a miner digging a test pit on the way to another site. The junction between two units of gneiss and migmatite links five major corundum rushes including the Bemainty rush in 2016 (Vincent 2017). It would not be a surprise to see many more rushes appear along that junction. However, currently much of this area is protected for conservation and so mining there is illegal. How the Government manages these rushes will be interesting. “Business is Business” is a phrase I heard repeatedly, money wins. The short term gains of a sapphire are attractive to the population, much of which lives off \$1 per day. Geological research into the deposit will reveal its potential but as it has been in the past, it is likely to be exploited, legally or otherwise.

The Future of Bemainty

At the time of writing, mining laws are being reviewed by the Ministry of Mines in Madagascar and until that is complete any action to halt mining is unlikely, though in a press release published on 4/5/2017 Conservation International asked the Government to step in. To evict the miners, the military would need to stay at the mine site for a period that would be costly to the Government and even then the outcome might not be beneficial; the miners could simply move deeper into the forest and explore there. Considering the potential for corundum in the eastern area, a long term will need to be adopted.

Independent consultants have been estimating the level of deforestation that mining is causing and it's considered minimal compared with other forms of deforestation. Conservation International has not visited the mining area inside CAZ but they say that activity is inside the "buffer zone" and therefore not considered a serious threat to CAZ overall. In October 2017, a biological survey of the whole of CAZ including the mining area will be carried out and the impact of mining on wildlife and the local people will be analysed.

Gemmology and Conservation

Madagascar's natural wealth, in terms of gemstones and wildlife, is due to its geology (Hughes, 2017). When Madagascar separated from Gondwanaland and what later became known as East Africa, about 65 million years ago, the gemstones in which the Bemainty sapphires grew had already formed (Ashwal & Tucker, 1999). Madagascar remained unpopulated by humans until around 1000 years ago, by which time unique flora and fauna had evolved there.

The CAZ area is home to thousands of species of plant, a vast proportion of which are endemic to the area and several endangered species of lemur including the Great Bamboo Lemur, Indri and the Black and White Ruffed Lemur (King et al, 2013). When the media covers this story it seems their interest is the wildlife, especially the lemurs, which are Madagascar's national mascot. The immediate damage done to the rainforest is considered minimal compared to slash and burn agriculture but connected hectares is important and measures such as animal behaviour are yet to be collated. During the rush it is credible that local rice crops were damaged or stolen by miners, as reported in The Guardian and we know the Mayor of Bemainty was killed in December (Pardieu, 2017). When the media report this data it will not show the gem industry in a desirable light.

Dialogue with conservationists and the gem industry will help identify what opportunities there are for the gem industry to support rehabilitation and repair the damage done by artisanal miners. For this reason, I have asked CI if I can join them on their biological survey because I believe there is potential to protect and promote Madagascar's biodiversity with Madagascan gemstones. For example, by donating to National Biodiversity Fund (FAPBM) and earmarking funds for CAZ, jewellery companies could collectively reduce the long term impact of small scale and artisanal mining as well as raise their profile in a market of conscious consumers.

Summary

The reality today is that the mining activity around Bemainty in CAZ is illegal, the flora and fauna is rare and much of it endangered. The situation is ripe for a storm of publicity from the media against the gem and jewellery industry once precise measurements reflecting the impacts of mining are released. Bemainty brings to the forefront a problem that is relevant to the whole coloured stone industry. Benefits of collaboration between gem and jewellery companies and conservationists in Madagascar could promote responsible mining and protect the jewellery industry from great damage.

Conservation International

Conservation International (CI) is a non profit environmental organisation working in 30 countries with over 2000 partners and is famed for it's "Nature Is Speaking" campaign, which starred 12 celebrities including Julia Roberts, Robert Redford, Harrison Ford and Reece Witherspoon. CI has been working in Madagascar for over 20 years, where has created and now manages protected areas including the Ankeliheny-Zahamena Corridor (CAZ) on behalf of the Government of Madagascar. CI has assisted in Madagascar's environmental policy.

A Word of Thanks

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About the Author

Rosey Perkins GG is an independent gemologist and gemological photojournalist based in London. She is particularly fascinated by corundum and its origin. Her research has taken her to Australia, Sri Lanka, Thailand, Vietnam, Cambodia, Tanzania, Mozambique and Madagascar. On a solo visit to Madagascar in September/October 2016 she documented the Bemainty Sapphire Rush and has joined Vincent Pardieu (www.conservationgemology.org) on field expeditions to Vietnam, Tanzania and Mozambique as his assistant and cameraman. Her travels can be read about at: www.roseyperkins.com.

Bibliography

Ashwal, L & Tucker, R. (1999). Geology of Madagascar: A Brief Outline. Gondwana Research. 2(3) 335-339.

Carver, E. (02/04/2017). Madagascar forest overwhelmed by thousands seeking sapphires. Associated Press.

Conservation International. (04/05/2017). Statement by Conservation International on Illegal Sapphire Mining in Madagascar. <http://www.conservation.org/NewsRoom/pressreleases/Pages/Statement-by-Conservation-International-on-Illegal-Sapphire-Mining-in-Madagascar.aspx>

Cook, R., Healy, T., (2012) "Madagascar Case study: Artisanal mining rushes in protected areas and a response toolkit", Estelle Levin and WWF, <https://portals.iucn.org/library/sites/library/files/documents/Bios-Cons-Nat-Pro-691-008.pdf>

The Guardian. (02/04/2017) <https://www.theguardian.com/world/2017/apr/02/sapphire-rush-threatens-rainforests-of-madagascar>.

Hughes et al., (2006) "Sorcerers & sapphires: A visit to Madagascar." The Guide, Vol. 25 (Issue 1, Part 1, Jan–Feb): pp. 1, 4–6.

Hughes et al (2017) Ruby and Sapphire: A Gemologist's Guide. Lotus Gemology. pp491.

Jones, P. (21/09/2016). "A Sapphire rush has sent at least 45000 miners into Madagascar's protected rainforests." <http://theconversation.com/a-sapphire-rush-has-sent-at-least-45-000-miners-into-madagascars-protected-rainforests-69164>

King et al. (2013). "Conserving the Critically Endangered black-and white ruffed lemur *Varecia variegata* through integrating ex situ and in situ efforts." Wild Conservation Vol. 1 (2013), pp. 25-30

Krzemnicki, M. (29/03/2017). Kashmir-like' sapphires from Madagascar entering the gem trade in large sizes and quantities. [http://www.ssef.ch/fileadmin/Documents/PDF/SSEF_TRADE_ALERT_-Kashmir like_sapphires_from_Madagascar_entering_the_gemtrade_in_large_sizes_and.pdf](http://www.ssef.ch/fileadmin/Documents/PDF/SSEF_TRADE_ALERT_-Kashmir_like_sapphires_from_Madagascar_entering_the_gemtrade_in_large_sizes_and.pdf)

Leuenerger, A., (2001) "The new ruby deposits in eastern Madagascar: Mining and production", Gems & Gemology, Vol 37, No 2 (Summer issue): 147-149.

Monks, K. "New Sapphire Rush in Madagascar May Threaten Rare Species". <http://edition.cnn.com/2017/04/06/africa/sapphire-rush-madagascar/>. CNN.

Pardieu, V. (2012) "Ruby and sapphire rush near Didy, Madagascar (April-June 2012)", <http://www.giathai.net/ruby-sapphire-rush-didy-madagascar/>

Pardieu et al, (2012) "Ruby and sapphire rush near Didy, Madagascar". Gems & Gemology. 48: 149-150.

Pardieu, V. et al., (2014) "Rubies from a new deposit in Zahamena National Park, Madagascar", Gems & Gemology, Winter 2015, Vol 51, No 4., <http://www.gia.edu/gems-gemology/winter-2015-gemnews-rubies-new-deposit-zahamena-national-park-madagascar>

Pardieu et al, (2017) "Sapphires from the Gem Rush Bemainty Area, Ambatondrazaka (Madagascar)". <https://www.gia.edu/gia-news-research/sapphires-gem-rush-bemainty-ambatondrazaka-madagascar>.

Pardieu, V. and Wise R.M. (2005). "Ruby boom town". Colored Stone.
Rakotondrazafy & al. (2008). "Gem Corundum Deposits of Madagascar: A Review." Ore
Geology Reviews (34): 134-154.

Perkins, (2016) Sapphire Rush in the Jungle East of Ambatondrazaka. <https://roseyperkins.com/wp-content/uploads/2016/11/SapphireRushMadagascarOctober2016by-RoseyPerkins.pdf>

Perkins (2016). Thoughts on a Sapphire Rush East of Ambatondrazaka. <https://roseyperkins.com/visit-sapphire-rush-near-ambatondrazaka-madagascar/>

Walsh, A., (2012) "Made In Madagascar: Sapphires, Ecotourism and the Global Bazaar."
University of Toronto Press.

