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RUBY AND SAPPHIRE RUSH NEAR DIDY, MADAGASCAR (APRIL - JUNE 2012)

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Figure 1: Rubies and sapphires from Didy in Madagascar were recently discovered by timber loggers in a remote jungle covered area in the North East of Madagascar. Some very fine, large and clean rubies and blue sapphires were produced from the new deposit. Photo © Vincent Pardieu / GIA.

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ABSTRACT

Ruby and sapphire rush near Didy, Madagascar: In April 2012, a gem rush occurred in northeastern Madagascar at coordinates 18°20'16" S, 48°33'53" E, located ~25 km south of Didy village, which is situated 50 km south of Ambatondrazaka. An expedition lead by author VP investigated the new find on April 18–27, 2012.

The rush began after some parcels of fine blue sapphires were sold into the local market by gold miners in early April in Moramanga, Ambatondrazaka and subsequently in the capital city of Antananarivo by gold miners and people working for a timber logging company active in the area. The deposit appeared to be situated inside the Ankeniheny–Zahamena corridor, a temporary protected area where mining is prohibited. Thousands of Malagasy miners and hundreds of buyers rushed to the area, and for a few months the government was unable to control illegal mining in this jungle region.

The drive from Ambatondrazaka to Didy was made challenging by patches of deep mud. Soon after our arrival in Didy, we were notified by local security forces that all foreigners had to return to Ambatondrazaka in an effort “to de-motivate the local population from participating in illegal mining.” Nirina Rakotosaona, the only Malagasy national of our team continued alone to the mining area. From Didy, the journey started with a three-hour boat trip up a local river tributary, followed by 10–15 hours’ walk through dangerous and dense jungle terrain.

The mining site was inhabited by an estimated 5,000 to 10,000 people. Miners worked the gem gravels with hand tools in shallow pits. The gravels were localized along a stream at a depth often less than 1 meter. Gems were also reportedly found on the adjacent hillside. Most of the production consisted of blue sapphire, usually without any milky or geuda-type material that is commonly found at other Malagasy deposits. The new deposit was also producing orangy pink sapphires and orangy red rubies, often containing some blue areas, reminiscent of stones found in Winza (Tanzania).

In Ambatondrazaka, where more than 400 foreign buyers (mostly from Sri Lanka) opened buying offices, and in Didy, we saw several clean and attractive blue sapphires weighing up to 4 g (20 carats) but heard of fine stones approaching 30 g (150 carats). We also saw some clean orangy red rubies up to 3 g (15 carats) and were told about fine rubies weighing 5 g (20 carats). Both local and foreign gem merchants were excited by the prospect of obtaining this attractive new material, and prices escalated quickly due to fierce competition among the buyers. For a few weeks Ambatondrazaka became the capital of the ruby and sapphire trade in Madagascar as other places like Andilamena, Diego, Ilakaka, Vatomaniry or Toamasina suddenly became nearly deserted.

At the end of June 2012, a few weeks after our expedition, the Malagasy authorities implemented strong measures to prevent the illegal ruby and sapphire mining in the protected area dedicated to conservation. Soldiers were sent to remove the miners and in Ambatondrazaka, foreign buyers had their offices closed. Within days Ambatondrazaka and the new deposit, that was also reportedly nearly exhausted, were deserted and most miners and buyers returned to the places they traveled from before the rush.

Several samples collected during the expedition were studied at the GIA laboratory in Bangkok revealing that they came from a metamorphic type deposit.

After examination, the blue sapphires from Didy were found to be of the high iron metamorphic type. This is something quite similar to the rubies and sapphires from other known deposits in northeastern Madagascar like Andrebabe (blue sapphires), Andilamena (rubies) and Toamasina/Mandraka (rubies and blue

sapphires) which makes the author think that these deposits could in fact be related. Overall their morphology and gemological properties are reminiscent of blue sapphires from Mogok in Burma or Tunduru in Tanzania, whilst the rubies from the new deposit look quite similar to those from the Winza deposit in Tanzania.

INTRODUCTION:

On April 14th 2012, a few weeks after the sapphire rush near Kataragama in Sri Lanka (Pardieu 2012) that put the gem island in turmoil, the GIA Laboratory Bangkok was informed of a new sapphire discovery in Madagascar by Philippe Ressigeac and Marc Noverraz, two gem merchants from Colorline Ilakaka, a company based in Ilakaka, the main sapphire mining area in Madagascar.

The following day the news was confirmed by co-author Nirina Rakotosaona, a Malagasy gem miner based in Andilamena, who was able to see a very nice parcel containing many natural blue sapphires and also a very large clean ruby. Things appeared very promising: Perhaps this was the new discovery that everybody was waiting to hear about in Madagascar.

According to Ressigeac, Noverraz and Rakotosaona a blue sapphire and ruby rush occurred in a jungle-covered area about one or two days travel from Ambatondrazaka (Figure 2) near a village called Didy. The sapphires were reportedly very interesting as unlike many other deposits in Madagascar most of the stones were natural blue stones, meaning that most of them were blue and transparent enough to be used in jewelry and did not require heat treatment to find a market. The finest stones from the new deposit were commonly described as deep blue gems with an appearance reminiscent of sapphires from Burma. Within hours an expedition was planned, despite the fact that in Thailand the Songkran holidays were keeping the whole country busy.



Figure 2: View over Ambatondrazaka. Photo © Vincent Pardieu / GIA.

From April 18th to 27th, 2012 author Vincent Pardieu lead a successful field expedition to Ambatondrazaka and Didy region for the GIA Laboratory Bangkok with the support of Marc Noverraz from Colorline Ilakaka Ltd, Nirina Rakotosaona from Societe Miniere du Cap Ltd, Lou

Pierre Bryl from Senoble & Bryl Ltd., and Noshad, a young Sri Lankan gem merchant who regularly visits Madagascar.

During our attempt to visit the new discovery site we found out that the deposit is located inside the Ankeniheny-Zahamena corridor (Figure 4), a large rainforest covered hilly area between two National Parks. The area is famous for being one of the last refuges for Madagascar's unique biodiversity including some rare lemurs (Figure 8). But this gem of the living world is facing many threats (Figure 5) like illegal logging (Figure 6) and the practice of "Tavy" (Figure 7), and now gem mining...



Figure 3: View over the jungle covered hills dominating the West of Didy. This area of unique biodiversity belongs to the Zahamena-Ankeniheny corridor. Photo © Vincent Pardieu / GIA.

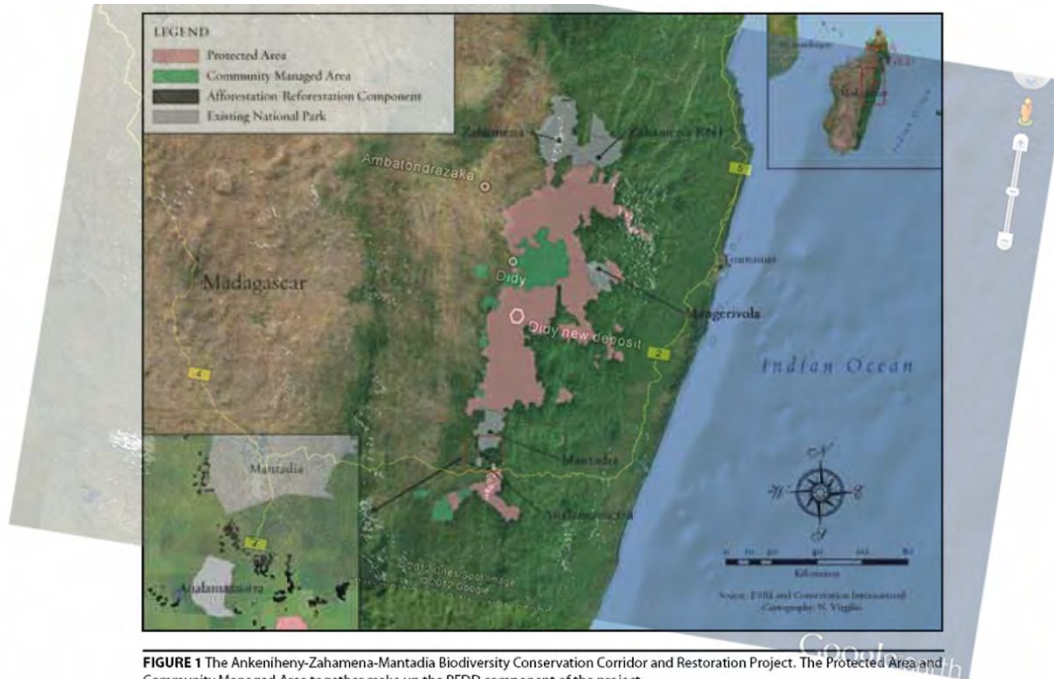


FIGURE 1 The Ankeniheny-Zahamena-Mantadia Biodiversity Conservation Corridor and Restoration Project. The Protected Area and Community Managed Area together make up the REDD component of the project.

Figure 4: Here is a combined map of the author's Google Earth map showing the exact location of the new deposit near Didy and another map from REDD showing the borders of the different protected areas including the Zahamena-Ankeniheny corridor (pink). As can be seen the new deposit seems to be located in the center of the corridor protected area.

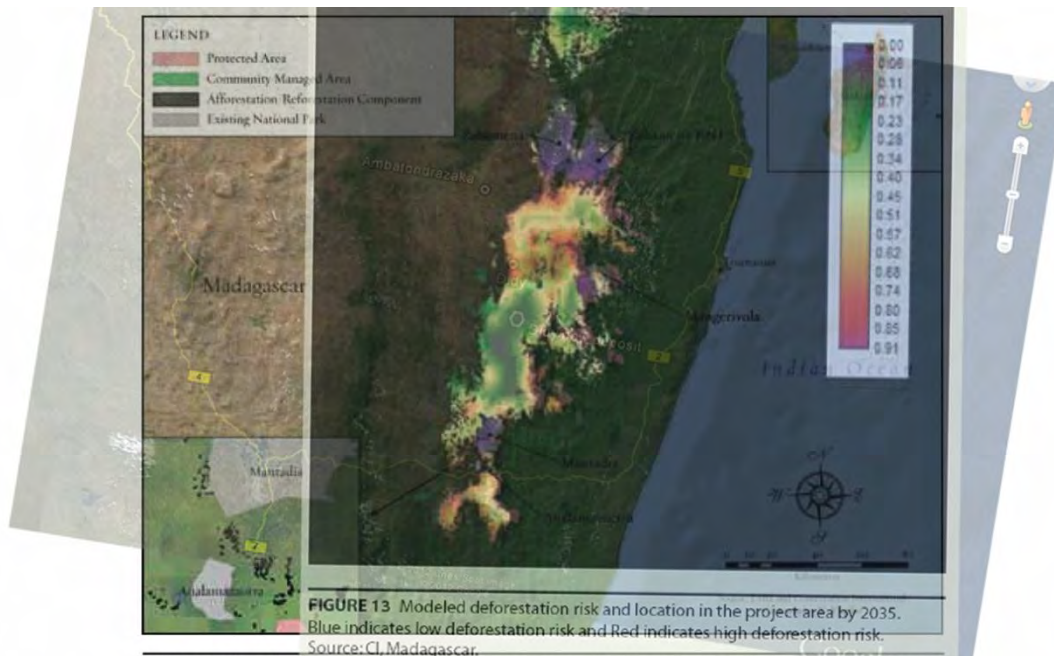


FIGURE 13 Modeled deforestation risk and location in the project area by 2035. Blue indicates low deforestation risk and Red indicates high deforestation risk. Source: CI, Madagascar.

FIGURE 1 The Ankeniheny-Zahamena-Mantadia Biodiversity Conservation Corridor and Restoration Project. The Protected Area and Community Managed Area together make up the REDD component of the project.

Figure 5: Here is another photo combination showing the Zahamena-Ankeniheny corridor and the estimated deforestation risk by 2035. Blue and green are estimated to be areas with low deforestation risk, while areas in red are estimated to be under threat of serious deforestation. Of course these estimates did not take the new ruby and sapphire discovery into consideration. The areas around the new discovery in dark green are low risk deforestation areas. However, 5,000 miners living for months in a forest will probably change these estimates to much less optimistic ones, unless of course gem mining can become an ally of conservation. Obviously in Madagascar this is sadly not yet the case.



Figure 6: Whilst gem mining is a concern for conservationists working in Madagascar trying to protect its unique biodiversity, a much greater threat is probably logging, as witnessed here in 2005 by author VP near Andrebabe. In Didy's case loggers searching for gold during their spare time reportedly discovered the new deposit. With the high market prices for gold and precious wood, the fragile ecosystem of Madagascar seems to have been facing many threats over the past few years as the country is going through some severe economic and political crises. Photo © Vincent Pardieu / AIGS (2005).



Figure 7: More than gem mining and illegal logging, the greater threat faced by the forests of Madagascar is probably the practice of "Tavy". During these difficult periods, many impoverished families move to forest covered areas and burn them to cultivate rice and cassava as shown in this photo taken near Moramanga in 2009. One family will typically burn 2 or 3 hectares of forest. The ashes are used as fertilizer. After two or three years the fragile soil is destroyed and will take more than 100 years to recover. The family will then move to another forest covered area that will suffer the same fate. Each year several thousand hectares of Malagasy forest

are destroyed by the practice of “Tavy”. Whilst gem mining in forest covered areas has a cost, it could also have a positive impact since each family mining gems instead of farming via “Tavy” means many hectares of forest will be spared. Photo © Vincent Pardieu / GIA.



Figure 8: Should Madagascar's unique biodiversity like this lemur be afraid of the arrival of thousands of gem miners in the forest near Didy? Sadly the most likely answer is yes as conservation friendly gem mining techniques and concepts like conservation gems are still mostly nice ideas (Cartier and Pardieu, 2012). Indeed on site, in the jungle it is to be expected that illegal gem mining will remain and even probably spread over the entire area. More than ever conservationists and members of the gem trade should consult with each other to find realistic solutions that would benefit everybody. Photo: modified from www.helpsimus.org

Whilst author Nirina Rakotosaona was able to visit the new mining site twice in April 2012 and collect some data from the mining operation, author Vincent Pardieu was prevented from doing so by the local authorities. Nevertheless VP was able to see, either in Didy or in Ambatondrazaka, many interesting parcels of material reportedly from the new deposit and hear stories and reports from miners and local people he met. During the expedition the GIA Laboratory Bangkok was able to acquire some of these samples for addition to the GIA reference collection.

Back in Bangkok, the samples collected during the expedition were studied at the GIA Laboratory Bangkok by author VP and his colleagues.

On May 8th 2012, a short expedition report was published in GIA's eBrief and later another report appeared in *Gems & Gemology* (Pardieu 2012).

Since author VP had to return to Madagascar at the end of July 2012, while the study of the samples collected was ongoing, the present report will focus on the field expedition report and an inclusion study of the samples collected. A complete gemological study of this new material will be published later.

RUBY AND SAPPHIRE MINING IN NORTHEASTERN MADAGASCAR:

Corundum has been known in northeastern Madagascar since the French colonial times, when geologists like Lacroix (Lacroix 1922, 1923) and Besairie (Besairie 1966) explored the island and described its mineral deposits. Rubies and sapphires, the gem varieties of the mineral corundum on the other hand have only recently been discovered. In October 2000 rubies were discovered in the jungle covered mountainous region east of Andilamena (Leuenberger 2001). Over the following years new ruby and sapphire discoveries occurred in several nearby areas in the region extending from Andilamena in the north west, to Ambatondrazaka in the south west, and up to the coast north of Toamasina in the east.

A particularly interesting discovery that only a few were aware of was that of blue sapphires at Andrebabe in 2002 (Hughes, Pardieu et al. 2006) a deposit that was for a while believed to be producing blue sapphires associated with basalts as the stones were rich in iron, but after study in the lab, the author found out that these stones are in fact of metamorphic origin (see Annex A).

At the end of 2004 the region experienced a new mining rush as the rubies produced at "Moramanga Carrieres" (Figure 9) in the east of Andilamena became famous as those commonly used for the new, at the time, lead glass treatment (Pardieu 2005; Pardieu and Wise 2005).



Figure 9: Richard W. Hughes (right corner) returning from the ruby and sapphire mining site dominating the "Moramanga Carrieres" ruby mining village in October 2005. The mining area was located deep in the jungle covered hills about one day's walking distance to the east of Andilamena town. While visiting the area for the first time in July 2005 author VP witnessed approximately 15,000 miners living and working there, a few months later in October 2005, when he visited the place for the second time with Richard W. Hughes, about 5,000 were still working there. Photo © Vincent Pardieu / AIGS (2005).



Figure 10: A ruby crystal from Andilamena, Madagascar. This material, most of the time heavily fractured, was used as the base material for the so called "Lead Glass Treatment" developed in Thailand after the discovery of Andilamena between 2001 and 2004. Photo © Vincent Pardieu / AIGS (2005).



Figure 11: "Polychrome" sapphires seen in Andilamena in July 2005. Kilos of these yellow, orange, green and light blue stones were mined from weathered kaolin rich lenses found a few meters above the mica rich layer where rubies were found. Photo © Vincent Pardieu / AIGS (2005).



Figure 12: Interestingly in October 2005, the miners working a few hundred meters away from the place that VP visited in July 2005, were not finding the polychrome sapphires he saw in July 2005 but rather these light blue to greenish blue, often milky and commonly fractured, sapphires. Photo © Vincent Pardieu / AIGS (2005).



Figure 13: Low quality rubies seen in Andilamena in July 2005. This material is heavily fractured and thus the light does not go through the stone. Instead it is reflected by the numerous fractures filled with limonite like foreign material and as a result the stones appear brownish pink. This material became famous as the base material for the lead glass filling treatment. Photo © Vincent Pardieu / AIGS (2005).



Figure 14: A parcel of small fine quality rubies from Andilamena. The stones from this source have better clarity and much less fracturing compared to the material in the previous photo, thus appearing a better color as the light travels inside the small gems without being reflected by the often limonite filled fractures. Photo © Vincent Pardieu / AIGS (2005).

After visiting the area twice in 2005, author Vincent Pardieu found out that the deposit was not a secondary deposit, as was believed since its discovery in 2000, but a primary type deposit where rubies (Figure 10, Figure 13, Figure 14) and “polychrome” sapphires (Figure 11) were found in situ in their weathered host metamorphic rocks (Pardieu 2005, Rakotondrazafy 2008). Rubies were found in a weathered horizontal mica rich layer while polychrome sapphires were found above the ruby rich layer in weathered kaolin rich pockets like lenses.

In January 2011 some new sapphire deposits were discovered to the north of Toamasina, near the village of Mandraka, initiating a rush that culminated with the intervention of the Malagasy military in April 2011 (see Annex A). The deposits in these areas were secondary type deposits producing mostly blue and pink-orange sapphires (Figure 15) of the metamorphic type with high iron content. Some purple stones with strong blue and pink to red color zoning were also found. As most stones were found to be much tumbled, it is probable that the source of the sapphires was located further in the jungle-covered hills west of the placers in which they were found.



Figure 15: Rough and faceted blue and pink orange sapphires and a diamond crystal believed to have been mined near Mandraka/Toamasina around April 2011. The rough diamond weights about 3 carats. The faceted stones weight between 1 and 1.5 carats, while the rough sapphires weigh between 0.6 and 9 carats. Photo © Vincent Pardieu / GIA. Photo © Vincent Pardieu / GIA.

The presence of corundum near Didy is noted on a map by Rakotondrazafy (Rakotondrazafy 2008), but no serious mining activity was known in the area until the recent discovery in April 2012.

Nevertheless in April 2012 Ambatondrazaka people from “New Ricky Gems”, an Ambatondrazaka based Sri Lankan gem merchant, told us about small quantities of rubies or blue sapphires that were regularly appearing from unknown deposits in the region for several years. Obviously the whole region is covered with deep jungle and is still unexplored, so this was entirely possible. Up until 2005 most publications, commonly described these deposits as secondary, but during his expeditions in 2005, VP found out that rubies and sapphires were found there in situ in their weathered host rock meaning that the Andilamena deposit is in fact a primary type deposit (Rakotondrazafy 2008).

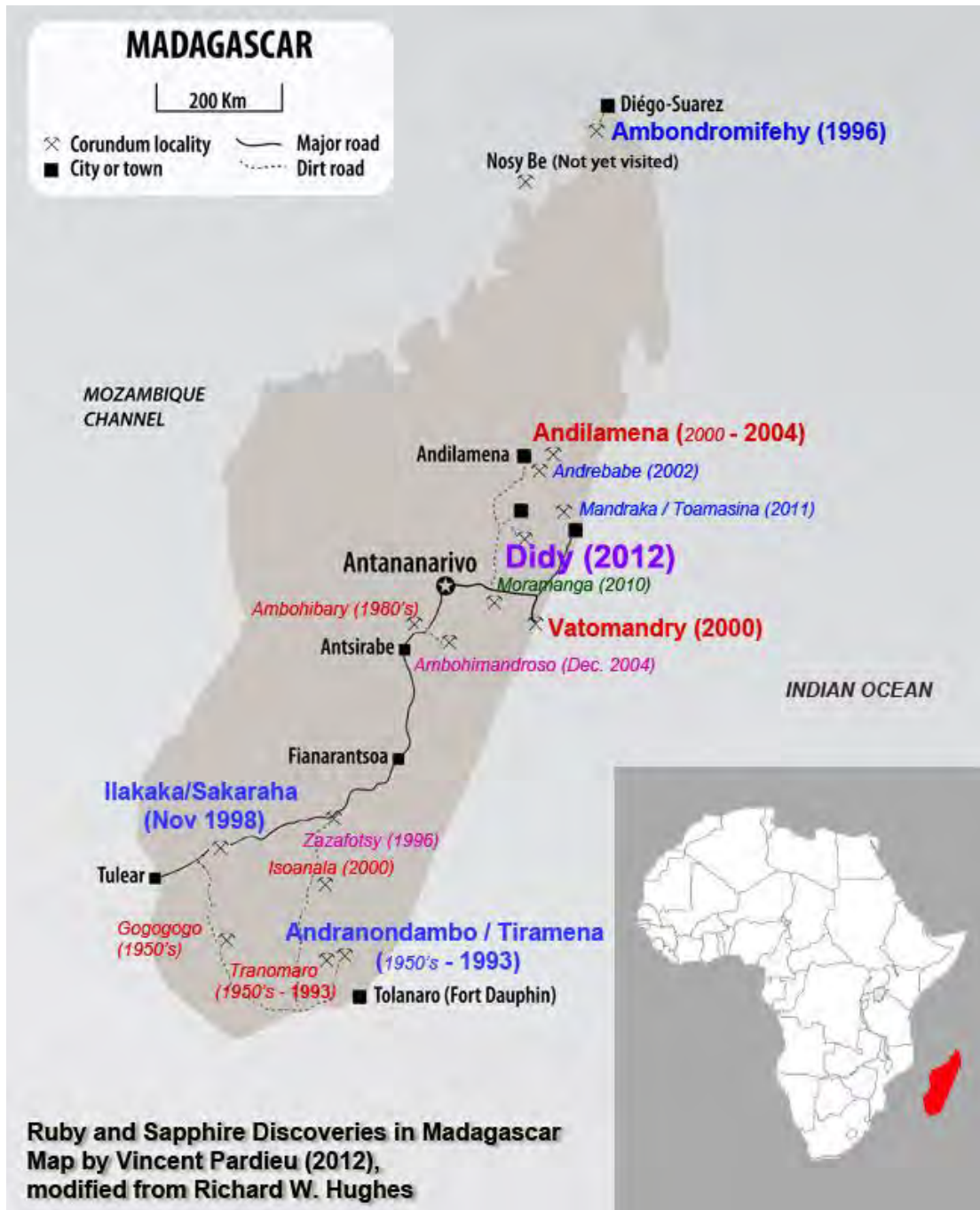


Figure 16: Map showing the main ruby and sapphire discoveries in Madagascar. Map courtesy: Richard W. Hughes (2006), modified and updated by Vincent Pardieu (2012).

GEOLOGY OF THE NEW RUBY AND SAPPHIRE DEPOSIT NEAR DIDY:

Introduction: Madagascar, sometimes known as the “Red island” due to its red soils, shares many geological features with other known gem mining areas like Sri Lanka and East Africa (Mozambique, Tanzania and Kenya). In fact, the islands’ rocks, like those of these other gem producing countries, are records of the entire process involved in the assembly of Rodinia (a supercontinent formed from most or all landmass existing between 1250 My and 750 My) and the dispersal followed by re-assembly of some of lands into the Gondwana supercontinent between 1300 My and 550 My. The main process recorded in Madagascar rocks is the Pan-African orogeny (i.e., mountain-building tectonic event) between ~950 My and ~550 My. This orogeny led to the formation of the supercontinent Gondawana that is constituted by present-day Africa, South America, and Arabian Gulf along the western portion, and India, Antarctica, Australia, Madagascar and Sri Lanka along the eastern portion.

According to a recent presentation from the BRGM (France's leading public institution in Earth science applications for the management of surface and subsurface resources and risks):

“From about 550 My to 150 My, Madagascar was in the central part of the Gondwana Supercontinent. 150 My ago, a rifting between Madagascar and East Africa dislocated Gondwana. Madagascar, India and Sri Lanka were still amalgamated until about 90 My when the opening of what would become the Indian Ocean between Madagascar and India (De Wit, 2003) started. In Madagascar this was a period of intensive volcanic activity.

Malagasy geology is dominated by a Precambrian crystalline basement (all the areas not in yellow on the map above (Figure 17) covering two thirds of the island. It can be separated into nine tectonic units including:

- The Antananarivo unit is a vast poorly differentiated ensemble of probably Archean gneiss and migmatites with many granitic intrusions with ages around 2500 My. Magmatic events at 800 and 630-500 My are well represented, suggesting an indisputably African affinity to this unit.

- The Tsaratanana unit consists of gneiss and migmatites associated with many basic and ultrabasic rocks dating to 2500 My and 800 My. This unit could correspond to an Archean Greenstone Belt, affected by high-temperature metamorphism. In some places, according to the BRGM, there is some evidence that this unit has been thrust over the Antananarivo Unit (Goncalves & Al, 2003).

- The Betsimisaraka unit is composed of gneiss and mica schists with many intercalations of basic and ultrabasic rocks and where the metamorphism is of relatively high pressure it was proposed as a suture zone between the Indian Block (Antongil) and the African Block (Antananarivo), in connection with the

Studying the map (Figure 17) it is interesting to see that the known ruby and blue sapphire deposits of Andilamena and Andrebabe, as well as the new deposit near Didy, are all located along the junction between the Antananarivo and the Tsaratanana units. On the other hand the Toamasina/Mandraka deposit is located in the Betsimisaraka unit, but since the stones found in this area are from a secondary deposit and are commonly very rounded, it is most likely that these sapphires were transported from a source located relatively far to the west and thus possibly from an area along the boundaries of the Antananarivo and the Tsaratanana units. This hypothesis, which needs to be confirmed, seems possible as the study of the sapphires from the Toamasina/Mandraka deposit show many similarities to the sapphires from the Andrebabe region and also from the new deposit near Didy.

An interesting possibility could be that all these deposits, from Andilamena, Andrebabe, Didy and Toamasina/Mandraka, could be geologically related as is suggested in the map presented by Rakotondrazafy, Giuliani, et al., page 135 of their publication about the gem corundum deposits of Madagascar (Rakotondrazafy 2008). After studying the blue sapphires from these different deposits, such a hypothesis does not look impossible since all these sapphires belong to metamorphic type origins and also show a significant high iron content.

THE APRIL 2012 DISCOVERY NEAR DIDY – AMBATONDRAZAKA:

In April 2012 a gem rush occurred at coordinates 18°20'16" S, 48°33'53" E. The location of the new discovery is located deep in the forest south east of Didy village in an area within the Ankeniheny-Zahamena Corridor, an area in theory at least, dedicated to conservation. After some inquiries in Antananarivo, the capital of Madagascar, we found out that the area where the new deposit was found is under the status of a “temporary protected forest area” and there was a project to turn the whole area into a permanent protected area. In April 2012, publications in “L’Express de Madagascar” (see Annex B) about the new discovery related some difficult discussions at ministerial levels about the case; at the time the government was considering changing the area’s status and allowing mining, or trying to close the new illegal mining site. Later in June it seems that the latter option was chosen.

It appears that a local private Malagasy timber logging company was working in the area for years and was using one or two private dirt tracks (clearly visible north and south of the discovery site using Google Earth) to remove timber. The tracks join the main road linking Moramanga to Ambatondrazaka near the village of Andaingo where the author and his party saw several trucks heavily laden with timber on April 19th and 25th 2012 (Figure 18).



Figure 18: Truck full of timber seen in Andaingo on our way back from Ambatondrazaka. Photo © Vincent Pardieu / GIA.

Local people in Didy told the expedition members that the timber loggers working there were also searching for gold when they were not busy cutting wood and it was while searching for this valuable commodity that they discovered the ruby and sapphire deposit. It seems that they were only able to keep the news secret for a few weeks, but at the beginning of April some stones appeared in Ambatondrazaka where “New Ricky Gems”, a Sri Lankan gemstone buying company that had been established for years, was able to buy some interesting gems (Figure 19). Soon people from “New Ricky Gems” sent the miners and buyers they were regularly working with on site. But it seems that the news really spread when a young independent Sri

Lankan buyer was presented a large parcel of fine blue sapphires and rubies in Moramanga. He bought the parcel for around US\$20,000 and sold it a few days later in Antananarivo to a major Sri Lankan buyer for over US\$ 600,000. Many said that the young man was very lucky, but in this case “luck” was the consequence of a lot of hard work since the young man had spent many years learning about rough sapphires the hard way in Ilakaka. In the author’s opinion he owes his success to the fact that he obviously had been in the right place at the right time, but also thanks to the fact that over the years he had been able to garner the right expertise and develop the right connections.

Within days the news of the new discovery spread like bush-fire throughout Madagascar and Sri Lanka, starting a gem rush.



Figure 19: Marc Noverraz and Lou Pierre Bryl looking at sapphires at New Ricky Gems in Ambatondrazaka. Photo © Vincent Pardieu / GIA.

Hundred of buyers (mostly Sri Lankan, but also Thais, Guineans, etc.), and thousands of Malagasy miners and businessmen working with them moved to the Ambatondrazaka region, quickly invading the mining site in the forest. The timber logging company working there reportedly asked for support from the local authorities, while in Ambatondrazaka the Sri Lankan buyers were starting to build their buying offices, making the quiet rice trading city start to look like a new Ilakaka.

THE GIA FIELD EXPEDITION (FE35):

On April 14th, 2012 a field expedition to the new ruby and sapphire producing area was immediately organized by the field gemology department of the GIA Laboratory Bangkok upon hearing news about the discovery and receiving confirmation the following day. Our objectives were to try to visit the new deposit, study it and obtain material for preliminary examination and characterization in the laboratory in order to be able to update the GIA's Origin Specific Corundum Database.

The expedition was led by author Vincent Pardieu accompanied by Lou Pierre Bryl.

We arrived in Antananarivo on April 19th 2012 at around noon. There we met Marc Noverraz from "Colorline Ilakaka Ltd" who came from Ilakaka, the island's main sapphire mining and trading center, with a good car and some expedition supplies. We immediately left for Ambatondrazaka (Figure 20).

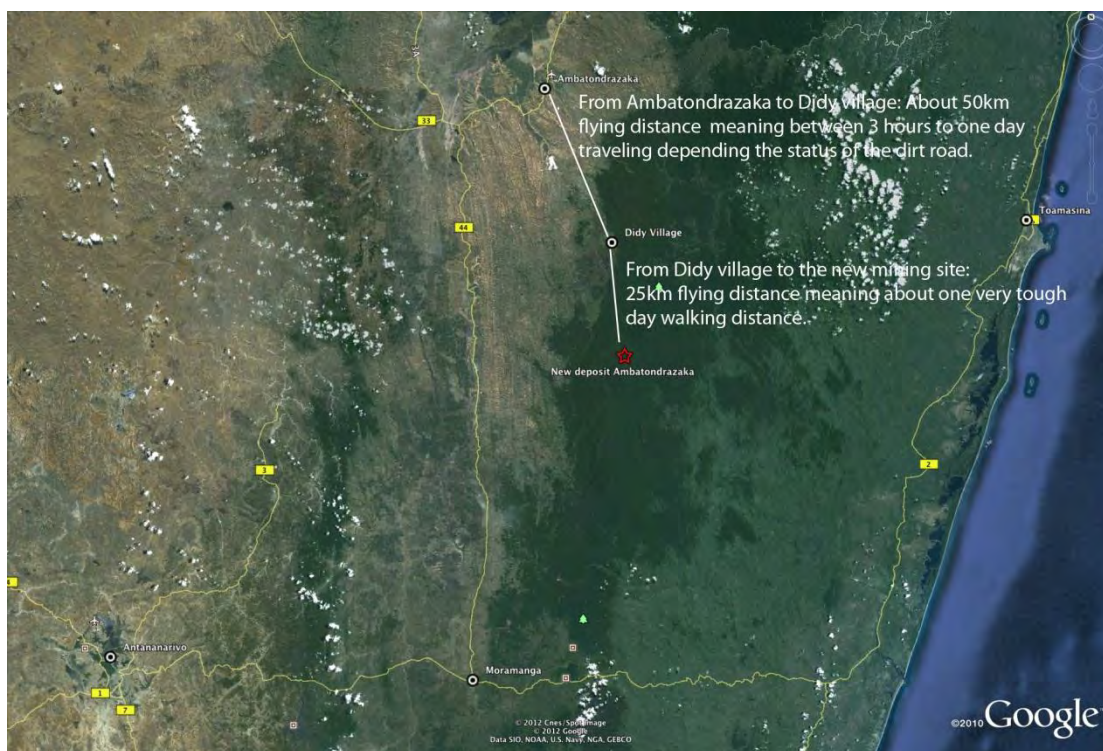


Figure 20: Google Earth map of the field expedition FE35 to Didy, Madagascar, that started in Antananarivo, then took us to Moramanga, Ambatondrazaka and finally Didy.

En-route Marc told us that Ilakaka was empty "like a ghost town"; most of the buyers and many miners had left for Didy. For those remaining in Ilakaka things were difficult as the Sri Lankan's traders are key elements of the local economy. Many villages in the area depended on business generated by the traders. With thousands of people away the local economy was suffering. Miners had difficulties finding a buyer for their stones, as only a few buyers (mostly Thais) had decided to stay on. Marc wondered if it was a good idea to rush to Ambatondrazaka and Didy like everybody else, since the chances of better business for the few who had decided to stay may present an opportunity in itself.

For the first hour, until Moramanga, the road was good, but thereafter it was mainly a dirt road. We finally reached Ambatondrazaka after nightfall at around 20:30 hrs. Nirina Rakotosaona had already booked some rooms for us and was patiently awaiting our arrival. Things were very unusual as all the hotels were full. The small usually very quiet city we used to depend on as a convenient resting point on the way to Andilamena was difficult to recognize. Sri Lankan buyers were all around the city driving big SUVs or waiting in front of their brand new buying offices (Figure 21).



Figure 21: Sri Lankan buyers discussing business near the bus station in Ambatondrazaka. Photo © Vincent Pardieu / GIA.



Figure 22: The central "Taxi-Brousse" and bus station in Ambatondrazaka with a tractor waiting to go to Didy with men and mining tools. In the background a local shop that was renovated, painted in white and turned into a gem buying office stands out. Photo © Vincent Pardieu / GIA.

We could see that many of the shops around the central bus and "taxi-brousse" station ("taxi-brousse" is the local name for the local cars, vans and minibuses taking people from one city to another) had already been transformed into gem buying offices (Figure 22), or were under renovation to be transformed into something more glittery than anything the small rice farming center had ever seen before! Obviously things were developing quickly and it was quite amazing to see the local people witnessing and discussing the changes their little town was going through.

We had dinner at one of the few restaurants in town, a Malagasy-Chinese owned affair. Few Sri Lankans were around and surprisingly no Thais... In fact we witnessed the arrival of the first Thai buyers a few days later on April 22nd. This proved to us that the Sri Lankan buyers lost no time in reaching their destination first. As we arrived they already had a very strong position with buying offices set-up for the expected blue and red waves to hit the city. Add to this the crowds of Malagasy businessmen and miners already on site or on their way and it would be an understatement to say things were busy! However, we thought that there would be a far greater chance of seeing Didy stones in Beruwalla than in Chanthaburi over the coming few days and weeks.

During the dinner we received an update about the situation in the jungle from author Nirina Rakotosaona who had just returned from the mining site. We had to expect a very tough 12 to 15 hour walk through the dense Malagasy rain forest. The track was dangerous as it was very slippery and in some areas the relief was very steep. The next day, following Nirina's account, we learned, with little surprise, that one of the local men carrying supplies for the miners had died after losing his footing in the jungle.

With so many buyers competing for stones in Ambatondrazaka, we decided to leave early the next morning for Didy, the last village at the end of the dirt track heading to the new deposit, and so on April 20th we took the road to Didy located 50 km south of Ambatondrazaka. The whole track is a dirt road that turns into mud at the first hint of rain. The road heads directly south following the border between the rainforest-covered hills in the west, that extend until the coast and Toamasina, and the rich but narrow rice farming plain.



Figure 23: On the way to Didy we passed several traditional Malagasy villages where rice farming and raising zebus are the main activities. Photo © Vincent Pardieu / GIA.

Didy is one of the biggest rice-farming villages in the area. It can be accessed within 3 hours with a good car or a motorbike if the track is not too muddy. It took us a good deal more time as we encountered several small adventures on the way. About 30 minutes after the turn to Didy we were first stopped by the local police. They were simply asking for our papers but they did nothing to stop us from going further. They obviously had no orders to stop the numerous tractors laden with miners on their way to Didy either.

On the same day, whilst driving from Ambatondrazaka to Didy, we saw about 300 people either walking, riding on motorbikes, or seated at the back of trucks or tractors, most of them carrying supplies and mining equipment. We even met one carrying a casino wheel! (Figure 24) It is not as unusual a sight as it may seem on the way to a gem rush. As usual, where there are good gems to be found, there are lucky miners with more money in their pocket than they ever had in their life. Hence, they are often in a good mood to celebrate their luck whilst others are keen to listen to their stories. Obviously, except for announcements on the radio calling for them not to go trying their chance in Didy, the authorities were doing nothing to prevent them. And the rumor about nice big stones was a stronger calling than the official warnings, particularly for those people suffering from the economic and political crisis that affected many people in the Red Island for several years.



Figure 24: Between Ambatondrazaka and Didy a tractor is carrying gem miners, mining tools, supplies and even a casino wheel. Photo © Vincent Pardieu / GIA.

Whilst our first encounter with the local authorities was easy, the track itself was very challenging and nearly stopped our adventure twice. About two kilometers after the police checkpoint we encountered a flat tire. We then decided to return to Ambatondrazaka in order to avoid getting stuck around Didy if we were unfortunate enough to develop a second tire problem. About two hours later we were back, ready to experience the next obstacle. Just before the entrance to a village the track turned into a long deep mud trap. It was a funny place as many local people were in discussion on each side of the track. Of course, as we tried to pass our car got stuck in the deep mud, then the local crowd came to rescue us, placing branches and wood in the mud hole and pushing our car. After about 20 minutes of a good mud fight our car was safe on the other side of the mud trap. As would be expected after such physical exertion and kind help some money was requested in appreciation for their effort. In fact after studying the whole event we left convinced that the mud hole was probably artificially created and maintained as such by the local villagers in order to earn them some income whilst “helping” travelers remove their vehicles from the mud trap! (Figure 25) We confirmed this a few days later when visiting the same place on our way back; we were not surprised to see the very same individuals hanging around, obviously waiting for another car to get stuck in their mud trap! As would be expected we got stuck again, and the whole process repeated itself. Things could have been much worse, as the track was a perfect one to set up an ambush, however in this case the ambush turned out to be a very friendly one, and thanks to them we had a great opportunity to give Marc, who was driving our car, a hard time.



Figure 25: Local villagers helping our car pass through to the other side of a mud trap on our way to Didy. Photo © Vincent Pardieu / GIA.

We reached Didy village a few minutes before nightfall. Again we had prepared our expedition well, as one of our friends is a young Sri Lankan buyer who had set up a small buying office in Didy and he kindly booked two rooms in Didy's only local hotel (Figure 26).



Figure 26: Arriving at our hotel in Didy after a long day on the road. Photo © Vincent Pardieu / GIA.

The place had the added advantage of being the local gem-trading center too, as about 20 motorbike riders were waiting for customers in front of the little hotel (Figure 27). The hotel was full, the restaurant was crowded and all the motorbikes riders had brand new bikes (Figure 27): Obviously business was good in Didy!



Figure 27: Motorbike drivers waiting for miners in front of Didy's only hotel. Photo © Vincent Pardieu / GIA.

We spent the evening in the restaurant discussing the situation in Didy with local people who had returned from the mining site (Figure 28).



Figure 28: Gem miners returning from the mines, or going there, meeting in a Didy restaurant. They were obviously not only hungry about gems but also about rice! Photo © Vincent Pardieu / GIA.

As usual we appreciated that “rumor” is a key factor in any gem rush. We heard about stories of miners fighting in the jungle with soldiers, about burned huts, about lucky people who discovered good stones, and the unlucky ones who lost everything when the soldiers caught them.

The track was reportedly very long, tough and dangerous. The death of the local miner was confirmed to have taken place on April 20th 2012 when he fell from a steep jungle path. Several other people were reportedly stuck there, as they were too tired to return. Due to the difficulty of the track, porters are rare and expensive. On April 20th we were told that the price to carry 10 kg from Didy to the mining site was about \$30, a small fortune in that part of Madagascar. According to the local buyers the number of stones coming from the new mining site had dropped significantly over for the previous two days. We met a few people returning from the mines who stated that the situation had been difficult for many miners as a group of 30 soldiers arrived at the mining site on April 15th 2012. Before the soldier’s arrival a few hundred people were working in the forest and stones were regularly arriving in Didy. With the arrival of the soldiers most of the mining activity stopped as the miners hid in the jungle. That explained why very few stones arrived in Didy that day compared to previous days.

According to the miners returning from the site the situation there had been tense. The soldiers had burned most of the huts used by the miners as shelter in the rainforest and many miners who had escaped into the jungle had only been able to escape with a limited food supply. Some lost everything they had. Working in the deep jungle about 12 hours walking distance from the closest village, the soldiers were also soon lacking food and supplies. Half of the soldiers reportedly left after two days and only 15 were left on site to secure the area. But each day several hundred new miners eager to chance their hand at the ruby and sapphire fever were reaching the new mining site hoping to find their path to untold riches.

According to accounts from different people, some of the miners hiding from the soldiers went prospecting in other places in the surrounding jungle, however most of the others regrouped between the mines and Didy, waiting for new comers to join them in order to return to the mining site in force. The plan was obviously a good one as most of the newcomers were not really the type who lacked stamina and determination. On the contrary, whilst most of the first miners who worked the jungle mine during the initial weeks were mostly local farmers, taxi drivers or local shopkeepers lacking mining experience, most of the newcomers were tough experience miners from Ilakaka, Andilamena and Ambondromifehy who had travelled a long way to reach the new find. Many of them were carrying everything they had, some had even borrowed some money in order to afford the expedition and buy enough food to work a few weeks in the jungle. Most had no other option than to succeed in finding at least one good stone to cover their expenses and all were dreaming about finding one of the big blue stones they heard about and believed would change their life forever. Obviously unlike the first local people who were chased away by the soldiers, they were not the type that would be afraid to face a few soldiers in the jungle with odds of 5000 to 20!

One miner who had just arrived from the mining site late in the evening told us that when he left the mines in the morning the balance of power had turned in favor of the miners. According to him the miners reportedly came in force and the soldiers finally gave up and decided to be practical while facing such crowds. Instead of using their time fighting the miners it seems that they decided to benefit from them by finding a way to convince the miners to work as security guard for their mining operation...

After 5 days of skirmishes, gem mining reportedly started again in the jungle-covered hills south of Didy later that day! If the information was accurate we could expect to see stones arriving in Didy in a few days.

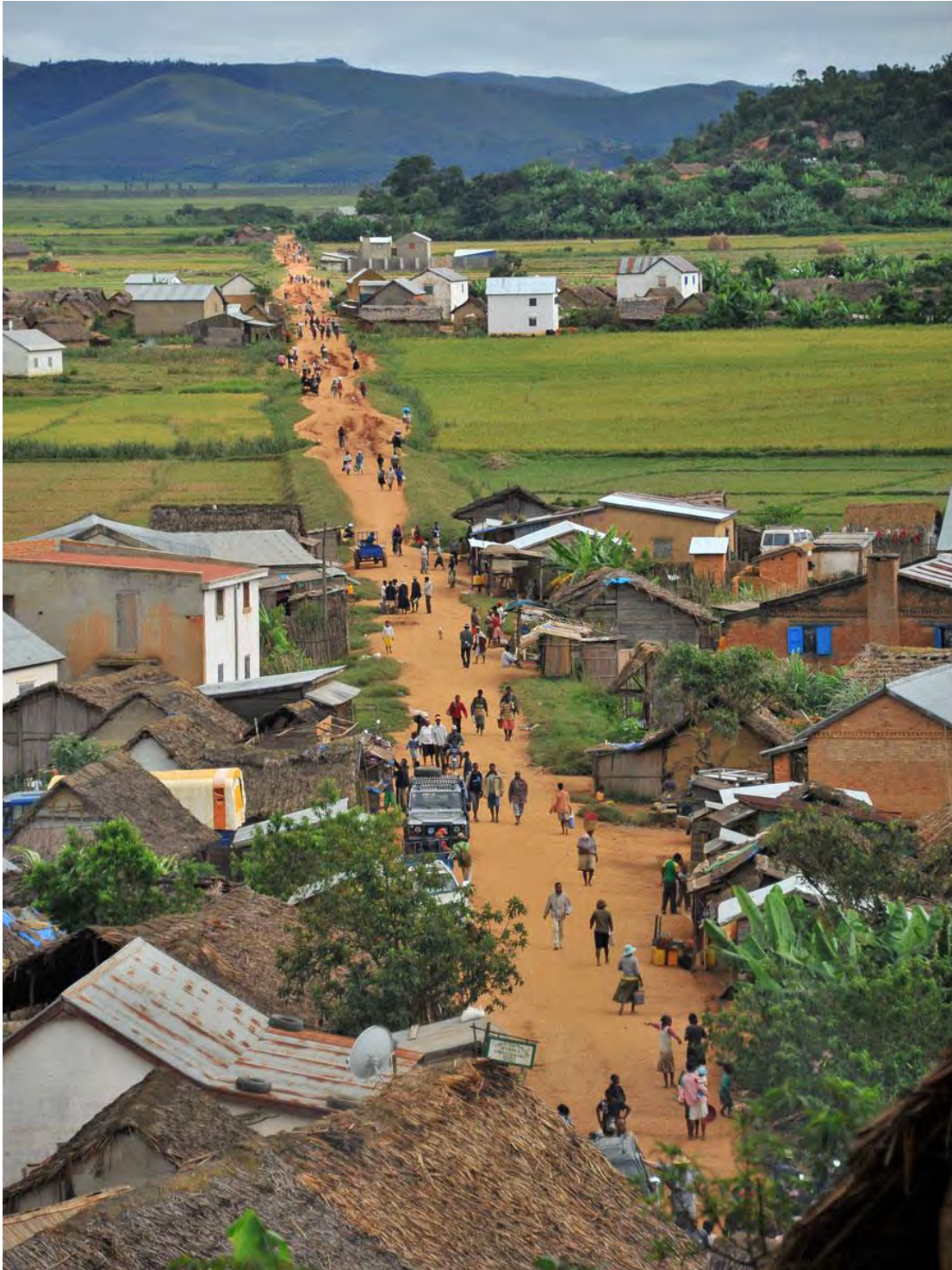


Figure 29: View over Didy's main road with people arriving in town walking from Ambatondrazaka. Photo © Vincent Pardieu / GIA.

The following day we decided to stay a bit longer in Didy to find out more news about the situation at the mines, and see if other miners could confirm that the work had re-started in the jungle. We walked a bit in Didy to get a feel for the place (Figure 29). Our plan was to go to Fierenana first, sleep there, and then the following day walk to the new mining site. In the meantime we basically also had half a day to try to see if we could find some good stones in

Didy and find a better place to stay as the small hotel had too many rats and unpleasant smells for our liking!. We quickly found a small house to rent with a good location near the entrance to the village. The family living there was more than happy to go and live with their parents for a few days and make some extra money renting out their house. The house was, by local standards, a clean and cozy traditional stone and wood house with a home cat and some good simple traditional Malagasy furniture. When we had finish setting up our new base, it was time to go around and try to see some stones and collect some information. We witnessed hundreds of people carrying mining equipment passing through Didy (Figure 30, Figure 31, Figure 32).



Figure 30: Malagasy miners walking through Didy. Photo © Vincent Pardieu / GIA.



Figure 31: Malagasy miners walking through Didy. Photo © Vincent Pardieu / GIA.



Figure 32: Malagasy miners walking through Didy. Photo © Vincent Pardieu / GIA.

About 20 buyers (mostly young Sri Lankans and some Malagasy people of Chinese origin) were also visible near the motorbike station or at the entrance to the village. They were

waiting for miners returning with stones from the mines. We did see some stones, but they were far from being plentiful (Figure 33).



Figure 33: A large blue sapphire seen in Didy. Photo © Vincent Pardieu / GIA.

In fact most of the stones were just passing through Didy as the Ambatondrazaka and Antananarivo based buyers had sent their own local men to the mining site with a mission to bring back to their boss any miner who had found a big gem, or better still, to buy what they could for them. As a result not many of the men returning from the mines were interested in showing their stones around in Didy; rather they were rushing to Ambatondrazaka. Just before lunch-time, after our visit to the market, we returned to the house to discuss moving closer to the new mining site. However, just after passing a gendarme, I took a photo of our team discussing events of the day in the street in Didy and noticed the gendarme making a phone call in the background (Figure 34).



Figure 34: The author's team in Didy, just before our expulsion notification. Photo © Vincent Pardieu / GIA.

A few minutes later, as we were discussing our plans further in our new home, the local “gendarmerie” security forces knocked on the door. When we opened the door, the very same gendarme we saw a few minutes before was there with seven other gendarmes. He was the chief of the local security force and was asked to enter and speak with us. After a short, polite and friendly discussion that lasted about 20 minutes he “notified us that he had received orders to ask all foreigners to move to Ambatondrazaka before the next day”.

According to the chief of the gendarmes it was the first step of a three-step plan to stop illegal mining activity in the forest:

- First step: Expulsion of all foreign buyers from Didy “as the presence of foreign buyers was motivating the local population to work on the illegal mining site”. He told us that upon returning to Ambatondrazaka the situation would be explained to us by the authorities.
- Second step: Stop the local businessmen and the supplies going on-site.
- The final step: Expel the remaining illegal miners.

But we wondered if the whole plan would have been more efficient if the authorities had decided to simply block miners going to Didy and the mining site. It was quite “interesting” to see that whilst the local authorities were asking the foreigners to leave Didy, they were still stamping the ID cards (and collecting 1000 Ariary per person in the process) of the Malagasy nationals from other villages coming to settle in Didy district for the purpose of mining. With that authorization they were legally able to stay.

In Didy we were presented with an interesting story justifying the soldier’s presence on-site. According to our source, it was possible that the soldiers were contacted by the logging company working in the area that was responsible for the original discovery. According to the man, the loggers wanted to keep the mining site for themselves and had paid the soldiers to help them get rid of the newcomers. That would explain the swift reaction of the army and why,

on the other hand, the authorities had done nothing to stop the trucks and tractors loaded with miners leaving Ambatondrazaka for Didy and beyond each hour (Figure 24, Figure 35). But once again, in such situations it is difficult to find out “the whole truth and nothing but the truth”!

After the departure of the gendarmes we all had a good discussion about our experience and within a few hours we found out that the Sri Lankan buyers who were waiting for stones also had the same conversation with the gendarmes. Since Lou Pierre and I had to be back in Bangkok on April 26th, we decided to play it safe and take advantage of the authorities’ relaxed attitude towards Malagasy nationals visiting Didy and travelling to the mining site in the jungle. We decided to separate into two groups; the foreigners would return to Ambatondrazaka as requested by the gendarmes, while the Malagasy members of our team would continue on to the mining site with a good camera and GPS in order to document the mining activity and subsequently return to Ambatondrazaka before our departure, hopefully with some good data and some interesting news.



Figure 35: On the way to Didy: While gem merchants travel by cars or motorbikes, miners travelled by truck, tractor or simply by walking. Photo © Vincent Pardieu / GIA.

The plan set, we spent the rest of the day searching for samples to buy for the GIA reference collection. Thanks to the help of one of the young Sri Lankans who based himself in Didy for a few days we were able to see several parcels and buy a representative sampling of interesting rough specimens of the production we had seen so far from the new deposit.

While looking for samples we once again witnessed hundreds of miners travelling through Didy in/on tractors, trucks, cars, motorbikes or just walking through without the local authorities preventing them.

According to locals many other people were also going to the new mining site via another track that started from Andaingo and on to Fierenana and then to Antanifotsy where the base camp of the local logging company cutting wood in the area prior to the discovery of the deposit is located.



Figure 36: Google Earth view of the area around the new deposit located in the jungle south of Didy, clearly showing the two timber logging tracks located north and south of the deposit. An unusual sight for an area dedicated, in theory, to conservation.

Upon looking at the Google Earth map we had with us (Figure 36), the obvious question that arose was “how can a Malagasy logging company operate in an area dedicated to conservation and build two long dirt roads to extract their wood without the authorities complaining about the activity?” After our return to Bangkok, we asked a friend living in Antananarivo to check this query out for us, but he was unable to confirm if it was really legal or illegal to cut wood in that specific area. The fact is that the whole island is about rumors and scandals concerning the illegal logging of precious wood. Rose wood is the most talked about issue. During the past three years of political instability and economic crisis, many Malagasy citizens and the local press have complained that illegal logging of precious wood in their country has occurred more than ever, obviously with some complicity at a very high level. Sadly conservation in Madagascar is facing some serious challenges and probably the main threat is illegal logging (Figure 6) and the practice of “Tavy” (Figure 7), since illegal loggers or farmers often take the opportunity to mine for gold during their spare time and as a consequence they may find gemstones. This is exactly what happened in Didy. But one day maybe we can hope that gemstones will be used to support conservation instead of being seen as a threat to the gems of the living world that are “our” national parks (Cartier and Pardieu 2012). Conservation friendly mining techniques could be implemented and if miners had to be taxed, it seems obvious that the money collected from the miners or the trade would be better used if it was going to support conservation than going in the pockets of the soldiers sent on site to stop illegal mining, but who instead find a way to personally benefit from it. However, in order to reach such a situation the gem trade and conservationists should collaborate with each other. We know it is easier to say but quite another to put into practice. But maybe this report on the Didy discovery might help as there are people willing to find better solutions on both sides.

Back to our schedule and on the morning of April 22nd, VP and the other foreign members of the team left Didy to return to Ambatondrazaka. We reached the town a few

minutes before nightfall and for the next 3 days we were able to witness the city's transformation from a rice-trading center into a gem-trading center...

In Ambatondrazaka we spent a lot of time with Sri Lankan traders we knew from our past expeditions to Ilakaka and Sri Lanka. Things were as quiet as they were in Didy, obviously as a consequence of the actions of the soldiers at the mining site. Stones were still arriving, but according to the buyers, not as many as during the previous week. When we were in town most Sri Lankan buyers agreed that between 300 and 500 of their countrymen were setting up offices or searching for a house to stay in Ambatondrazaka. Many more were on their way. Rental prices for good locations went to heights never heard of in the whole region. Places that were rented for US\$ 50 per month before the discovery of the rubies and sapphires could now routinely command more than US\$ 1000. Many locals were scouting the streets of the town asking any foreigner they saw if they were searching for a place to rent, and white paint was out of stock in town. House owners were obviously very happy to see their old houses renovated and to generate some additional income. With the arrival of hundreds of foreigners and miners even prices for food and basic supplies were very high making things difficult for the most vulnerable people in the area, whilst others were obviously taking good advantage of the situation and making a small fortune. It was interesting to see that, as in Didy, most motorbike riders had brand new bikes.

The economy of Ambatondrazaka was not the only factor affected by the gem rush. In the countryside we saw numerous unattended paddy fields that should have been harvested a few days or weeks prior. Very few people could be seen harvesting the rice and most of those seen were women. Many farmers were facing an obvious manpower shortage and hence were unable to harvest their paddy fields. Most of the people usually available to help the farmers with their harvests had probably found better wages either working as carriers between Didy and the mining site, or trying to become miners themselves. One man told us that some farmers had also joined the crowd of the wannabe miners and let their crops go unattended.

With such rental rates and such good wages, the local people were quick to adapt themselves. Many small businesses closed and some basic commodities were starting to become harder to find. Within days the shops were cleaned and renovated, the walls were painted white and a buying desk and lighting was set up. Lights were very important as most of the time miners were reaching Ambatondrazaka late in the evening after a long day travelling from Didy. The different Sri Lankan companies were obviously competing with each other to ensure that any good stone found would find its way to their office first. To motivate miners to come to their office first with good stones, buyers were giving very good prices for medium quality stones. Obviously they had come in force and were investing, as well as waiting, for the blue and red stones to come to their brand new offices.

From his side Nirina headed for Fierenana where the tracks from Didy and Andaingo merged. A few Malagasy businessmen had set-up a buying office there but the place was reportedly very basic. It is accessible from Didy after about 3 hours on small boats through the swamps. The boat operators were understandably very happy about the discovery of the new mining site and soon raised their prices. At Fierenana the miners had the choice between taking the timber logging track penetrating deep into the jungle, or traveling via a more direct way through the jungle. In any case the journey took between 10 to 15 hours for a healthy man. Nirina, after about one year living in the jungle and training himself for the "Diagonale des Fous", a famous 150 km long race on Reunion Island, took less than 8 hours to reach the mining site. The track was still very tough and dangerous. During his first visit from April 16th to 18th several hundred miners were playing hide and seek with the soldiers.

On April 23rd NR was able to see several thousand miners working a narrow stream. On that day he walked up and down the stream for about 2 hours and there were people everywhere (Figure 37, Figure 38).

According to him, it is possible that close to 10,000 people were already occupying the new discovery site, most of them miners but also probably around 500 local businessmen searching for big stones for the merchants based in Ambatondrazaka. All these people lived in tents or in huts they rapidly built with what they found on site, and there is of course no sanitation.



Figure 37: Malagasy miners working on the new mining site south of Didy. Photo © Nirina Rakotosaona / Vincent Pardieu.



Figure 38: Malagasy miners working on the new mining site south of Didy. Photo © Nirina Rakotosaona / Vincent Pardieu.

On the mining front, gem rich gravels are found at less than one meter deep around the stream. Some stones were also found on the hillside. According to NR, at least 3 different types of gravels can be found at the site, but only one type looks to be rich in rubies and sapphires. So far the deposit was obviously only a secondary one, and while some miners were searching for gems others were searching for gold (Figure 39).



Figure 39: Malagasy miners searching for gold (left) or sapphires (right) at the new mining site south of Didy. Photo © Nirina Rakotosaona / Vincent Pardieu.

After spending some time documenting the mining, and collecting some GPS data, Nirina returned to Ambatondrazaka to meet us and share the news he garnered from his visit to the mining site.

Obviously in Ambatondrazaka after looking at the production of the first few weeks where only a few hundred people without much experience worked the new deposit, the local and foreign gem merchants were very excited about the potential of the new find and were hoping that with thousands of experienced miners working there many fine stones will be produced. As we left Ambatondrazaka prices were reaching very high levels and competition amongst the numerous buyers to acquire the best stones was getting serious. But a few questions remained; how big is the deposit? And of course; will it be possible to work it legally? Given the current economic and political situation in Madagascar few believe that the authorities will be able to stop the thousands of people living with “gem fever”.

Back in Bangkok author VP followed the events near Didy. The ruby and sapphire fever stopped at the end of June 2012 when the Malagasy government decided to move. According to the local media insecurity had grown in the region (see: **ANNEX C: LINKS TO ONLINE ARTICLES IN THE MALAGASY AND INTERNATIONAL MEDIA ABOUT THE NEW SAPPHIRE DISCOVERY NEAR DIDY:**), but according to some gem merchants who visited the mining area during that period, compared to other gem mining sites in Africa the whole situation was handled in accordance with the Malagasy way meaning “without much trouble and with a minimum of violence”. Soldiers were sent to the mining site where foreign buyers were checked by the police and mining rapidly came to a stop. By the end of July 2012, most buyers and miners had returned to the traditional gem mining areas they originated from.

According to several Sri Lankan buyers we met in Ilakaka at the end of July 2012, mining is nevertheless still ongoing in the forest near Didy. As the soldiers arrived many miners

returned home, but many others went prospecting in other places deeper in the forest. Those miners believed one simple thing; the government will not be able to keep a security force in the forest forever. Within a few weeks, the soldiers will leave. But the local people now know that there are gems in the forest near their village. Some of them have learned how to mine them, recognize them and trade them. People now dream of returning there when things become quieter or to find another place in the forest where they will be able to find gems. They will probably return to mine in the forest near Didy. This is what happens after most gemstone discoveries everywhere.

Visiting Madagascar again at the end of July 2012, author VP heard about a rumor stating that about 300 miners are reportedly working a new area located about 10 kilometers from the site of the April rush. A new sapphire deposit was also reportedly discovered further north about two days walking distance from Fenorive Est, a city on the coast north of Toamasina. Sapphire from Fenorive Est is not really a new development as the author collected several samples that reportedly came from the area in 2005, but who knows about the accuracy of the information? People from the gem trade we met in Antananarivo and Ilakaka were speaking about new mining sites deep in the forest where miners had found sapphires in some places and alexandrite chrysoberyl or blue spinels in other places. The spring 2012 rush may be over, but what happened then was probably just a chapter in a much longer and probably more complicated story about gemstones sources in northeastern Madagascar.

FIELD AND MARKET OBSERVATIONS OF ROUGH CRYSTALS SEEN AROUND DIDY:

During the visit to Madagascar author VP was able to see several clean and attractive rough blue sapphires of up to 20 carats but also heard about fine rough stones of up to 150 carats. Some clean orangy-red rubies of up to 15 carats were also handled and there were reports of some very fine clean rough stones of up to 40 carats. Besides fine blue and red stones many others were purplish looking due to strong blue/pink color zoning. Stories about large fine stones are not rare during gem rushes, but after witnessing the money spent in Ambatondrazaka by so many merchants, looking into the eyes and seeing the excitement of people with many years of experience in the trade, while also being told about the beauties they recently saw or bought, and remembering the fine quality stones we saw for ourselves, make it more than likely that most of these stories were not just rumors.

Fine large gems had obviously been found in the remote jungle stream south of Didy. As a result, Didy, like Winza, will be probably become a name that many people will clearly remember, as so far, to the best of the author's knowledge, rubies of such size and quality have never been heard of from Madagascar, let alone any other place!



Figure 40: A typical parcel seen in Didy which is quite representative of the production from the new deposit. The stones are a mix of blue, pink, purple and red rough material. Photo © Vincent Pardieu / GIA.

But let's forget about rumors and stories and concentrate on the stones we saw during the expedition. It is interesting to note that most of the stones the authors saw while visiting the area were blue sapphires. No milky or geuda type stones have so far been seen from the new discovery site. This is very different from the situation commonly encountered at other Malagasy deposits like Ilakaka or Toamasina where more than 90% of the production is commonly composed of stones that will need heat treatment to have a chance of becoming blue and

transparent. Besides blue sapphires a significant number of orangy pink or orangy red stones, often hosting some blue areas and which appear similar in some respects to the stones mined from Winza in Tanzania, are also produced in significant quantities. Overall though the production from Didy is more about blue sapphires that it was in Winza.



Figure 41: A fine and clean orangy red ruby weighing about 15 carats seen in Ambatondrazaka such orangy red stone is not without reminding the rubies from the Winza deposit in Tanzania. Photo © Vincent Pardieu / GIA.



Figure 42: A parcel of fine blue sapphires from Didy weighing between 3 and 15 carats seen in Ambatondrazaka. Photo © Vincent Pardieu / GIA.



Figure 43: A large rough sapphire, reportedly from Didy, weighing about 40 carats, with strong blue, pink and red color zoning with an overall dark purple color. Photo © Vincent Pardieu / GIA.

Most of the time the rough had sharp edges and some limited indications of alluvial transportation indicating that the deposit is obviously, so far, only secondary in nature.

RUBIES AND SAPPHIRES FROM DIDY: A PRELIMINARY DESCRIPTION.

The blue sapphires, the rubies and the bicolor stones produced from the area were found to be of an iron rich metamorphic type after examination in the GIA Laboratory Bangkok.

Iron rich metamorphic type blue sapphires are so far mostly known to originate from deposits like Mogok in Burma (Myanmar), Tunduru, Uмба and Winza in Tanzania, Andrebabe and Mandraka/Toamasina in Madagascar and more recently from Kataragama in Sri Lanka. On the other hand the rubies look to be gemologically close (and also probably geologically), from what is known, to stones from Winza in Tanzania and Montepuez in Mozambique.

Several very interesting samples are currently being studied at the GIA Laboratory in Bangkok and a complete publication about these new stones will be published soon.

In the meantime we have decided to invite you, after traveling with us to the new deposit, to now travel with us inside these beautiful gems and discover their fascinating internal world.

THE INTERNAL WORLD OF DIDY RUBIES AND SAPPHIRES:

A microscopic study of the internal features seen in a large volume of this new material revealed many inclusions commonly seen in rubies and sapphires from other known deposits.

Some unusual features were also noted in the stones from the new deposit near Didy.

Whilst blue sapphires from Didy often exhibited strong color zoning, many other stones had an even blue coloration. With such stones inclusion scenes displaying evenly blue colored areas, folded healed fissures (Figure 53, Figure 54, Figure 55, Figure 61) associated with quite large euhedral colorless transparent crystal inclusions (Figure 53, Figure 54) are reminiscent of what can be seen in blue sapphires from Mogok in Burma that share similar relatively high iron content. The most common crystal inclusion we saw in the blue sapphires from Didy we studied are euhedral zircon crystals as single crystals (Figure 47) or in clusters (Figure 48) associated, or not, with tension fissures (Figure 49). Besides zircon crystals we also found inclusions of magnesite (MgCO_3) (Figure 44, Figure 45), apatite ($\text{Ca}_5(\text{F,Cl,OH})(\text{PO}_4)_3$) (Figure 46, Figure 51, Figure 52), and ilmenite (FeTiO_3). The presence of a carbonate like magnesite, is suggestive of a metamorphic type geological environment for the formation of these sapphires. Negative crystals associated, or not, with healed fissures were also commonly found. Needles and clouds of minute particles were also commonly encountered in the stones studied which is also of interest. One sample even hosted many clouds composed of very fine whitish particles.

The pink sapphires/rubies showed many stones where visible color zoning, commonly with some pink and purple areas, but also many blue color zones (Figure 78, Figure 79, Figure 80, Figure 81), was a feature. Crystal inclusions included orange euhedral garnet (Figure 67), elongated greenish amphibole, (Figure 69) and black opaque ilmenite (Figure 68) reminiscent of the unusual inclusion scenes seen in rubies from Winza (Tanzania). Healed fissures (Figure 72, Figure 73, Figure 74, Figure 75) were also commonly found. The rubies, as was the case for the blue sapphires, were found to be very transparent. We observed clouds composed of very fine minute particles in only one specimen (Figure 70, Figure 71). Rutile-like needles (or crystals) and iron rich coarse particles were not seen in any of the stones studied unlike rubies from other Malagasy ruby deposits near Andilamena, Vatomandry or Mananjary that do contain such inclusions. On the other hand long tubes, probably filled with boehmite, were seen in several specimens (Figure 72).

The following figures are intended to provide a general overview of the types of inclusions encountered in sapphires and rubies from Didy:

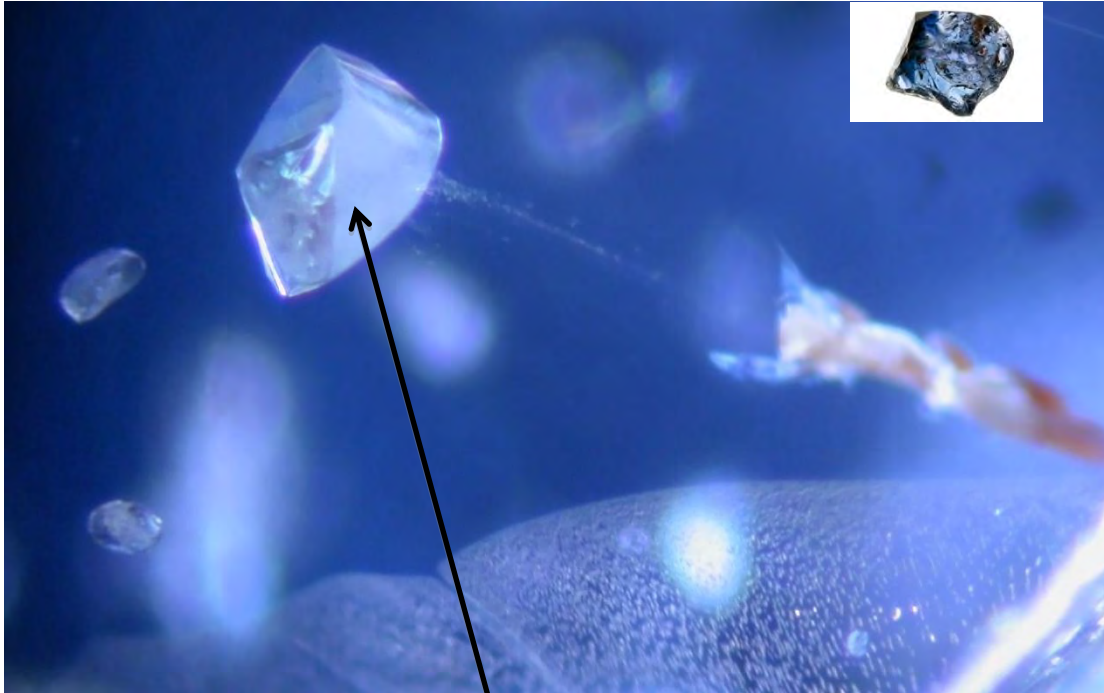
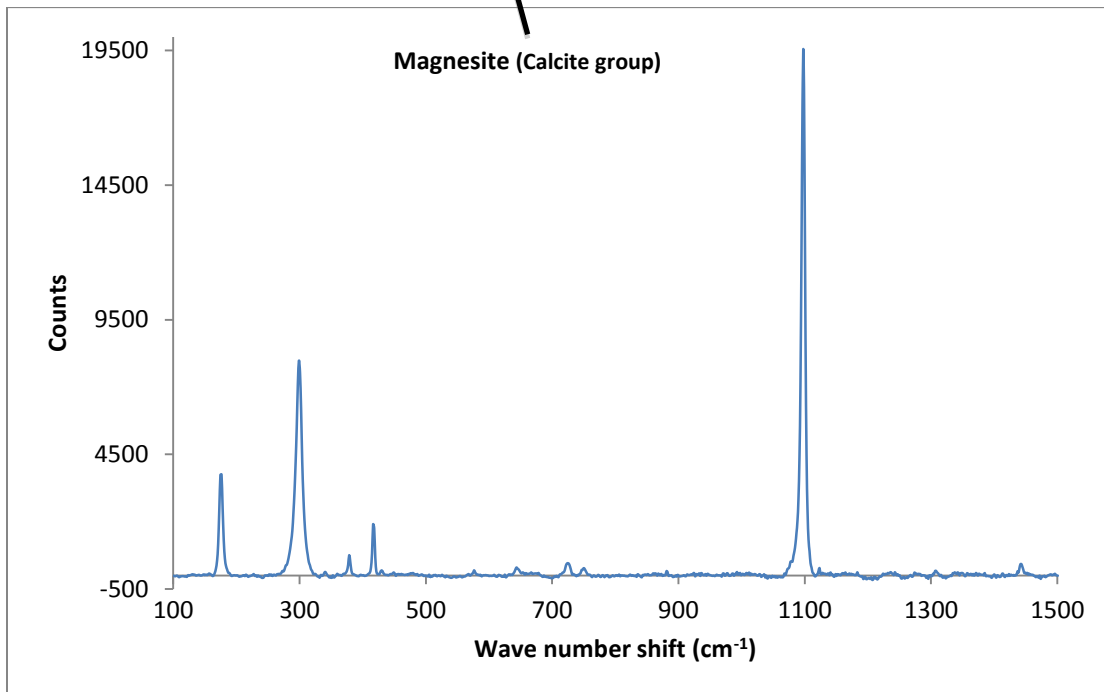


Figure 44: Magnesite crystals inclusion (identified by Raman) associated with a thin comet-tail like structure. Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.



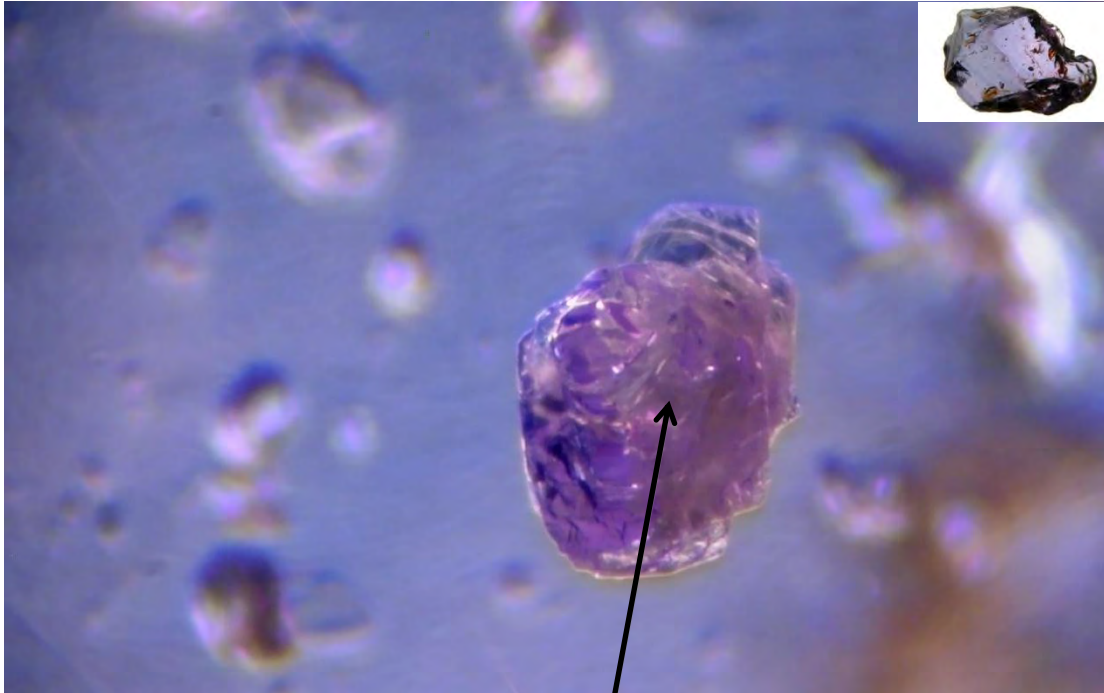
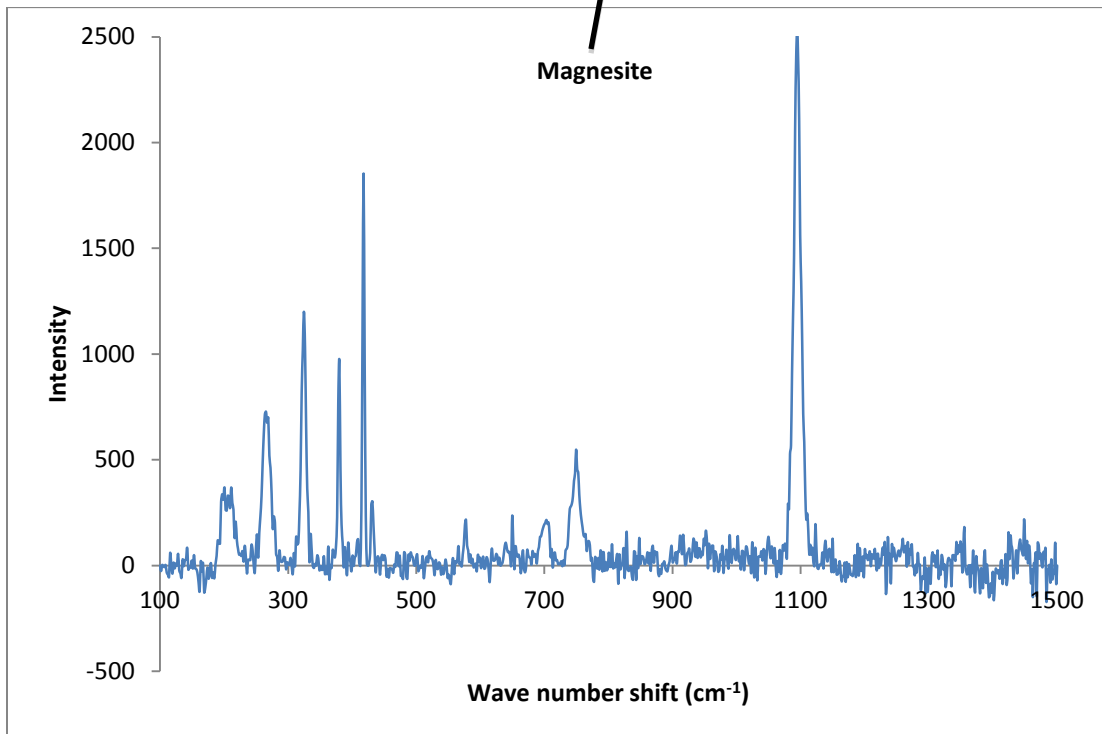


Figure 45: High luster magnesite crystal inclusion (identified with Raman) in a blue sapphire from Didy. Darkfield illumination, magnified 60x. Photo © Vincent Pardieu / GIA.



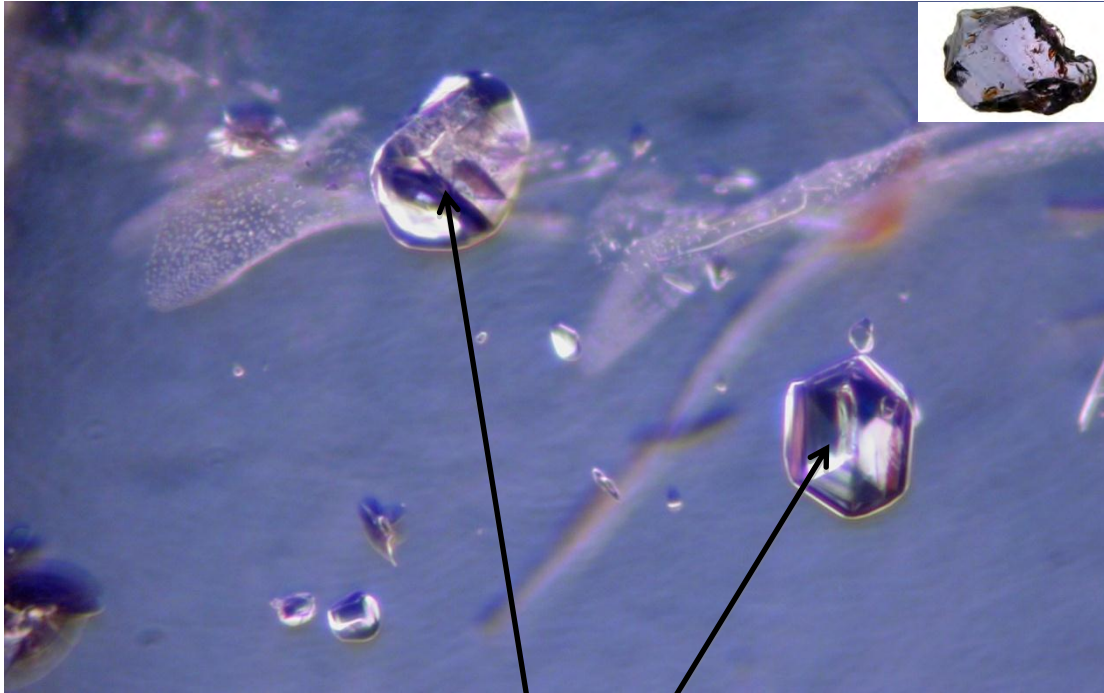
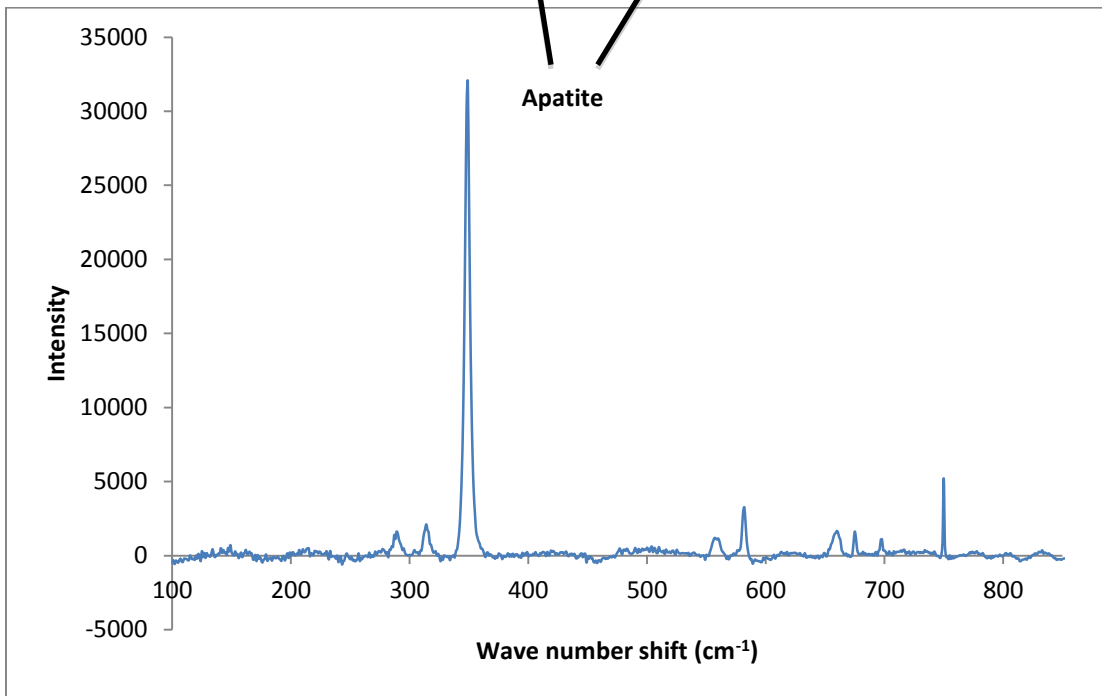


Figure 46: Apatite inclusions (identified with Raman). Darkfield illumination, magnified 60x. Photo © Vincent Pardieu / GIA.



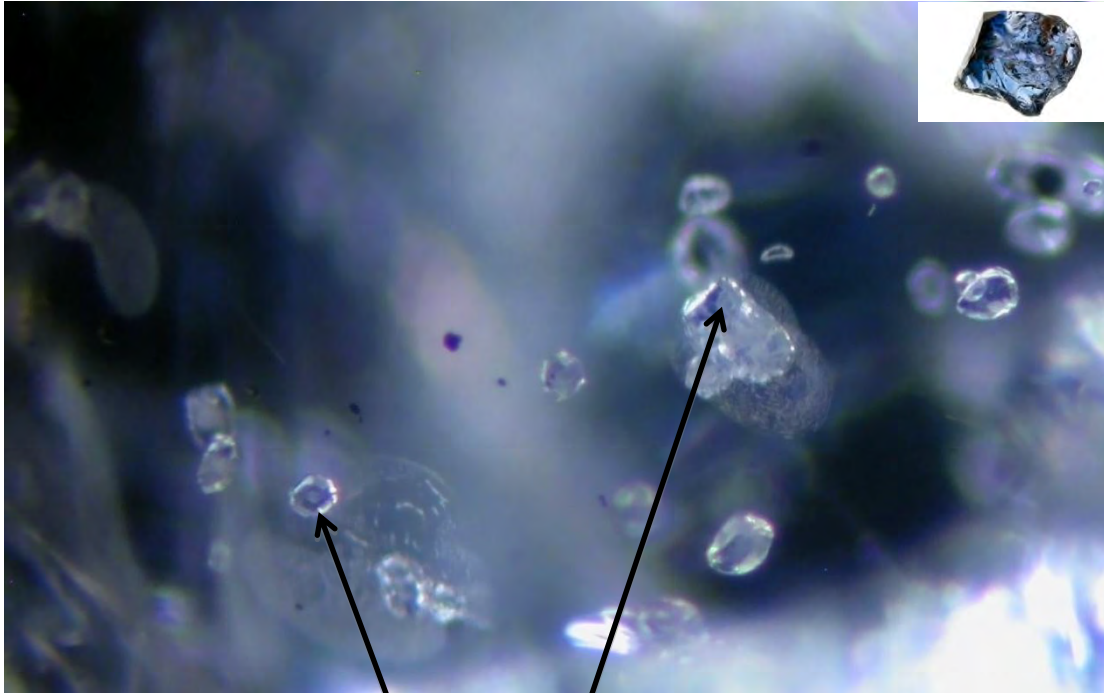
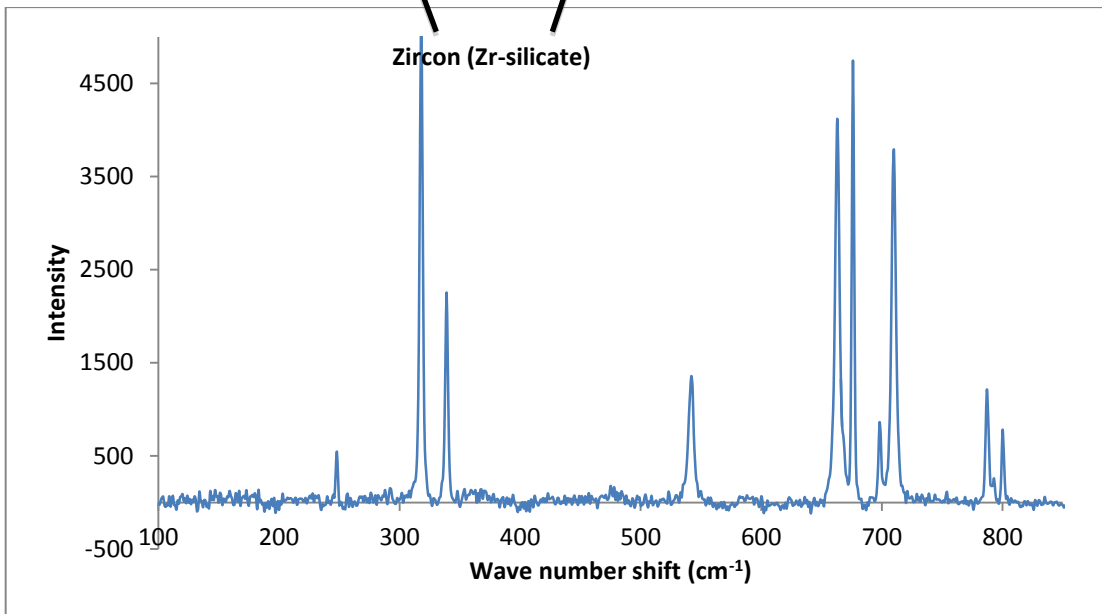


Figure 47: Zircon crystal inclusions (identified by Raman) associated with healed fissures and small black opaque crystals seen in a blue sapphire from Didy. Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.



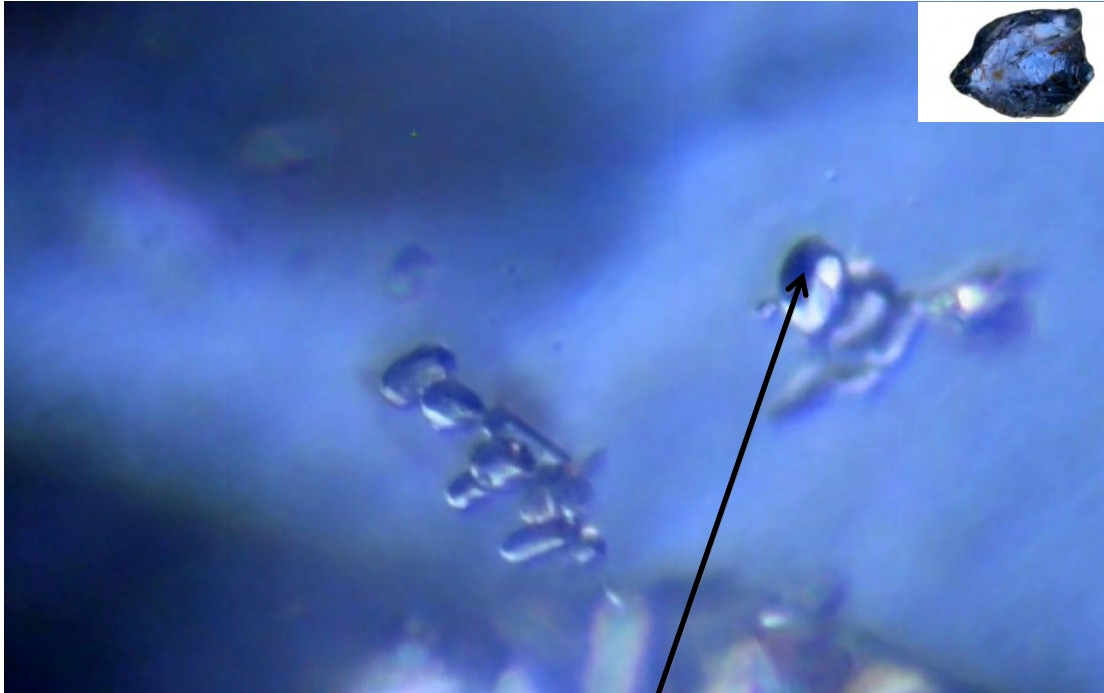
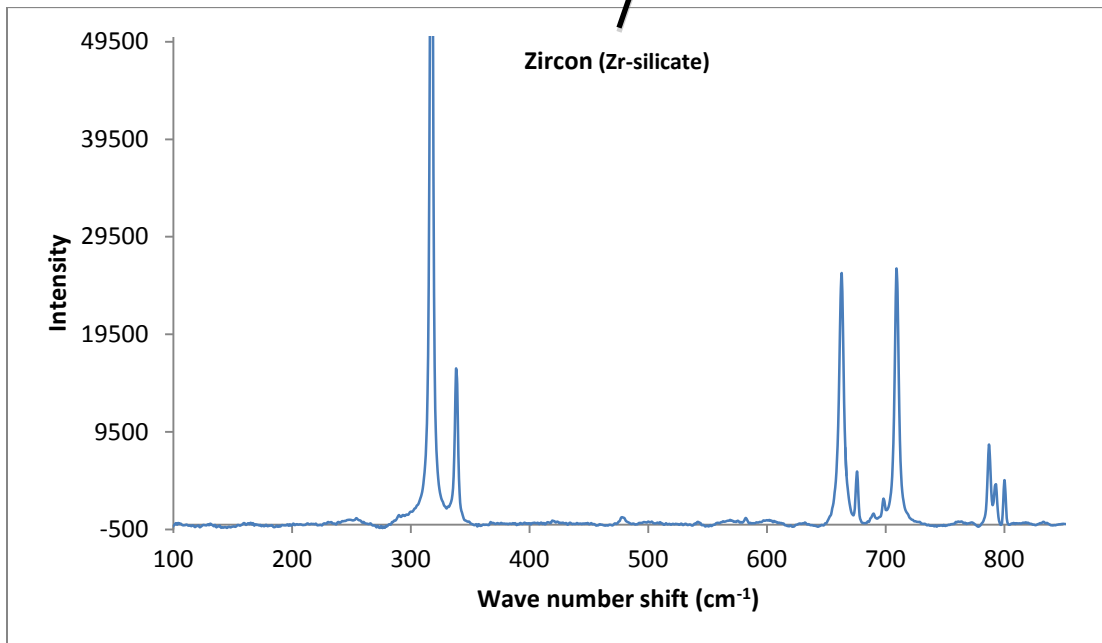


Figure 48: Zircon crystals (identified by Raman) forming clusters, an inclusion scene commonly seen in Madagascar sapphires, Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.



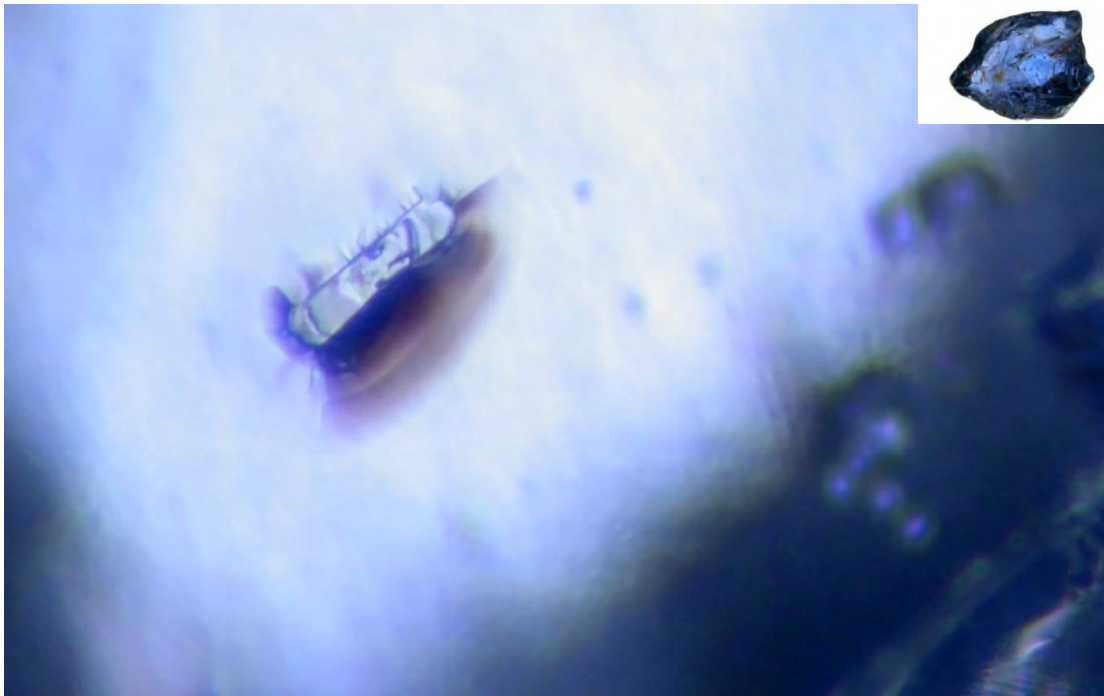


Figure 49: Another zircon crystal (also identified by Raman) this time as a single crystals associated with unhealed tension fissures. Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.

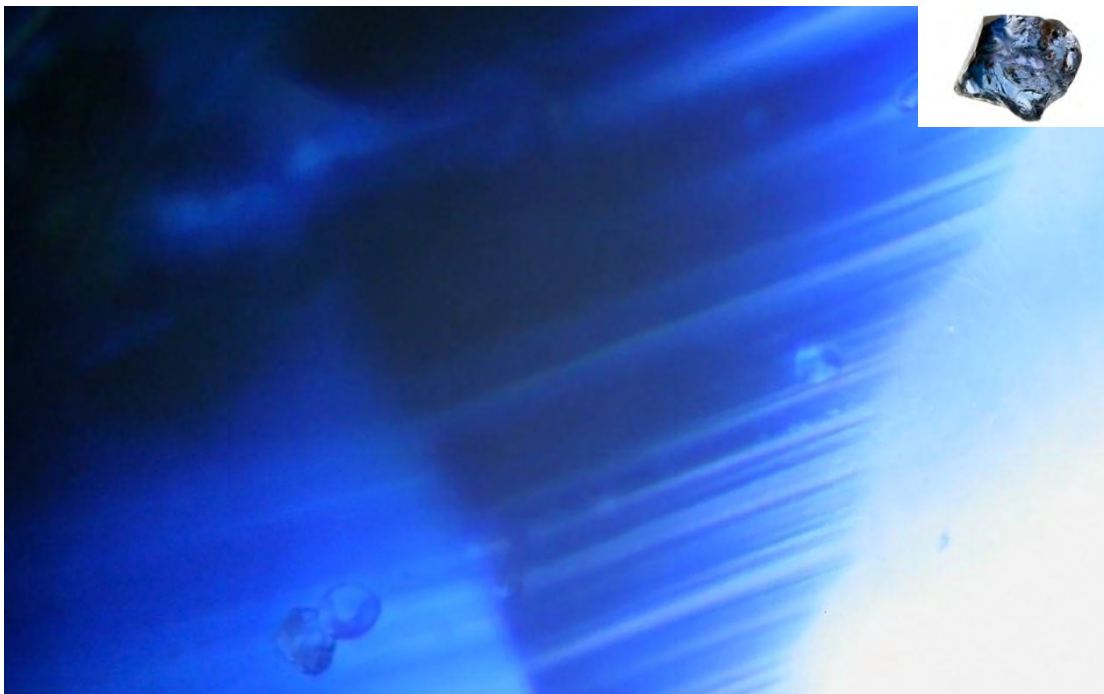


Figure 50: Strong blue/colorless color banding associated with zircon-like crystals in a sapphire from Didy, Madagascar. Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.

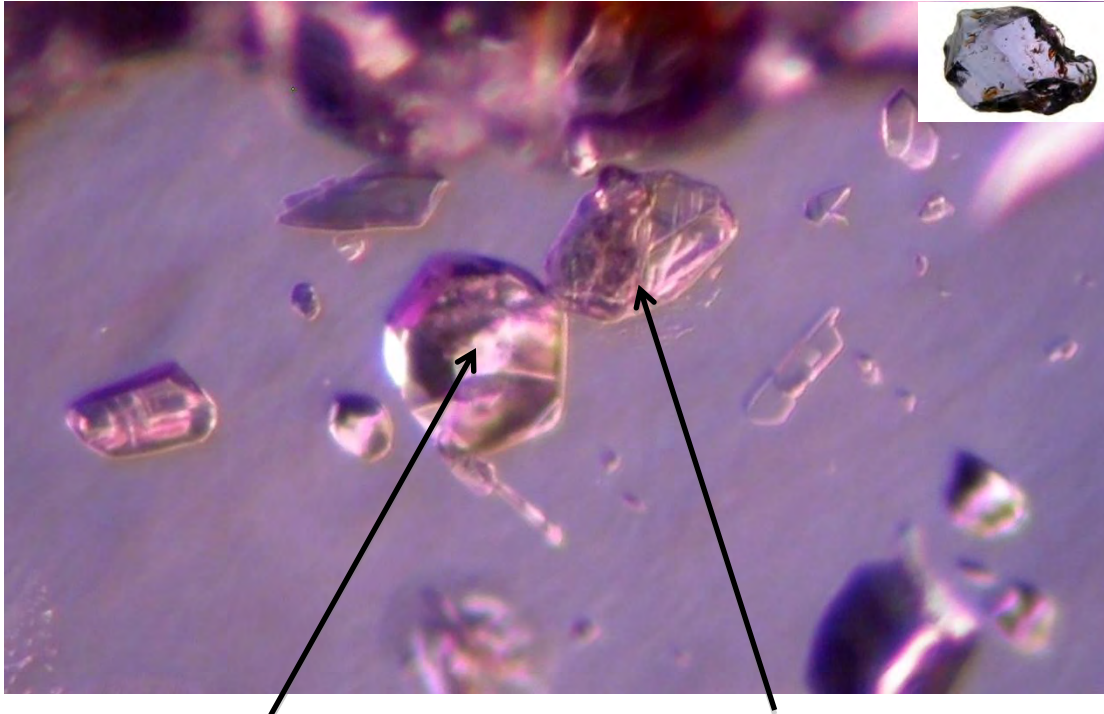


Figure 51: Hexagonal crystal of apatite (identified with Raman) associated with some mica like crystals. Photo © Vincent Pardieu / GIA.

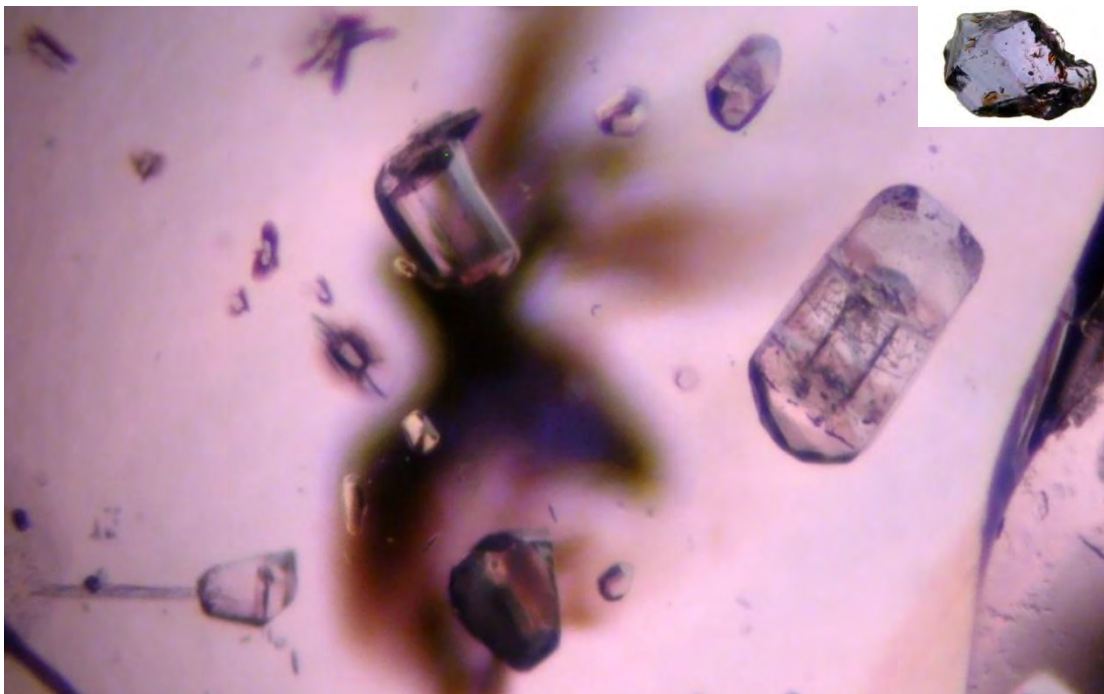


Figure 52: Additional photo of fine euhedral transparent apatite crystals in association with small zircon crystals surrounded by unhealed fissures. Apatite and Zircon are the two most commonly encountered inclusions in sapphires from Didy. Photo © Vincent Pardieu / GIA.



Figure 53: Folded healed fissures associated with isolated euhedral zircon crystals (identified with Raman). Such an inclusion scene is often associated with Burmese sapphires. Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.

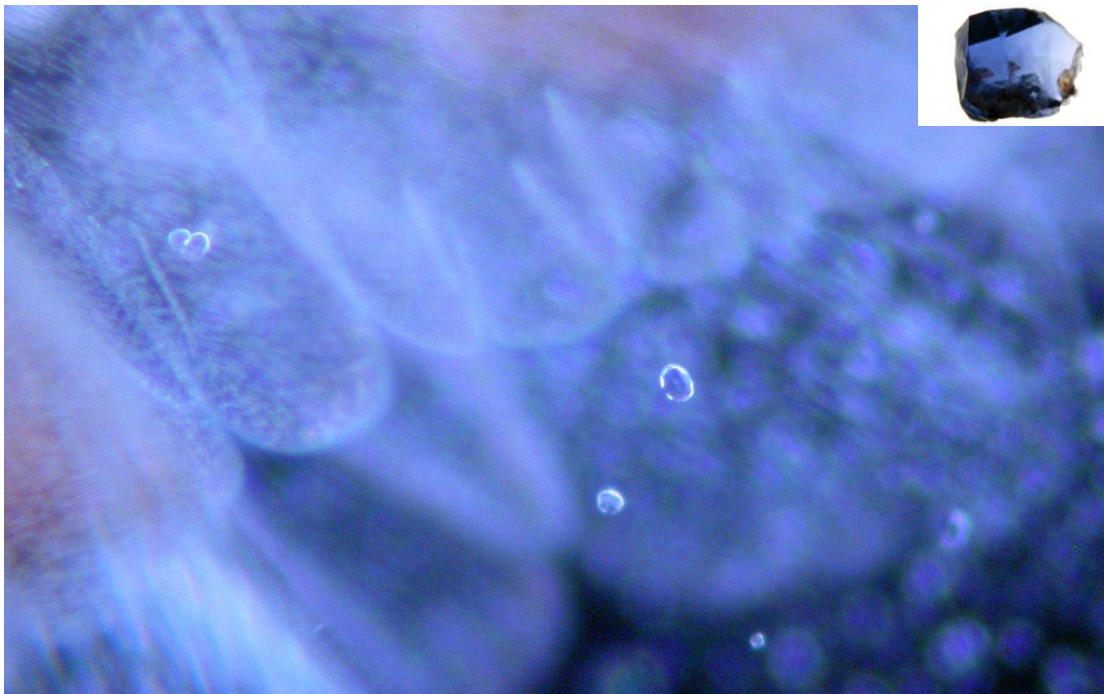


Figure 54: Same view as in the previous photo but this time focused on the euhedral transparent, colorless zircon crystals. Darkfield illumination, magnified 40x. Photo © Vincent Pardieu / GIA.

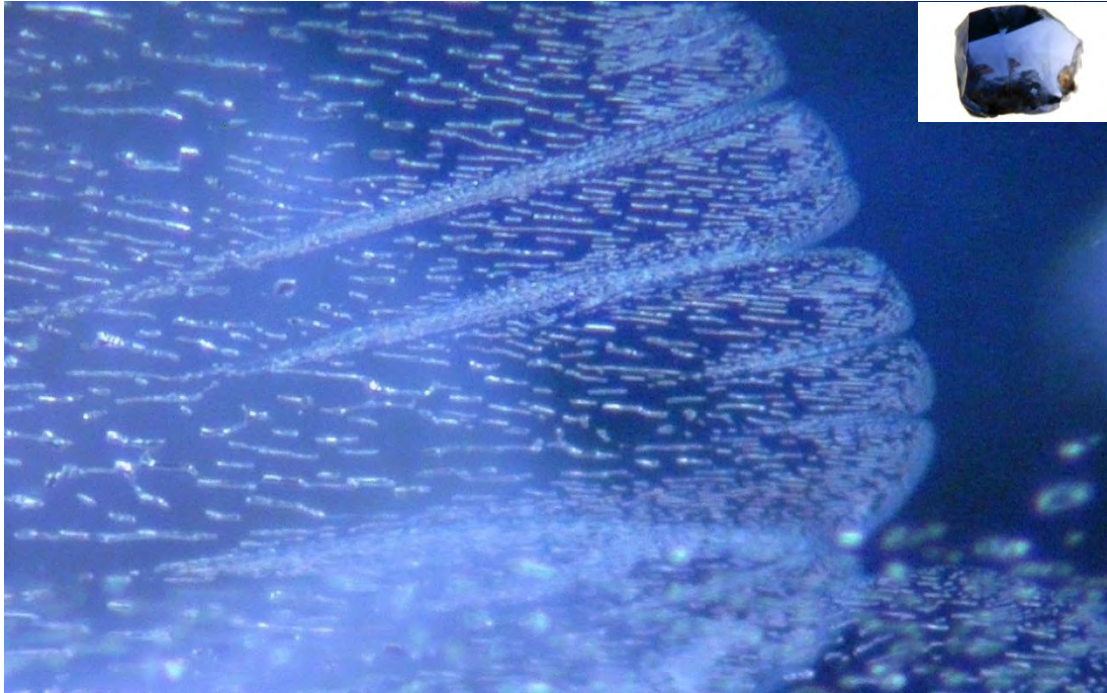


Figure 55: Details of the folded healed fissures in a blue sapphire from Didy, Madagascar. Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.

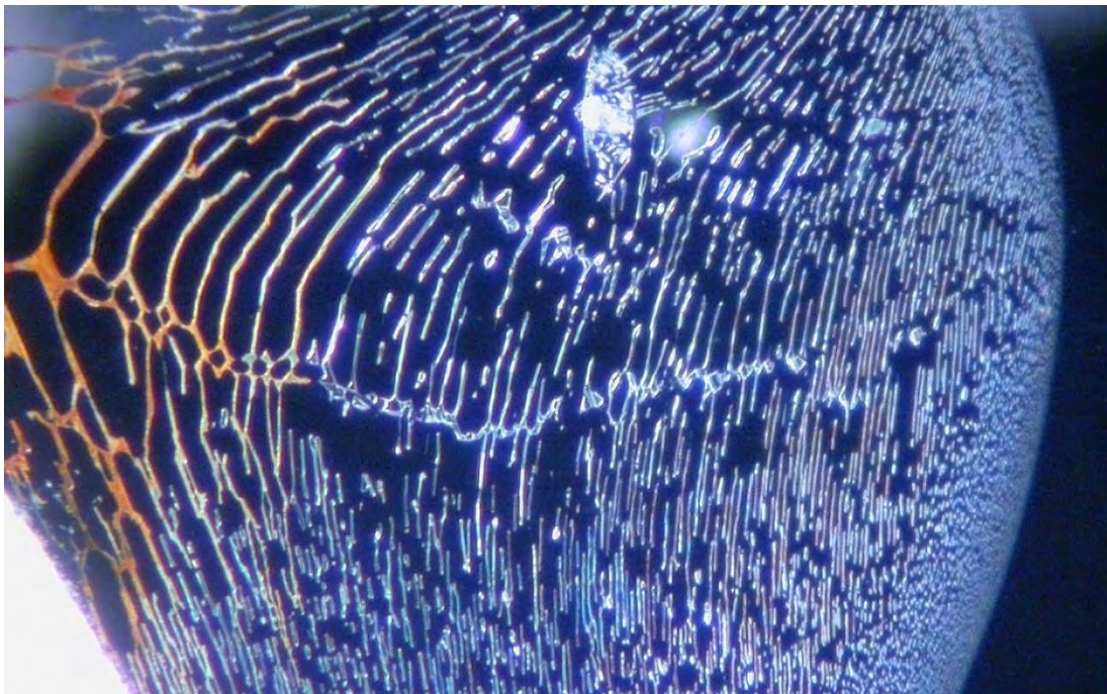


Figure 56: Healed fissure partially filled with a dry orange limonite-like foreign substance in GIA reference sample 100305162422. Photo © Vincent Pardieu / GIA.

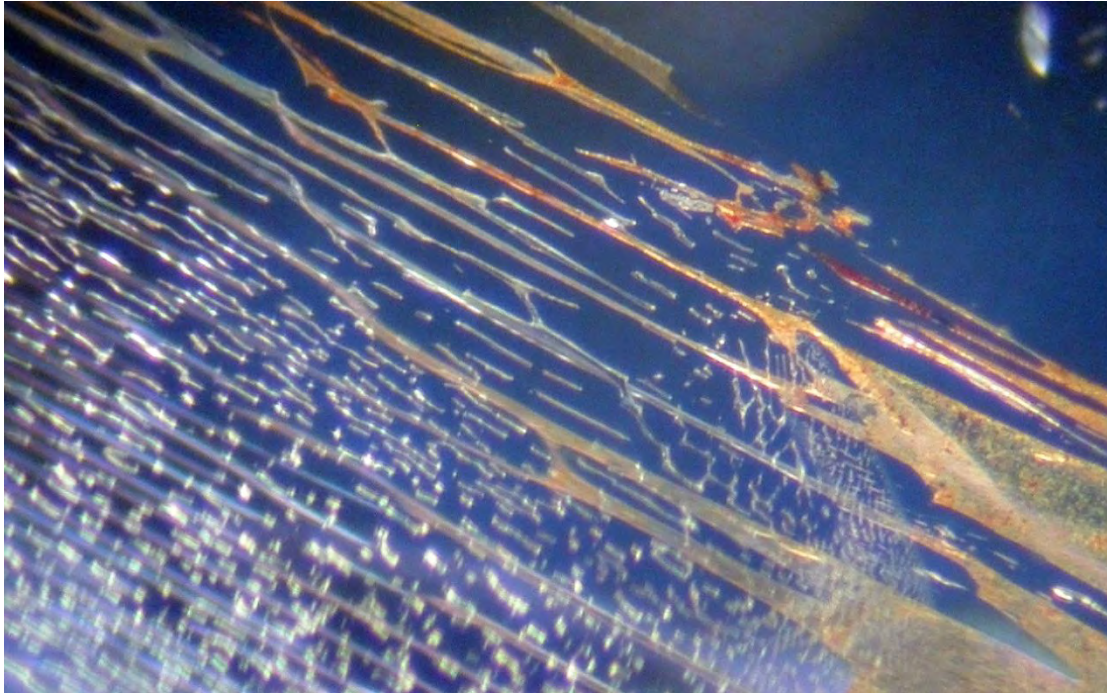


Figure 57: Healed fissure partially filled with a dry orangy limonite-like foreign substance in GIA reference sample 100305162427. Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.

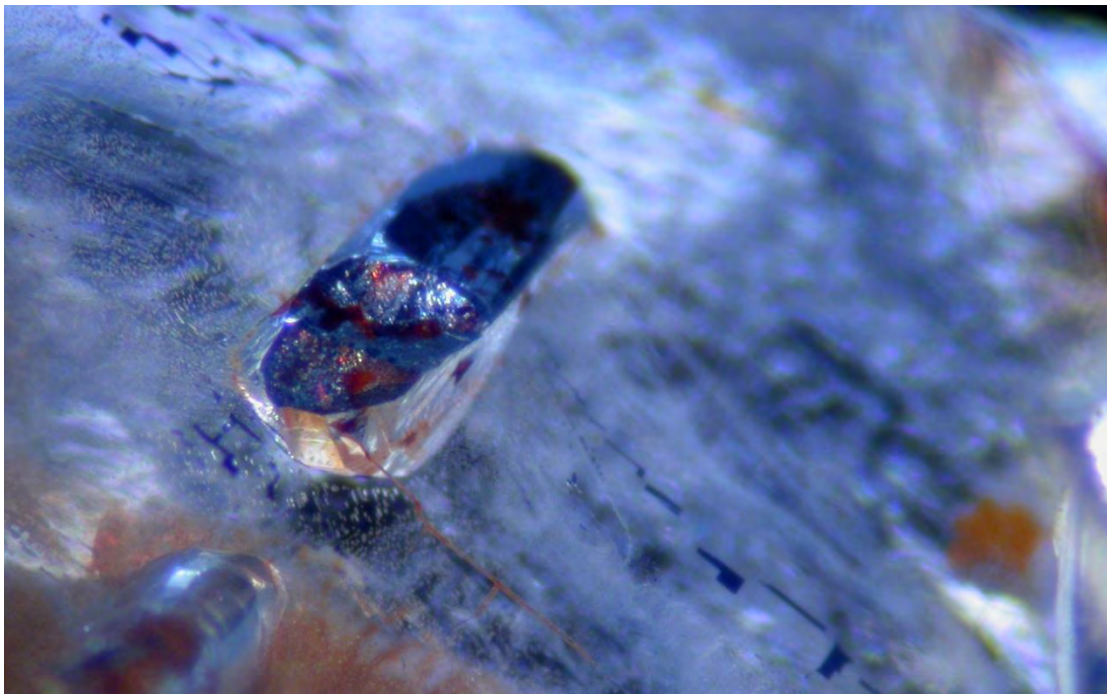


Figure 58: A large negative crystal, easy to recognize here with its high luster, associated with a large healed fissure in GIA reference sample 100305162422. Photo © Vincent Pardieu / GIA.

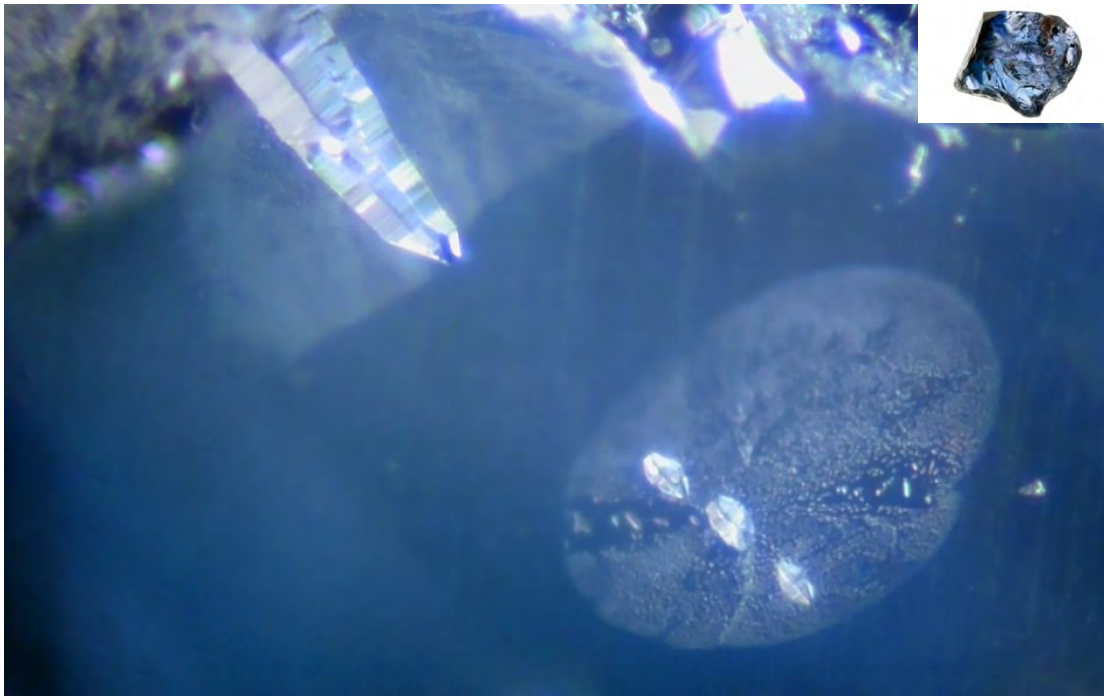


Figure 59: High luster negative crystals associated with healed fissures. Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.

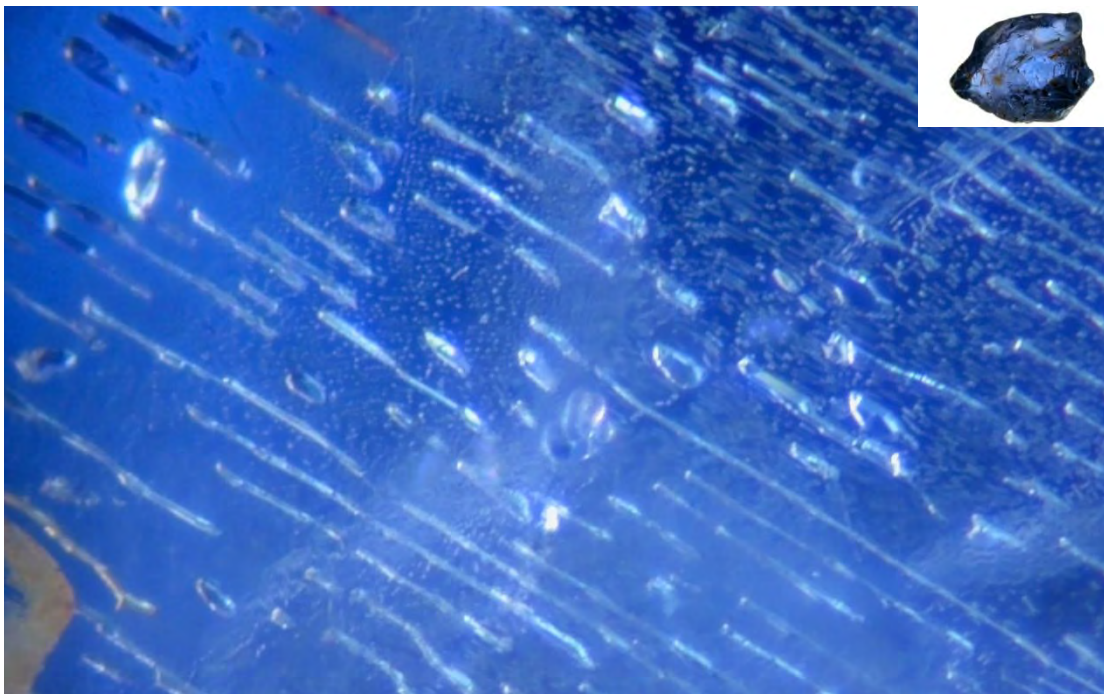


Figure 60: Details of healed fissures in a sapphire from Didy, Madagascar. Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.

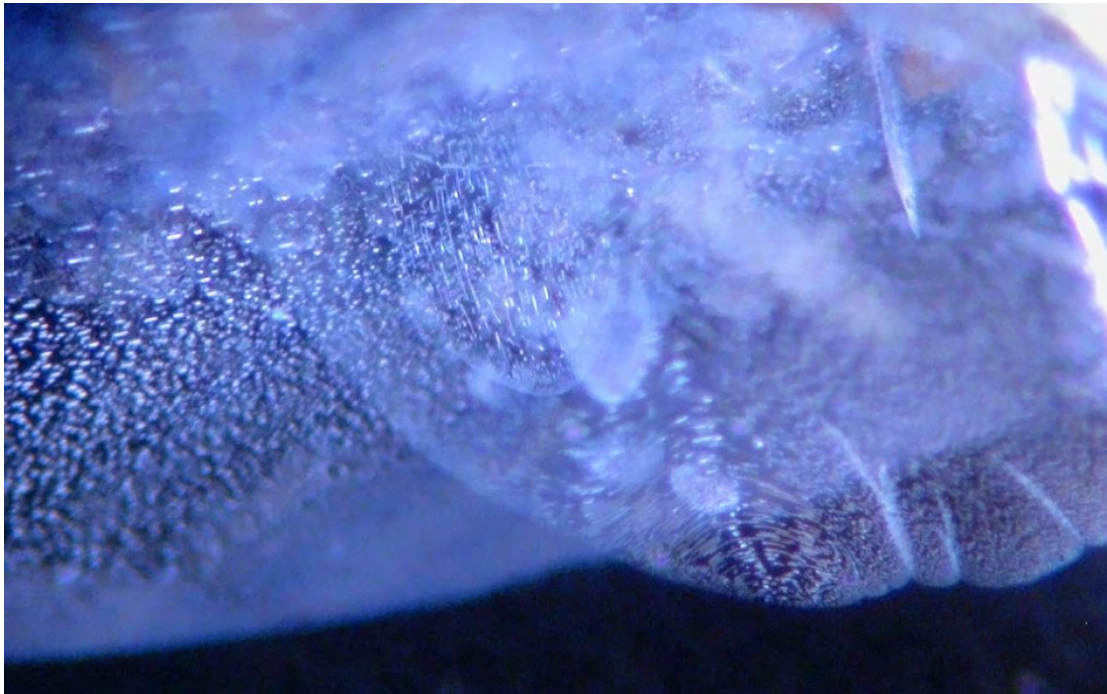


Figure 61: Healed fissures with a folded aspect seen in GIA reference sample 100305162416 using dark field illumination and 40x magnification. Photo © Vincent Pardieu / GIA.

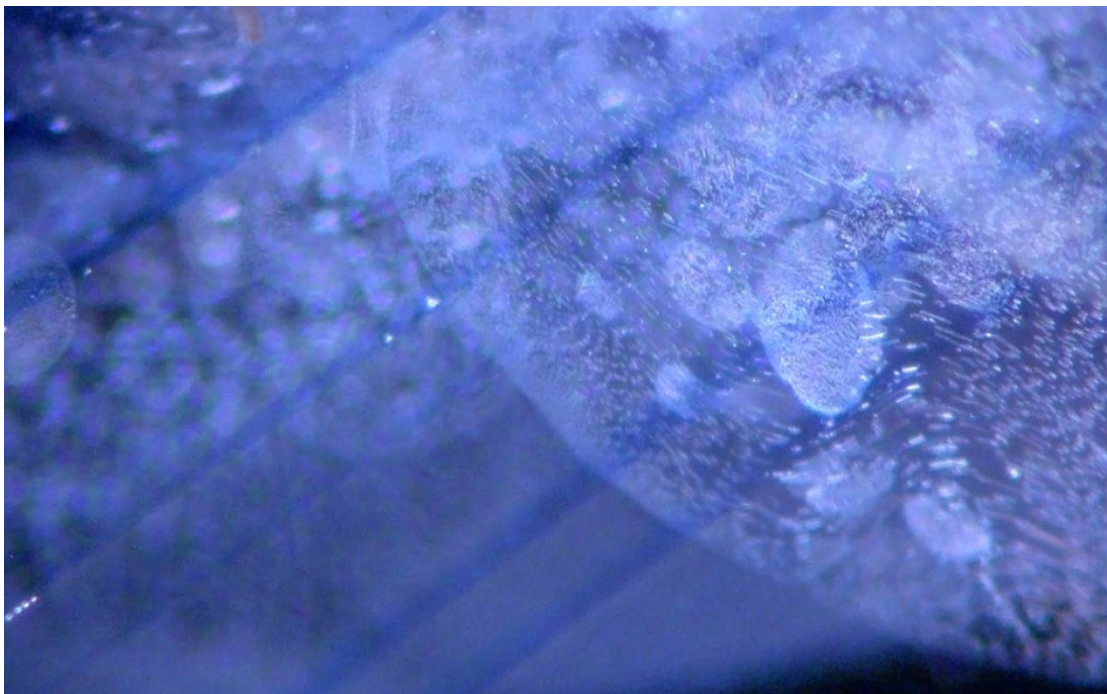


Figure 62: Details of the healed fissures associated with strong blue color bands in GIA reference sample 100305162416 using dark field illumination and 40x magnification. Photo © Vincent Pardieu / GIA.

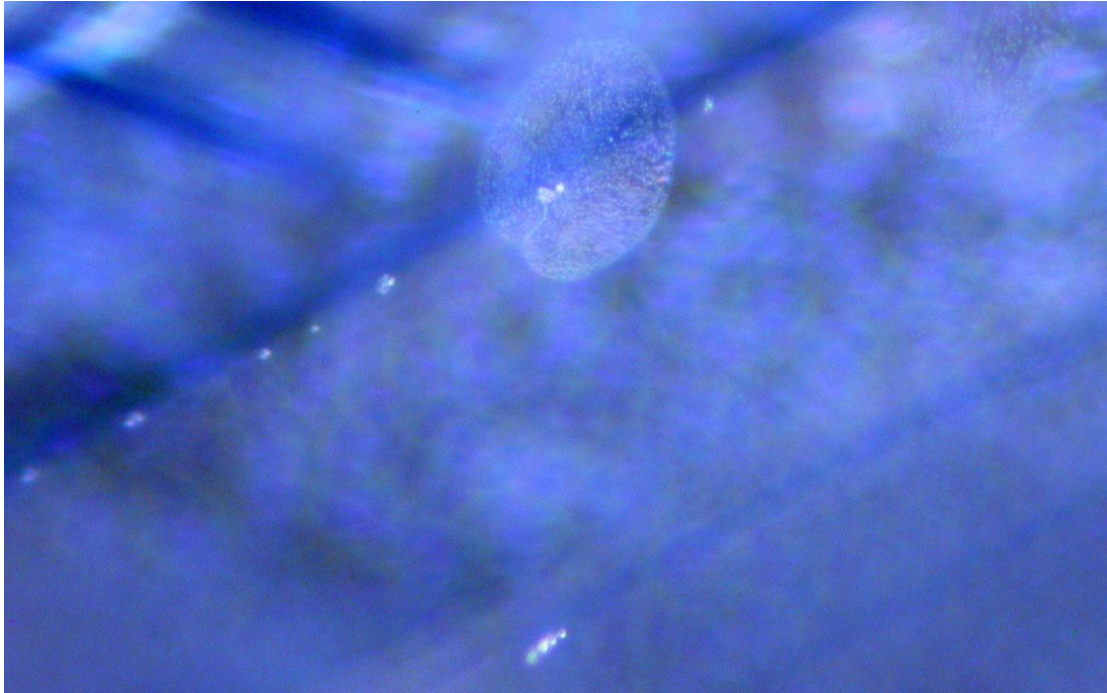


Figure 63: Details of small negative crystals arranged along a deep blue color band and associated with a healed fissure in GIA reference sample 100305162416 using dark field illumination and 40x magnification. Photo © Vincent Pardieu / GIA.

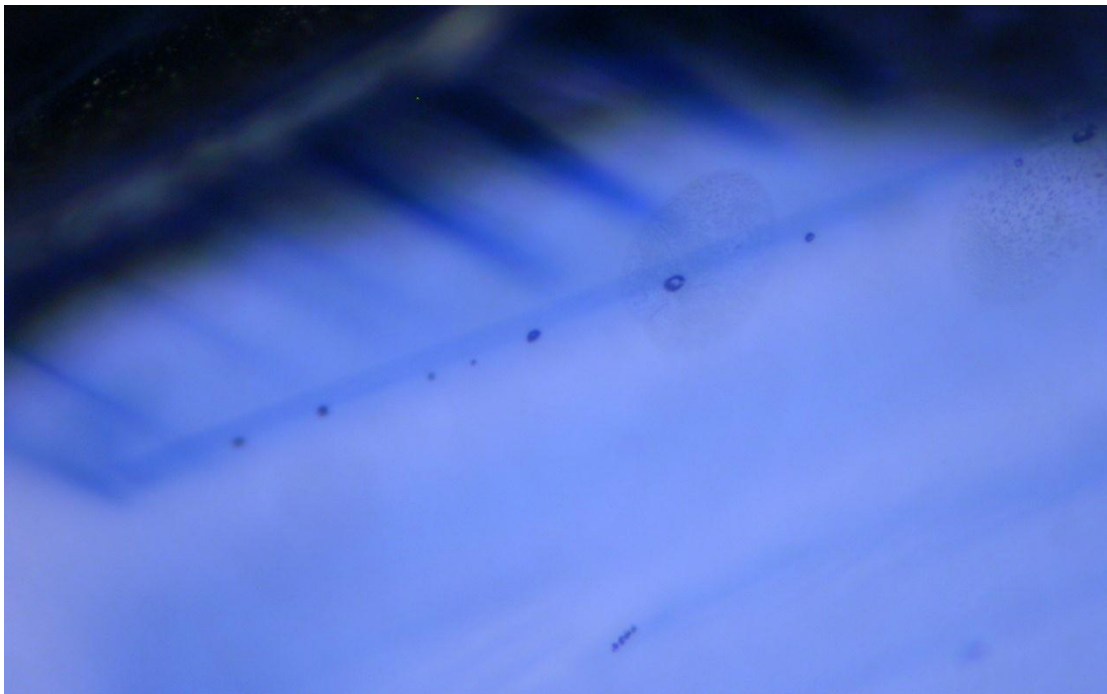


Figure 64: Details of small negative crystals arranged along a deep blue color band and associated with a healed fissure in GIA reference sample 100305162416 using this time bright field illumination and 35x magnification. Photo © Vincent Pardieu / GIA.

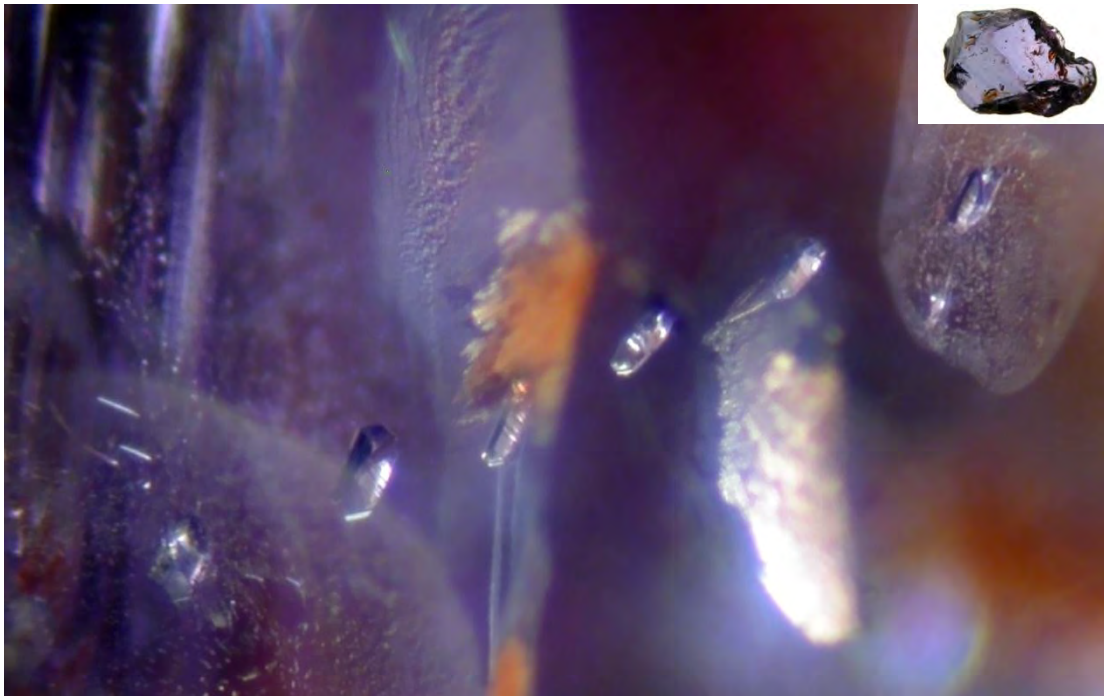


Figure 65: Group of aligned negative crystals associated with healed fissures in a pink/blue sapphire from Didy, Madagascar. Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.

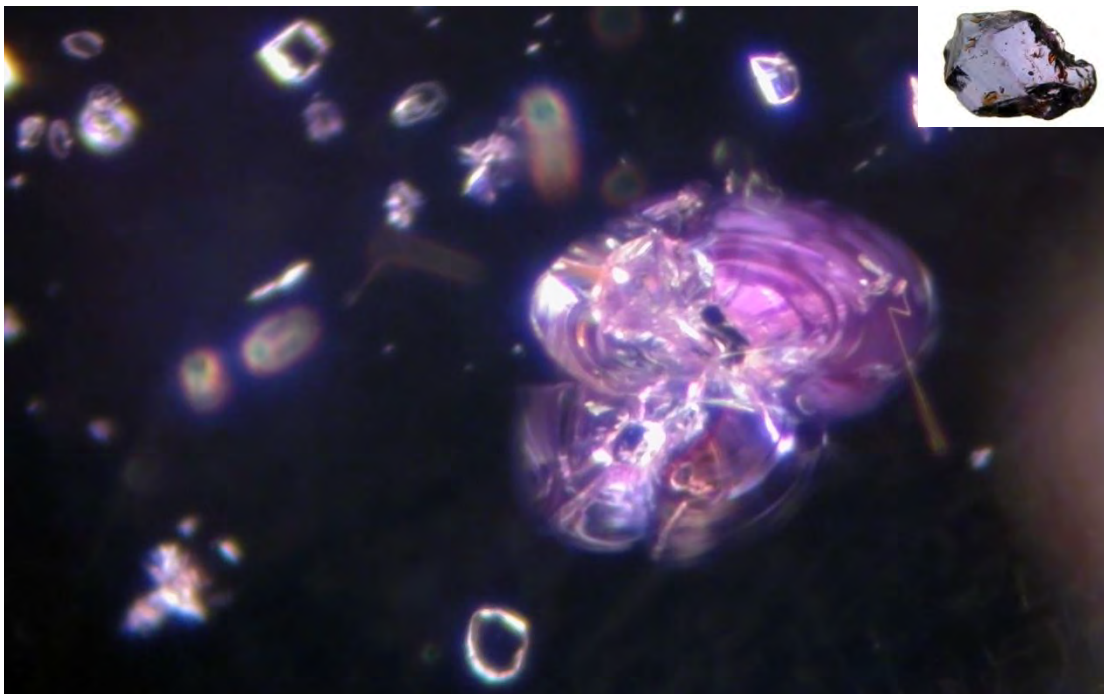


Figure 66: Black opaque (unknown) crystal inclusions associated with unhealed fissures seen in a sapphire from Didy. Darkfield illumination, magnified 50x, Photo © Vincent Pardieu / GIA.

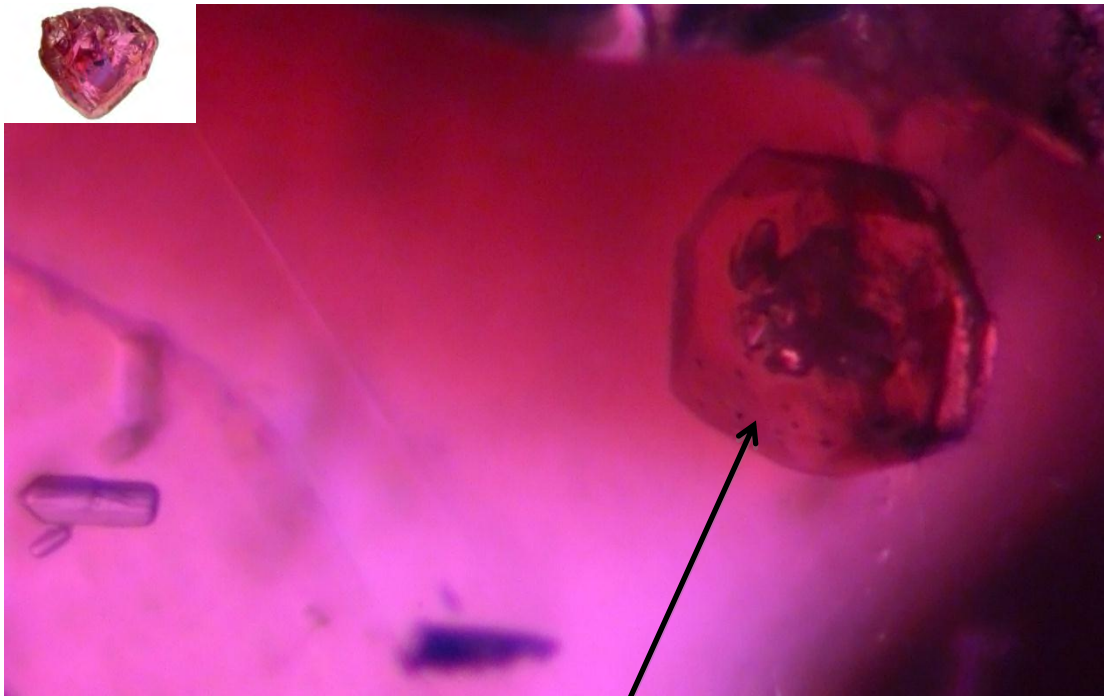
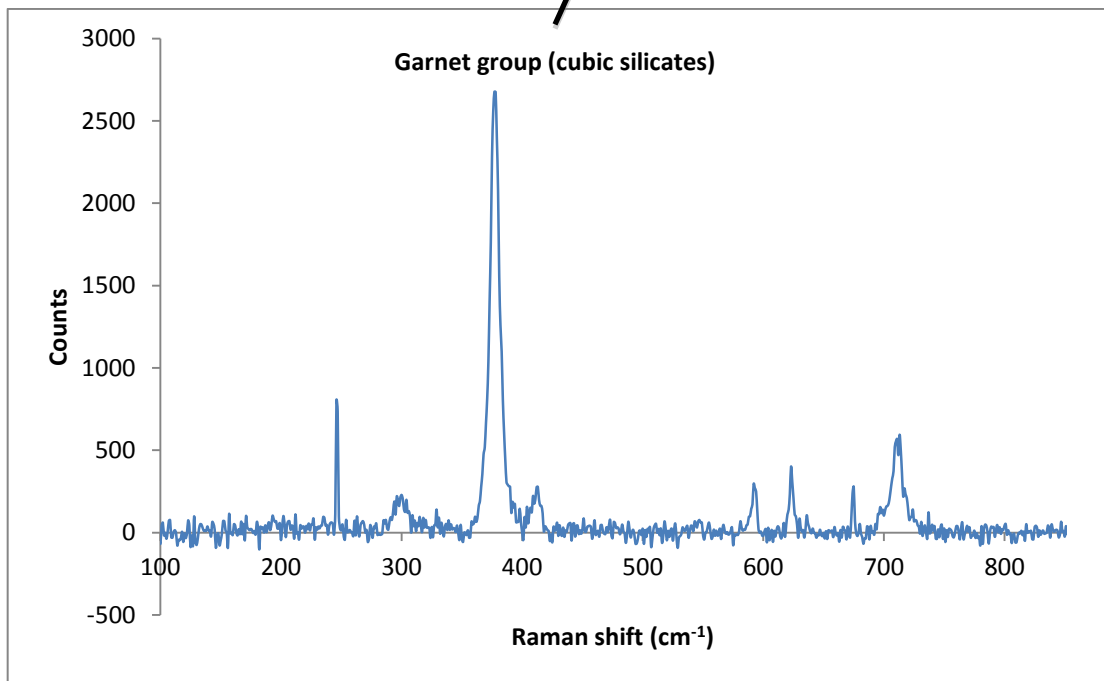


Figure 67: Orange garnet inclusion (identified with Raman) in a ruby from Didy, Madagascar. Such inclusions were commonly seen in rubies from Winza, Tanzania. Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.



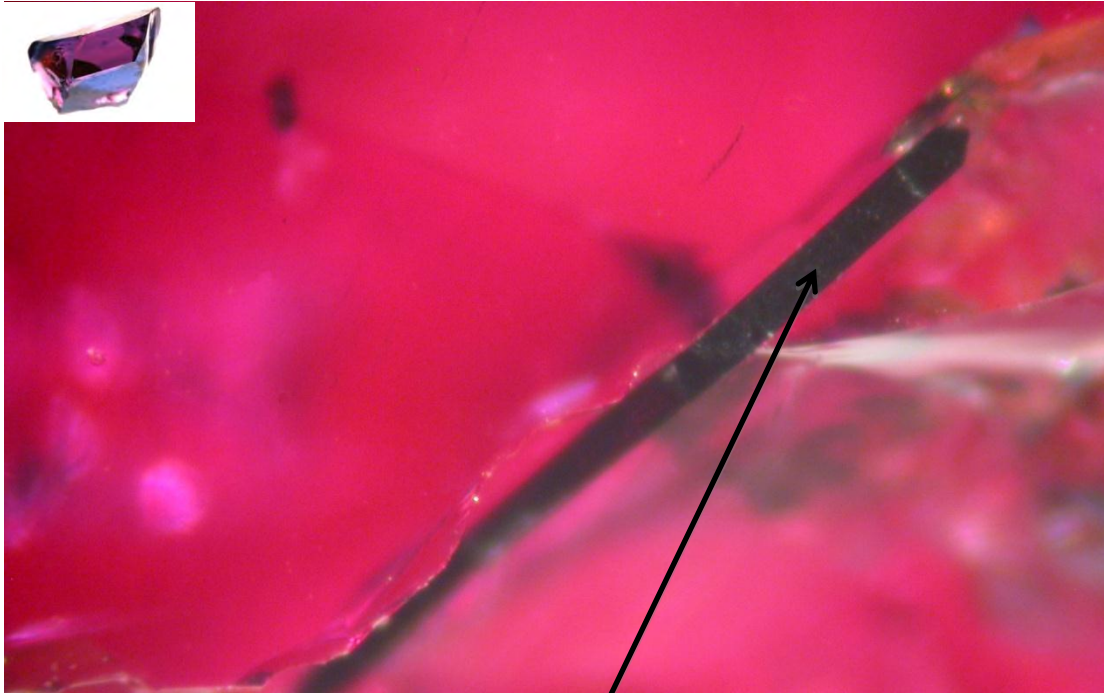
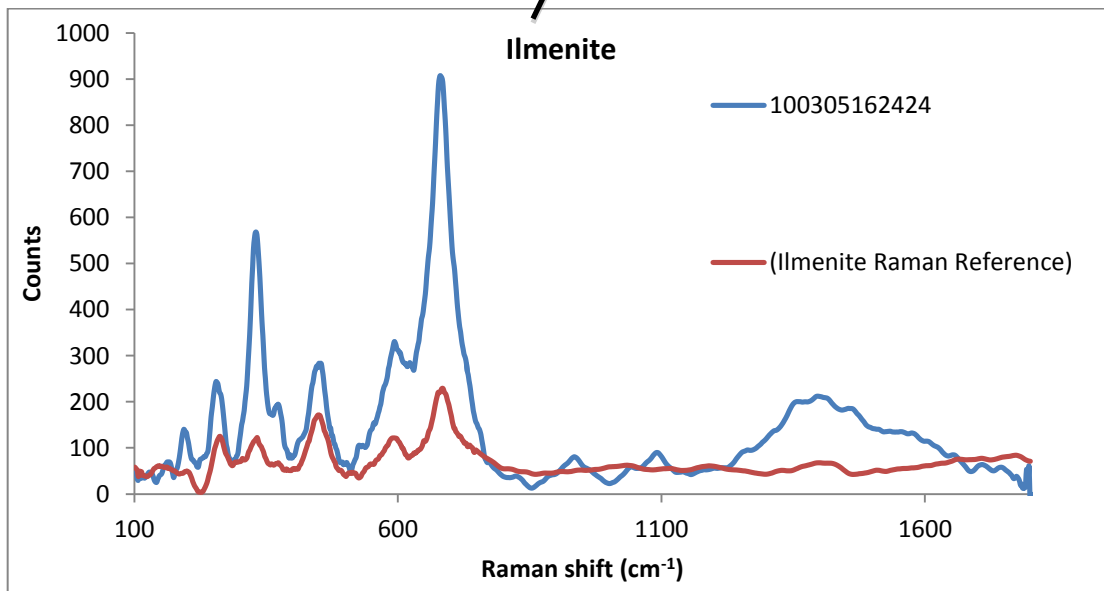


Figure 68: Details of a black opaque crystal inclusion present in sample 100305162424. The inclusion was identified as ilmenite using Raman and LA-ICP-MS. Darkfield illumination, magnified 40x. Photo © Vincent Pardieu / GIA.



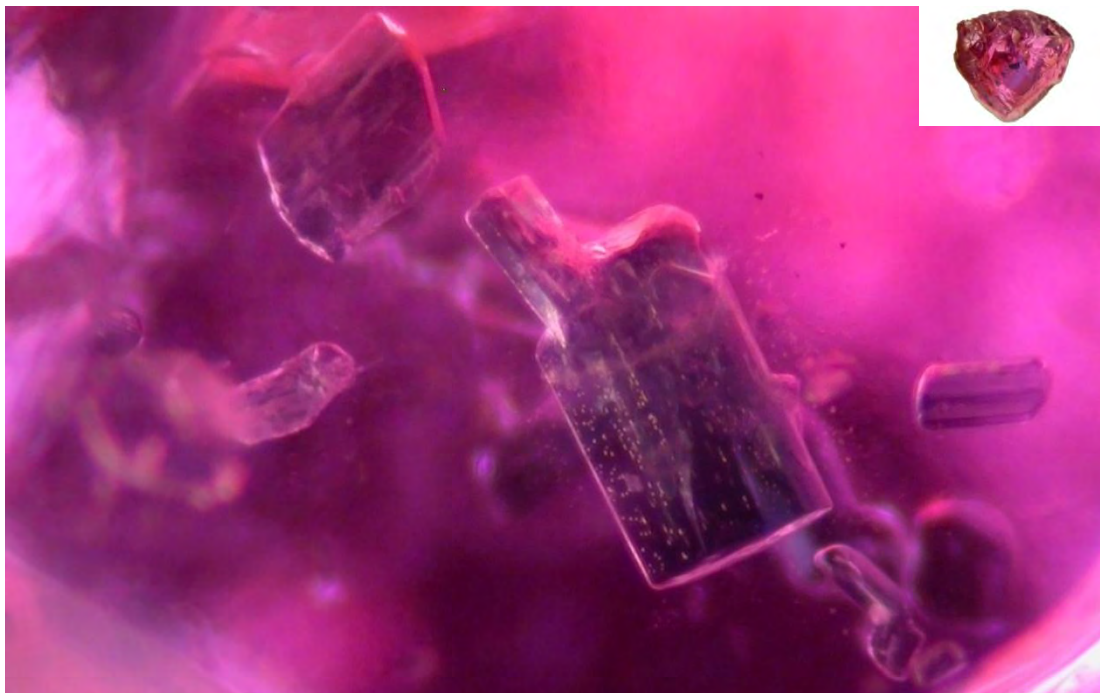


Figure 69: Euhedral dark greenish transparent crystal (probably hornblende amphibole) in a ruby from Didy Madagascar. Amphibole inclusions are commonly seen in rubies from Winza (Tanzania) and Montepuez (Mozambique). Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.



Figure 70: Minute particles are rarely seen in rubies and sapphires from Didy, nevertheless they can sometimes be found, as we can see here. Darkfield illumination, magnified 25x. Photo © Vincent Pardieu / GIA.

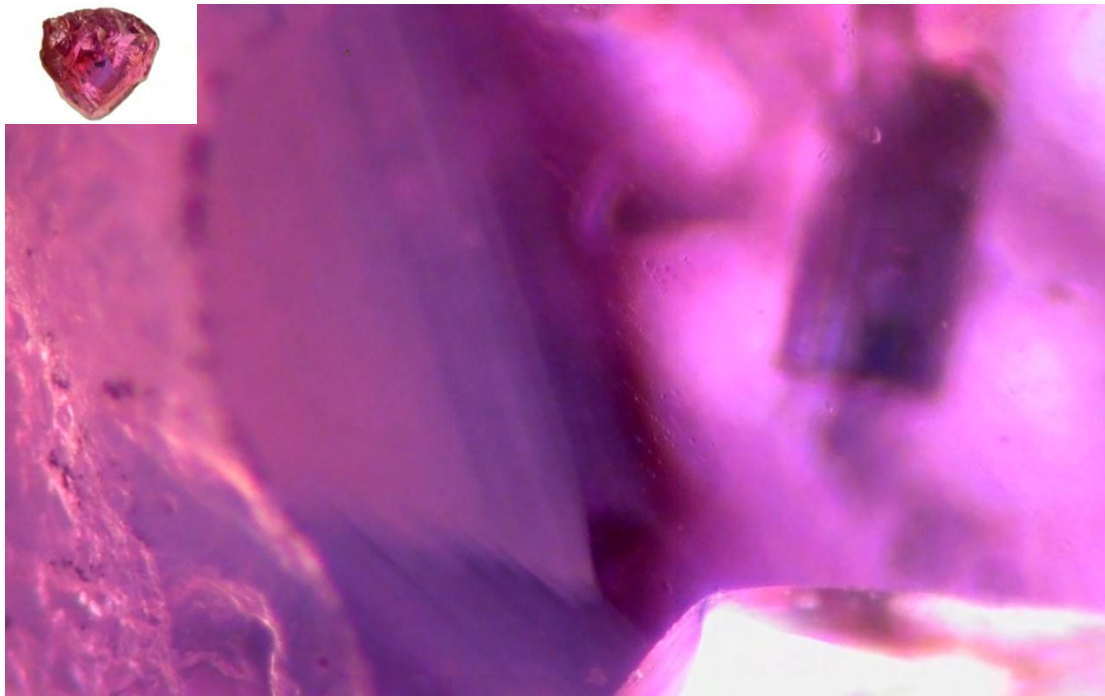


Figure 71: Details of the dense whitish cloud of minute particles seen in the previous photo. In fact the cloud is not homogeneous but appears to be formed of narrow bands associated with the host crystal structure. Darkfield illumination, magnified 30x. Photo © Vincent Pardieu / GIA.



Figure 72: Details of a healed fissure composed of minute negative crystals associated with a long tube, probably filled with boehmite. Darkfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.

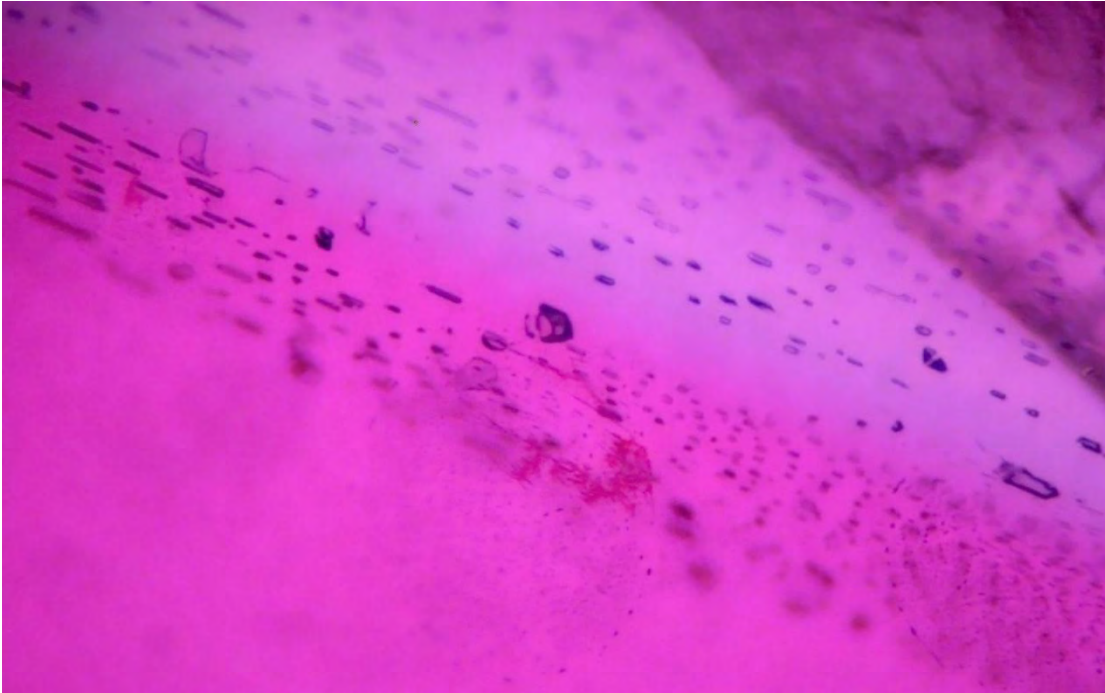


Figure 73: Details of the healed fissure visible at the junction between the red central area and the light purplish pink area. It is mainly composed of negative crystals. Brightfield illumination, magnified 60x. Photo © Vincent Pardieu / GIA.

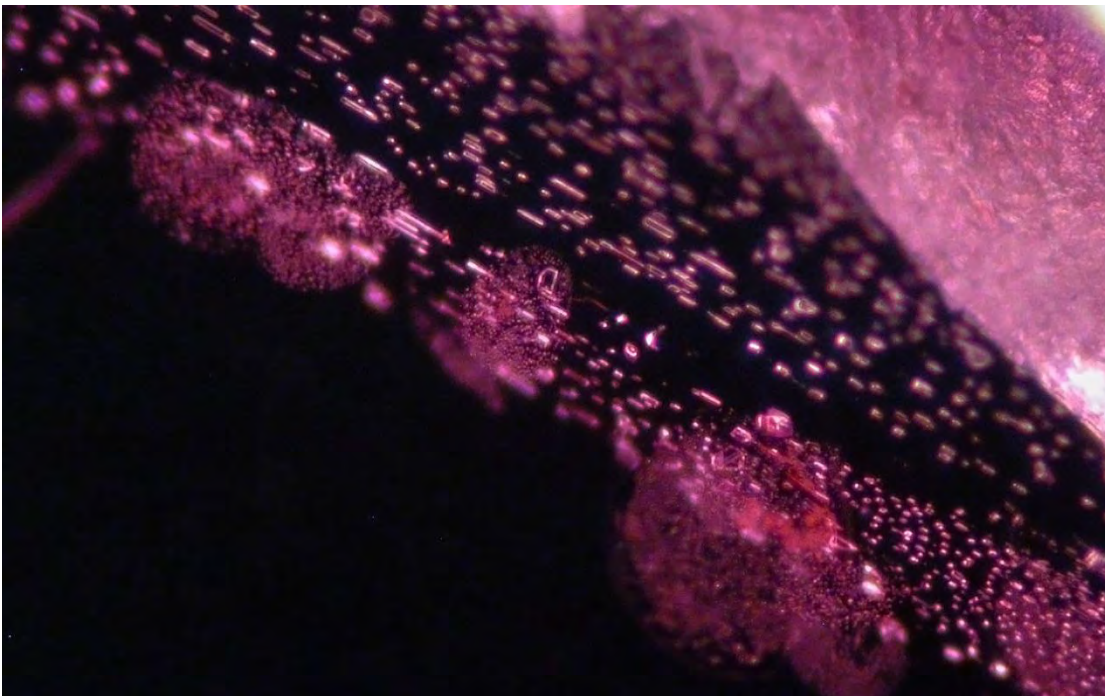


Figure 74: Details of the healed fissure visible at the junction between the red central area and the light purplish pink area. The negative crystals are associated with secondary healed fissures. Darkfield illumination, magnified 60x. Photo © Vincent Pardieu / GIA.



Figure 75: Healed fissure in a sapphire from Didy together with a very strong pink/blue color zoning. The fissure is associated with a many colorless zircon and dark opaque ilmenite-like inclusions. Brightfield illumination plus fiber-optics, magnified 40x. Photo © Vincent Pardieu / GIA.

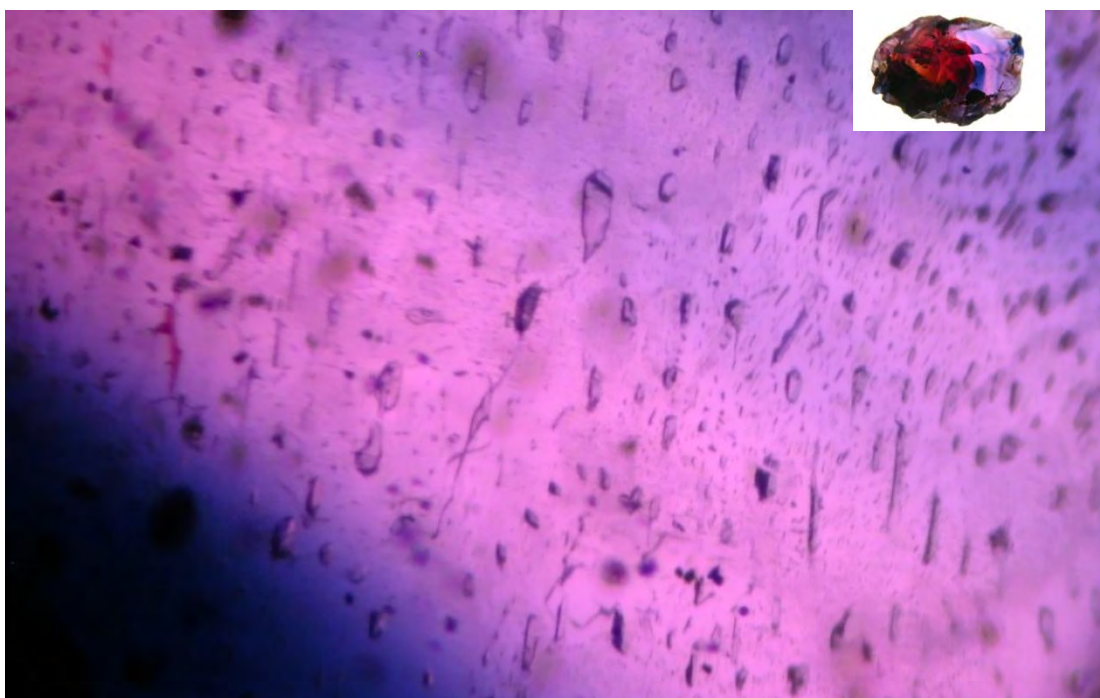


Figure 76: Details of some healed fissure in a sapphire from Didy with very strong blue/pink color zoning. Brightfield illumination, magnified 50x. Photo © Vincent Pardieu / GIA.

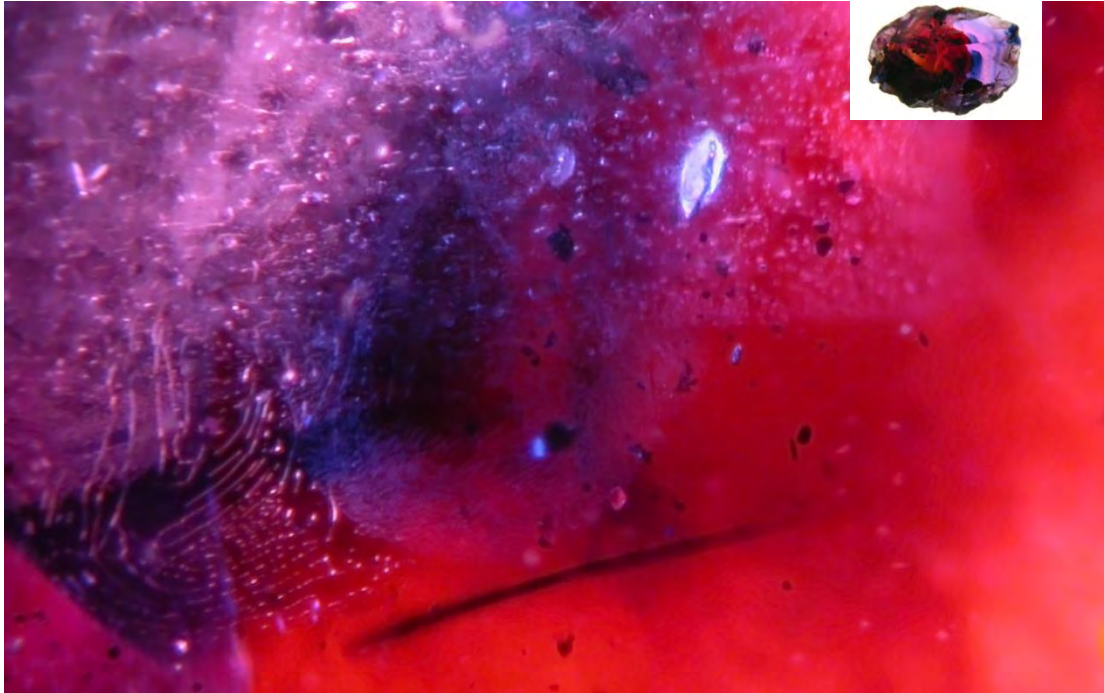


Figure 77: Healed fissures and mineral inclusions, mainly colorless zircon-like crystals and dark opaque ilmenite-like crystals, in a strongly color zoned sapphire from Didy. Darkfield illumination, magnified 30x. Photo © Vincent Pardieu / GIA.

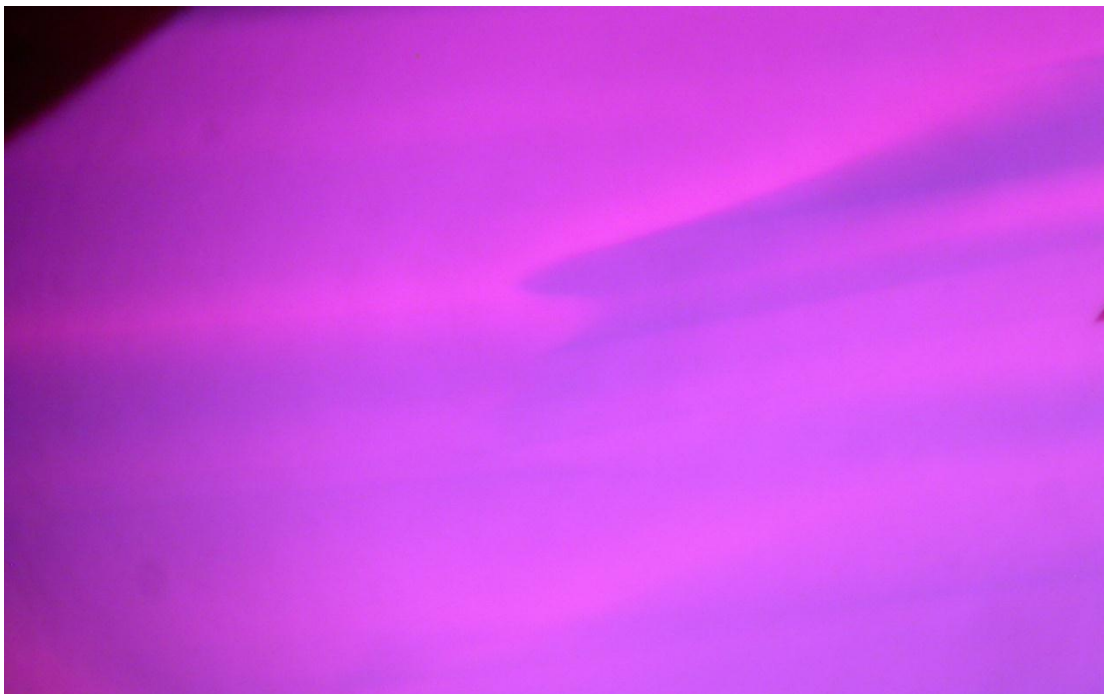


Figure 78: Details of the color zoning of sample 100305162424 seen in the direction of the c-axis using bright field illumination and 40x magnification. Darkfield illumination, magnified 40x. Photo © Vincent Pardieu / GIA.

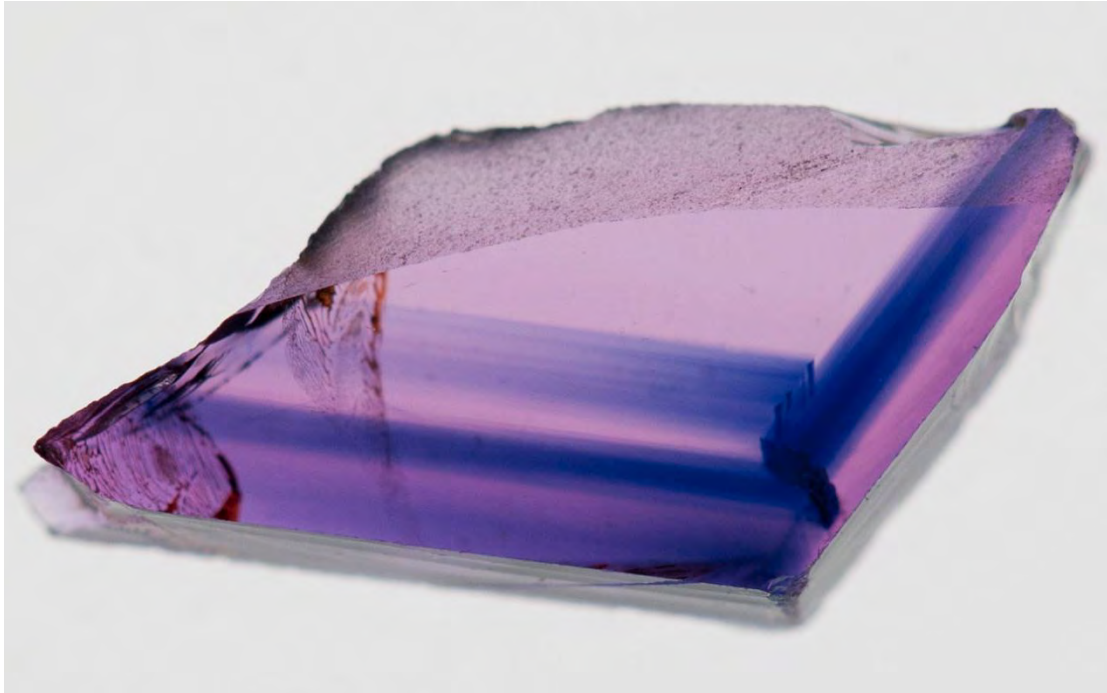


Figure 79: Views of GIA reference sample 100305162418 (E1 type; see Annex C for a description of the classification system), seen here after fabrication and weighing 0.940 carats. Brightfield illumination, magnified 20x. Photo © Vincent Pardieu / GIA.



Figure 80: Details seen in GIA reference sample 100305162418 of the strong pink/blue color zoning seen in the direction of the c-axis, some areas appear quite an even blue. Brightfield illumination, magnified 80x. Photo © Vincent Pardieu / GIA.

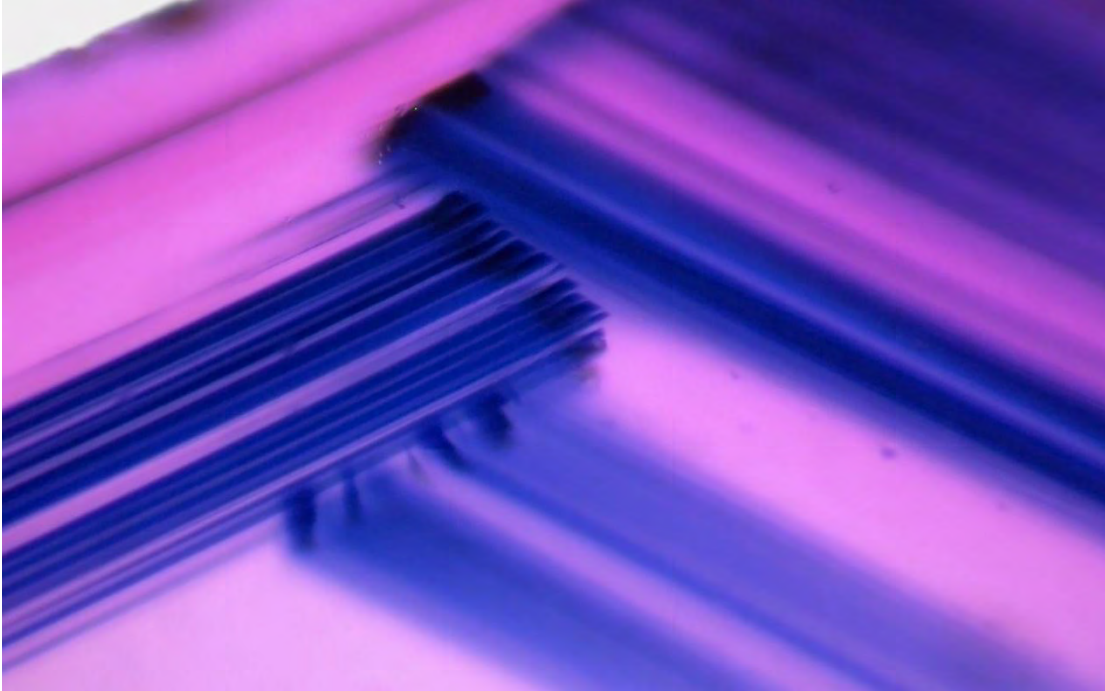


Figure 81: On tilting GIA reference sample 100305162418 by a few degrees, and looking in the direction of the hexagonal dipyramids, we can see that the area is far from being an even blue but is in fact composed of very narrow blue bands on an otherwise pink area. Brightfield illumination, magnified 80x. Photo © Vincent Pardieu / GIA.

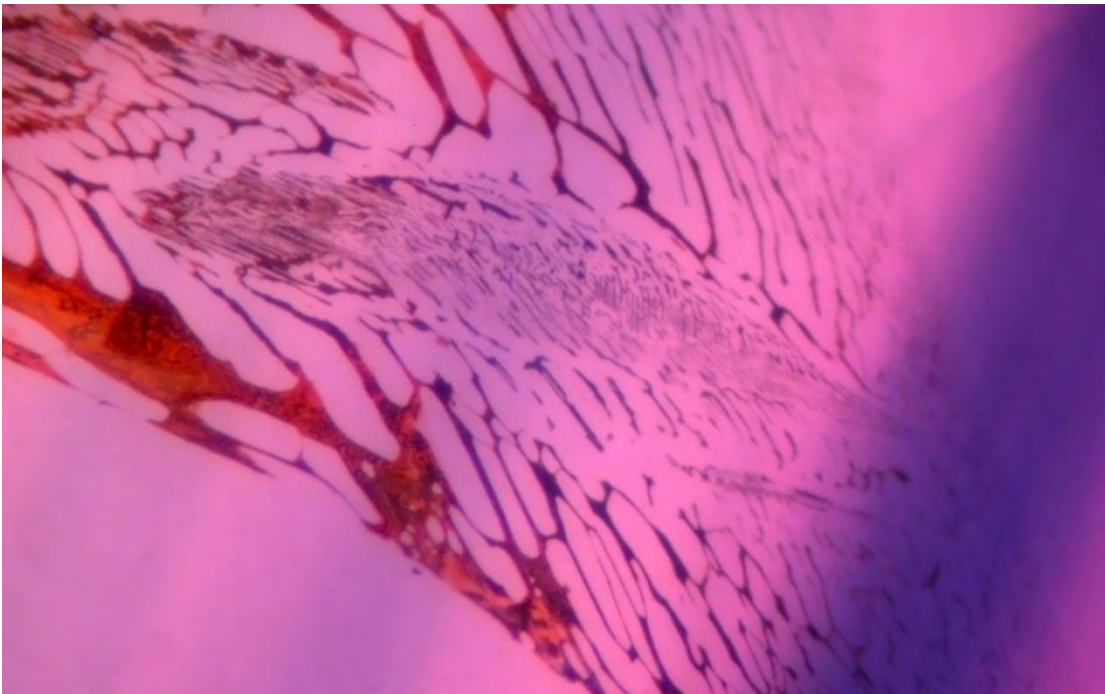


Figure 82: Surface reaching healed fissure with an attractive network of healing channels associated with pink/blue color banding seen in GIA reference sample 100305162418. The fissure is filled with a limonite-like brownish orange foreign substance. Brightfield illumination, magnified 60x. Photo © Vincent Pardieu / GIA.

SPECIAL THANKS

Firstly the authors would like to thank Philippe Ressigeac and Marc Noverraz, from Colorline Ilakaka (Ilakaka, Madagascar) and Nirina Rakotosaona, from Societe Miniere du Cap (Antananarivo, Madagascar) for being the first to inform us about the new ruby and sapphire discovery in Madagascar and for their support during GIA's FE35 expedition to Madagascar.

We would also like to extend thanks to:

- Lou Pierre Bryl from *Senoble and Bryl* for being such a great travel companion during the expedition.
- All the miners and traders we met during the expedition and particularly to Noschad, Maksood, for their support, friendship and collaboration during the expedition which was greatly appreciated.
- The Malagasy authorities and the people of Didy for their welcome and hospitality.
- All the staff and the management at the GIA Laboratory Bangkok who provided a lot of support to the project, and particularly Nicholas Sturman, Emily Dubinsky and Kenneth Scarratt last but not the least, to Dr. John Emmett for his wise advice.

ANNEX A: BLUE SAPPHIRES FROM ANDREBABE (MADAGASCAR):

The Andrebabe sapphire deposit is located to the South of Andilamena town in the forest covered area dominated by Andrebabe Mountain. Sapphires were discovered there in 2002 about two years after the discovery of the Andilamena ruby deposit located at a place called "Moramanga Carrieres"(Figure 9) in the east of Andilamena.

In June 2005 author VP was informed, by gem merchant Marc Noverraz, from Ilakaka, that the best blue sapphires he saw in Madagascar were saturated evenly colored blue sapphires from Andrebabe. The beauty of the stones reminded him of the beauty of sapphires from Mogok in Burma.

In September 2005, while the author was on his second visit to Madagascar, a visit to this mysterious deposit was arranged. The team was composed of Richard W. Hughes, Dana Schorr and author VP.



Figure 83: On the way to Andrebabe in October 2005 with left to right: Dana Schorr and Richard W. Hughes and the two Malagasy policemen who escorted us. To reach the deposit located at the end of a timber-logging track we had to endure a tough 4 hour walk through the lush hilly jungle. Photo © Vincent Pardieu / AIGS.

On arriving in Andilamena we learned that mining was taking place in Andrebabe and had been for the past year. Mining there was reportedly difficult as there were a lot of “fady” (the local word for Malagasy numerous taboos) and stories about the people native to that area... Few miners were willing to take the risk of working there. Nevertheless we decided to visit the area, and after a two hour drive and more than four hours walking on a logging track, we found the Andrebabe sapphire mining site. But on reaching the site all the miners ran into the surrounding jungle and we could only study their mining pits (Figure 82).



Figure 84: A sapphire mine in the jungle at Andrebabe (Madagascar) visited by author VP in 2005. The miners ran away as we arrived at the mining site. Photo © Vincent Pardieu / AIGS.

The miners were working along a river stream in an area rich in mica, however we were unable to find sapphire on site but did find small zircon crystals. Back in Andilamena we found a Thai gem merchant who was regularly buying Andrebabe sapphires. We were therefore able to study a low quality parcel he obtained a few days before our visit and buy some samples from him (Figure 85).



Figure 85: Blue sapphire parcel reportedly from Andrebabe seen in Andilamena in October 2005. Photo © Vincent Pardieu / AIGS.

The stones were dark blue with strong dichroism. They were obviously rich in iron. At the first glance we thought that the stones were probably associated with a basalt type deposit like in Diego in the north of Madagascar or closer to home, in Thailand and Cambodia around Chanthaburi, Pailin or Kanchanaburi. A report on an expedition in 2006 concerning the latter can be read on Richard W. Hughes' website (Hughes, Pardieu et al. 2006).

Later during another visit in 2010, the author obtained some additional small samples reportedly from Andrebabe, since after a few years of inactivity the author heard that some miners had returned and started mining the site again.

Back at the GIA laboratory the author studied the new samples and compared them with some of those he collected during the October 2005 expedition. To his surprise, all the samples were obviously of metamorphic origin despite their high iron content.

This study is interesting because previously high iron metamorphic sapphires were known to occur in Madagascar, yet no specific deposits were clearly identified. Furthermore with the new recent discoveries near Toamasina and Didy, it seems that the jungle covered hills in the northeast of Madagascar could be the source of these interesting "Burmese-like" iron rich metamorphic type Malagasy blue sapphires.

ANNEX B: BLUE AND PINK SAPPHIRES FROM TOAMASINA (MADAGASCAR).

In January 2011 Malagasy sapphire miner Nirina Rakotosaona informed the GIA Laboratory about a new blue and geuda sapphire discovery near Mandraka, a small village located along the Ivoloina River in the Toamasina Province, on the eastern coast of Madagascar (Figure 86):

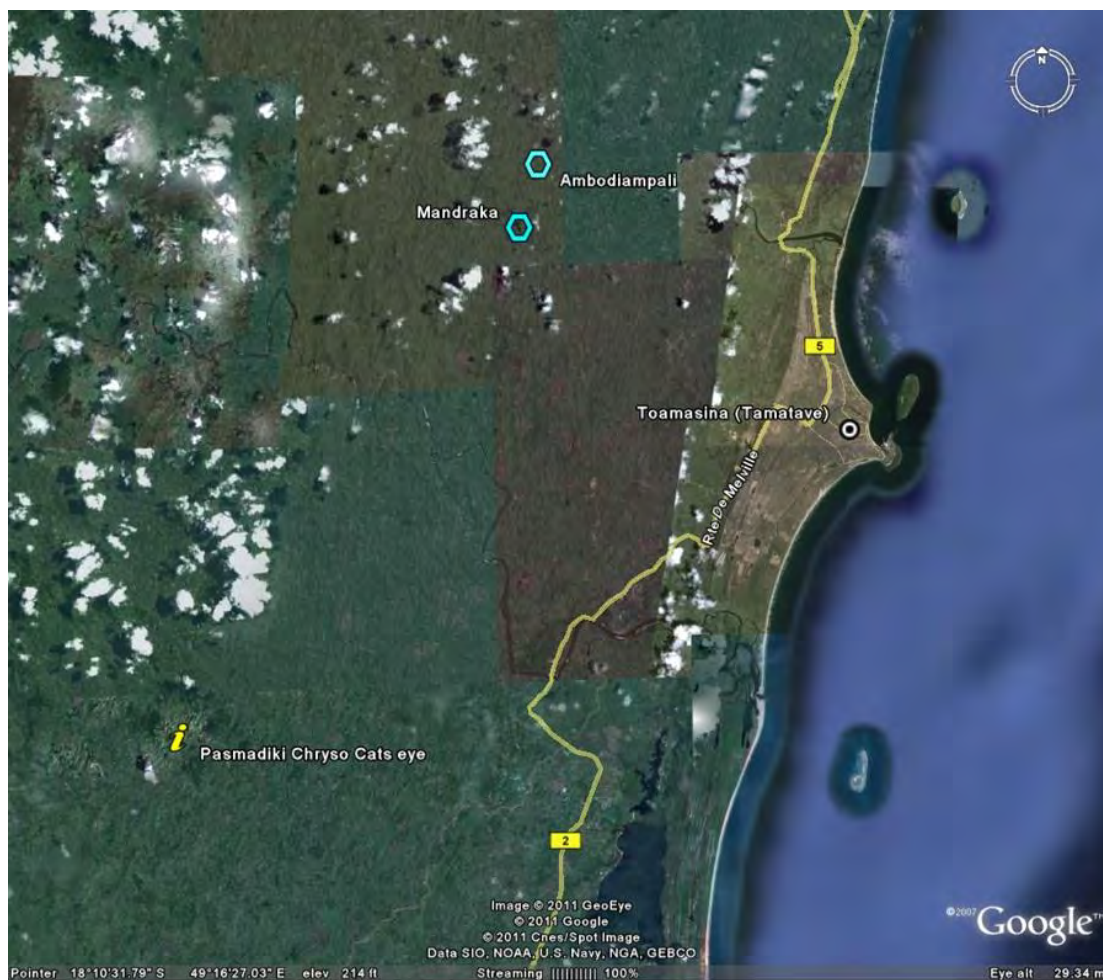


Figure 86: Google Earth map showing the location of the new sapphire deposit near Toamasina, Madagascar

According to Rakotosaona, the deposit was discovered by gold prospectors in December 2010. Within weeks a gem rush ensued, spurred by hopes that Toamasina could become the new Ilakaka. This information was confirmed by Mr. Ramzy, a Sri Lanka gem merchant based in Madagascar who, along with many other gem merchants, opened an office in Toamasina in January 2011.

Within a few months several thousand miners from all over Madagascar moved to the area, while gem buyers mainly from Sri Lanka, Thailand, and Africa settled in Toamasina. As prospectors started to work all over the region, other sapphire deposits were discovered near Sahamanorina and Ambodiampaly, two villages also located in the jungle northwest of Toamasina. A chrysoberyl deposit was also reportedly discovered in the region at the end of

January 2011 near Pasmadiki village in the southern part of Toamasina. According to Mr. Ramzy, this deposit produced several large cat's-eye stones weighing up to 100 carats in the rough.

Mr. Ramzy and Rakotosaona state that during the first few months the new deposit was reportedly producing only big blue and geuda-type rough stones weighing 10 to 50 carats. These stones had very good shapes and were usually very clean, unlike stones commonly produced from other Malagasy deposits like Ilakaka. One concern for the buyers based in Toamasina was that most of the stones had a distinct blue to green dichroism suggestive of high iron content, an observation that was later confirmed at the GIA Laboratory Bangkok.

According to Nirina Rakotosaona, some miners were lucky enough to find a big stone, but the rarity of these stones turned the gem rush into a nightmare for most of them and many went broke after several weeks of hard work without income. The situation had become very difficult there by February 2012, and Nirina Rakotosaona and his team left the area to work on another deposit. Nonetheless, new people were still reportedly coming to try their luck at the Toamasina sapphire mining "casino."

In March 2011, according to Mr. Ramzy, some new production, consisting mainly of small blue sapphires but also of pink/orange stones, started to appear in the market in Toamasina (Figure 87), rekindling hope and supplying some regular income to the local miners.



Figure 87: Rough and faceted blue and pink orange sapphires and a diamond crystal believed to have been mined near Mandraka/Toamasina around April 2011. The rough diamond weights about 3 carats. The faceted stones weight between 1 and 1.5 cts, while the rough sapphires weigh between 0.6 and 9 cts. Photo © Vincent Pardieu / GIA. Photo © Vincent Pardieu / GIA.

For the miners rushing to the area, the difficulty was not only in finding good sapphires, it was also in dealing with the owner of the mining rights for the sapphire-rich area. Indeed, according to Joel Valencio from the *L'Express de Madagascar*, a local Malagasy newspaper, the deposit was located along the perimeter of Mining Land, a Chinese mining company who had an official mining exploration permit for the whole area. The miners rushing to Toamasina soon found

themselves in conflict with Mining Land, who reportedly asked the Malagasy government for support against these illegal miners. The government first issued an official expulsion order on February 20th, 2011. But it seems that it had only a limited effect. Discussions between Mining Land, the Malagasy authorities, and the illegal miners failed to resolve the issue of illegal mining. According to Joel Valencio, on April 20th, 2011, Malagasy troops moved to the area, expelling about 7000 illegal miners and making several arrests. These facts were corroborated to the author by Toamasina-based Sri Lankan gem merchants.

After these events, gem merchants based in Madagascar reported that sapphire mining was still taking place around Toamasina during the remainder of 2011, but on a smaller scale compared to the period between January and April 2011. The number of buyers in Toamasina, which were reportedly as high as about 200 in April 2011, also decreased rapidly, mainly, it seems, due to difficulties between the foreign buyers and the local authorities. According to Mr. Ramzy, by the end of the year (November 2011) around 20 buyers, mostly Sri Lankan, were still present and active in Toamasina. In April 2012, after the discovery of a new sapphire deposit near Didy village it was reported that all the buyers left Toamasina for Ambatondrazaka town, the main town located north of Didy.

Most of the stones from Toamasina (blue, geuda, and pink/orange sapphires, and chrysoberyl) found a market with Sri Lankan merchants. The geuda-type blue stones were heat treated (Figure 88), but according to the burners and merchants who spoke with author VP in Sri Lanka in January 2011, the results were not as good as initially expected because they could not successfully eliminate the greenish component of most stones. On the other hand, according to the same Sri Lankan burners the heat treatment of pinkish orange sapphires from Toamasina was very successful in producing beautiful stones ranging from delicate padparadsha-like colors to highly saturated “Fanta”-like orange gems (so nicknamed for their resemblance to the popular orange soda).



Figure 88: Heat treated blue sapphires reportedly from the new deposit near Toamasina (Madagascar), seen at the Ratnapura morning gem market (Sri Lanka) in January 2012. Photo © Vincent Pardieu / GIA.

In December 2011 and January 2012, the GIA Laboratory Bangkok had the opportunity to study and acquire two parcels of sapphires from Toamasina, including several blue and pinkish orange sapphires and a 3 carat rough diamond (see Figure 87) also reported to have been found near Toamasina by miners searching gold or sapphires, or both.

Three reportedly unheated faceted blue sapphires and 14 rough sapphires (including three blue and 11 pinkish orange stones) were studied. Most of the stones were very clean and hence had very few inclusions. The most common inclusions seen in the blue sapphires were bands of minute particles and healed fissures, and in some stones several small colorless crystals usually with an atypical shape could be seen sometimes associated with comet tail-like structures (see Figure 89). We were not able to identify these inclusions using Raman owing to their depth in the stones.

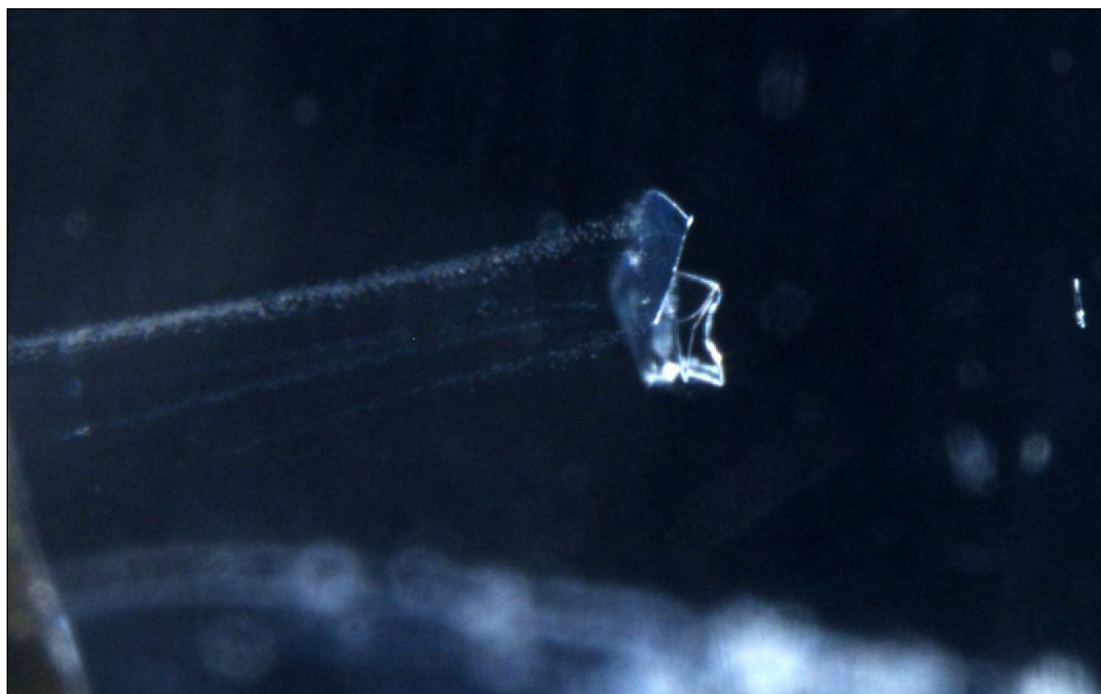


Figure 89: Colorless crystal associated with comet tail-like structure in a blue sapphire from Toamasina; magnified 60x, darkfield illumination. Photo by Emily Dubinsky © GIA

In the pinkish orange sapphires the most common feature observed was a thin margin of sharp, strong, narrowly spaced red and colorless color zoning following the hexagonal dipyramids around the rim of most of the crystals. In these stones, the center of the stone presented an even orangy coloration (see Figure 90). The rare inclusions seen in these pinkish orange sapphires were small negative crystals, healed fissures and bands of minute particles. The scarcity of inclusions in most stones posed difficulties for the local buyers, particularly when fabricated synthetics (tumbled to look like natural rough) started to appear in the Toamasina market.

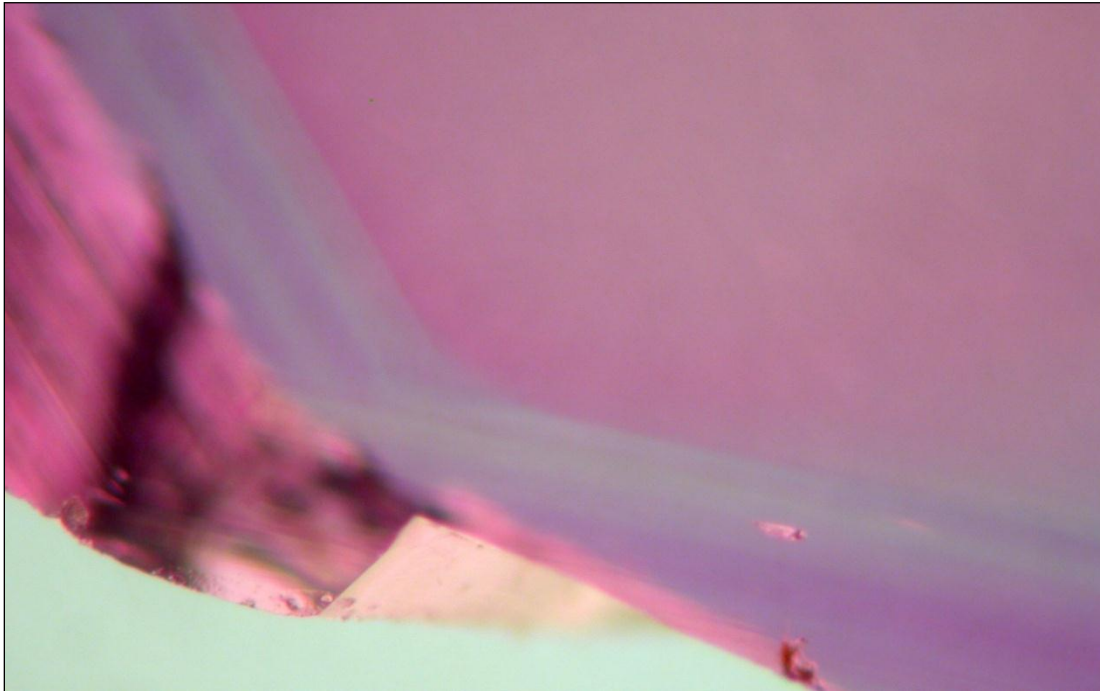


Figure 90: Thin red and colorless color banding following the hexagonal dipyrramids at the rim of a sapphire crystal from Toamasina; magnified 60x, brightfield illumination. Unlike the rim, the center of the specimen shows an even pinkish orange coloration. Note the small negative crystal associated with growth zones in the lower part of the photo: Photo © Vincent Pardieu / GIA.

Annex C: Links to online articles in the Malagasy and international media about the new sapphire discovery near Didy:

April 18th 2012: “Reserve Forestiere: Rue vers le saphir de Didy”

<http://www.lexpressmada.com/reserve-forestiere-madagascar/33792-rue-vers-le-saphir-de-didy.html>

April 21th 2012: “Ambatondrazaka: Hausse des prix du aux saphirs”

<http://www.lexpressmada.com/ambatondrazaka-8200--madagascar/33896-hausse-8200-des-8200-prix-8200-due-8200-au-8200-saphir.html>

April 24th 2012: “Didy- Ambatondrazaka: La mine de saphir bouclee”

<http://www.lexpressmada.com/didy-ambatondrazaka-madagascar/33961-la-8200-mine-8200-de-8200-saphir-8200-bouclee.html>

April 26th 2012: “Accident dans une carriere”

<http://www.lexpressmada.com/breves-madagascar/34027-minutes.html>

May 5th 2012: “Mines: A la decouverte du nouvel Eldorado du saphir”

<http://www.lexpressmada.com/mines-madagascar/34237-a-la-conquete-du-nouvel-eldorado-du-saphir.html>

May 5th 2012: “Environnement: Mort lente de la foret”

<http://www.lexpressmada.com/environnement-madagascar/34238-mort-lente-de-la-foret.html>

May 5th 2012: “Didy: Business parallele”

<http://www.lexpressmada.com/didy-madagascar/34239-business-parallele.html>

May 5th 2012: “Didy: Expulsion manu military”

<http://www.lexpressmada.com/didy-madagascar/34240-expulsion-8200-manu-8200-militari.html>

May 12th 2012: “Didy: Retour des exploitants illicites de saphir”

<http://www.lexpressmada.com/didy-madagascar/34416-retour-des-exploitants-illicites-de-saphir.html>

May 19th 2012: “Exploitation de saphir: L'insecurite regne a Didy”

<http://www.lexpressmada.com/exploitation-de-saphir-madagascar/34591-l-insecurite-regne-a-didy.html>

May 26th 2012: “Mesures pour Didy”

<http://www.lexpressmada.com/breves-madagascar/34775-indices.html>

May 31st 2012: Saphir de Didy: Creation d'une commission special a Ambatondrazaka"

<http://www.newsmada.com/saphir-de-didy-creation-dune-commission-speciale-a-ambatondrazaka/>

June 2nd 2012: "Un mini-conseil sur la ruée vers Didy"

<http://www.lexpressmada.com/breves-madagascar/34945-a-chaud.html>

June 12th 2012: "Ambatondrazaka: Les exploitants sommes de quitter Didy"

<http://www.lexpressmada.com/ambatondrazaka-madagascar/35192-les-exploitants-sommes-de-quitter-didy.html>

June 15th 2012: "Les étrangers risquent l'expulsion"

<http://www.lexpressmada.com/saphir-didy-madagascar/35274-les-etrangers-risquent-l-expulsion.html>

June 16th 2012: "Developpement Durable: Plaidoirie de l'économie verte du Bresil"

<http://www.lexpressmada.com/developpement-durable-madagascar/35297-plaidoirie-de-l-economie-verte-au-bresil.html>

June 18th 2012: "Didy: L'expulsion des exploitants reportée"

<http://www.lexpressmada.com/didy-madagascar/35318-l-expulsion-des-exploitants-reportee.html>

June 21st 2012: "Des militaires pour Didy"

<http://www.lexpressmada.com/breves-madagascar/35444-minutes.html>

June 22nd 2012: "Ilakaka: Chute du prix des pierres précieuses"

<http://www.lexpressmada.com/ilakaka-madagascar/35450-chute-du-prix-des-pierres-precieuses.html>

June 23rd 2012: "Exploitation Illicite: L'EMMo Nat aux portes de Didy"

<http://www.lexpressmada.com/exploitation-illicite-madagascar/35502-l-emmo-nat-aux-portes-de-didy.html>

June 27th 2012: "Les exploitants illicites délogés":

<http://www.lexpressmada.com/saphir-didy-madagascar/35519-les-exploitants-illicites-deloges.html>

June 28th 2012: "Exploitation illicite de saphir à Didy : La prise de responsabilité ne revient pas uniquement au Ministère des Mines"

<http://matv.mg/?p=597>

In the international press:

April 21th 2012: “Unesco site threatened as sapphire hunters descend on rainforest”

<http://www.africareview.com/News/Madagascar+sapphire+rush+threatens+Unesco+site++/-/979180/1391006/-/fwfqpn/-/index.html>

July 22nd 2012: **AFP: Panners seek sapphires in Madagascar lemur haven**

<http://www.afp.com/en/news/topstories/panners-look-sapphires-madagascar-lemur-haven>

and

<http://www.france24.com/en/20120722-sapphire-find-sends-panners-madagascar-lemur-park>

ANNEX D: GIA FIELD GEMOLOGY CATALOGUING SYSTEM

Cataloguing classifications:

A Conditions: The stone was mined by the field gemologist.

B Conditions: The field gemologist collected the stones at the mines after witnessing the mining.

C Conditions: The field gemologist collected the stones from the miners at the mine, but without witnessing the mining.

D Conditions: The field gemologist collected the stones from the miners, but not at the mine.

E Conditions: The field gemologist collected the stones from a secondary source close to the mines.

F Conditions: The field gemologist collected the stones from a secondary source in the international market.

Z Conditions: The field gemologist was not able to obtain any information about the conditions under which the stone was collected.

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