Includes Book Review: World of Magnificent Spinels - Provenance and Identification

No.13 May 2013

Contributions to Gemology

Record-breaking rubies discovered in Didy, Madagascar
在马达加斯加Didy矿区破天荒发现红宝石

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简体中文 繁體中文

Record-breaking Discovery of Ruby and Sapphire at the Didy Mine in Madagascar: Investigating the Source

By Dr. Adolf Peretti, FGA FGG and Lawrence Hahn, GG
GRS Laboratories (http://www.gemresearch.ch/video/Didy5.htm)

In May 2012, the GRS lab in Bangkok received two very large, high-quality rough ruby crystals (Fig. 1A) for testing from a client who had flown straight to the lab from Madagascar.

The concerned client had heard rumors swirling about in Madagascar that the crystals were synthetic, and that he needed confirmation of their authenticity before his group would proceed with further investments.

Laboratory testing with ED-XRF, FTIR, UV-VIS, Raman and microscope of the specimens confirmed that the huge crystals were indeed natural and unheated. To link these crystals to the mine in question for their client, the authors undertook a perilous field trip to the source of the crystals for a first-hand inspection of the mine site. By documenting the gemstone rush on video and collecting rock and mineral samples from the site for comparison, they would be able to decode the geological conditions under which this corundum deposit was formed.

Fig. 1A, B: A gem-quality rough of over 60 carats from Didy (Madagascar) is faceted into an over 26 carats of magnificent ruby (right). World record prices were paid for such magnificent rubies, initiating an enormous buying rush. All pictures are by the authors Peretti and Hahn and copyrighted by GRS if not otherwise noted. (http://www.gemresearch.ch/video/Didy4.htm)

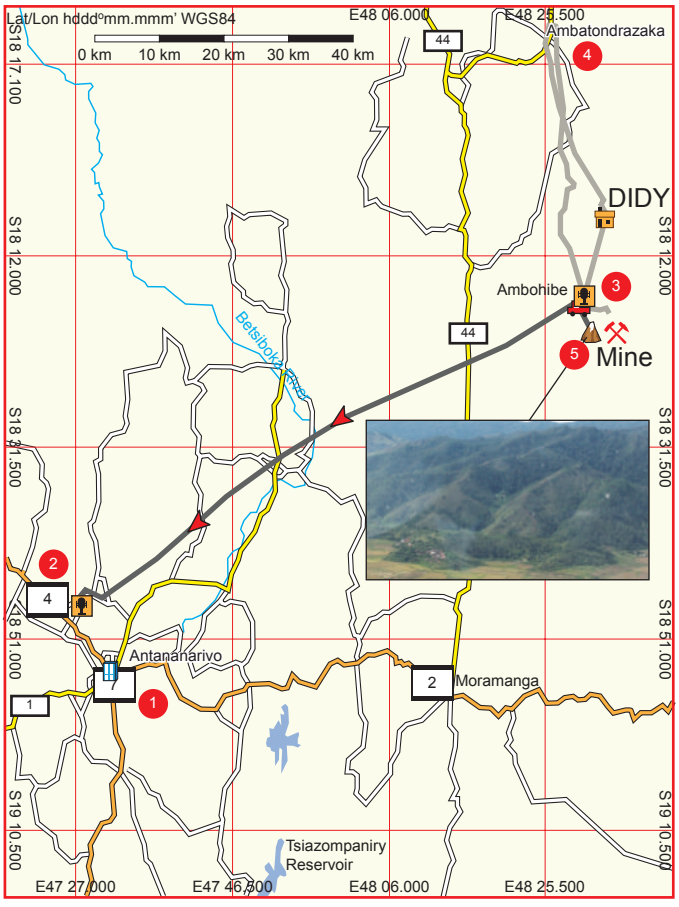

Fig. 2: A section of the detailed flight map to the mine by helicopter as recorded by our own GPS; 3-4 Good weather flight from Ambohibe to Ambatondrazaka navigated by Peretti when the board computer crashed. (Fig. 5) 4-3 Bad weather flight following terrain to Ambohibe without use of GPS; 3-2 return flight to the capital bypassing the rainforest (1 is the capital Antananarivo).

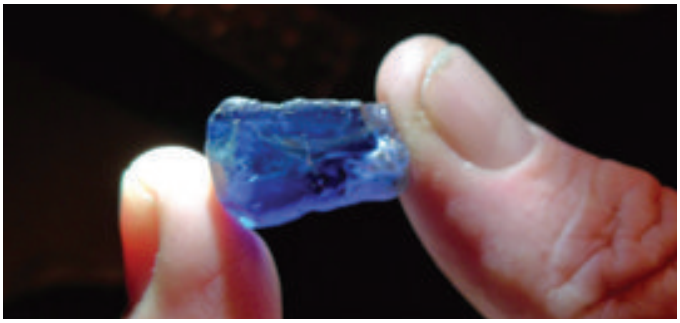

Fig. 13: A 40-carat GRS-type "Royal Blue" rough sapphire from Didy (Madagascar) that can be cut to a 10- to 20-carat gemstone. Estimated wholesale value exceeds US$100,000. Note that this is not a crystal fragment but the sapphire's original shape without crystal terminations as grown in the mother rock.

Fig. 15: Miners digging deeper into the alluvial bed to reach the gem-bearing layers. These layers are carried away with baskets to the washing place.

camped under the trees with improvised shops and gambling platforms with six to eight people inside a single tent. Some huts were double-layered with a professional tent inside covered by a larger one, as a shield against the heavy rain. Some tents covered a mining pit protecting a deep cylindrical hole into the ground.

GEOLOGICAL FIELD WORK AT THE ABANDONED MINE 17:00

(http://www.gemresearch.ch/video/Didy3.htm)

We were determined to walk until dark by using flashlights for another hour and perhaps throughout the entire night. Possibly some miners might be organizing an ambush to rob us along the way back, so moving fast was our best option.

17:20 We reached the deserted mining place; our last chance to examine and collect rock samples. The porters and Eugene exchanged views on what had just transpired. Finally, Peretti could commence his fieldwork (Fig. 20). With a small hammer he began examining rock samples from the alluvial riverbed. Soon, different types of rocks were identified, like a mica-gneiss, amphibolites, gabbros and quartz boulders. He knew that sapphire often forms in geological systems that produce radioactive minerals, like thorianite-uraninite, zircon or ekanite, which can also be radioactive. So a Geiger counter was brought along. A very slow and systematic scan of smaller pebbles in the waste pile of the mine revealed very highly radioactive minerals after an area of only 40cm^2 by 40cm^2 was searched. The scale measured out-of-limit and its beeping sound attracted the rest of the crew. A large crystal was retrieved for later lab analysis. Hahn and Eugene joined the search attentive to the Geiger counter beeps becoming more intense the closer they got to a specimen. The measurable radioactivity radius with our device was only of 15cm diameter distance (B- and minor Y-rays). It took only 2 minutes to find another sample. 5kg of rock samples were packed and brought back to the laboratory. (Fig. 19)

Fig. 14: At the washing place, we encounter a woman washing, probably from Didy. Her child should be at school. He is most probably searching for platinum and not gold but may not be aware of it (Platinum occurrence See Fig. 17).

Fig. 16: Two strong Malagasy men washing a heavy load of soil that exposes large pebbles from the alluvial bed mostly composed of gneiss, amphibolites and gabbros, but no carbonates.

Fig. 17: A map showing the "Geology Dreamland" for the Didy (Madagascar) mine. The mine is situated in the metamorphic rock suite of gneiss, amphibolite, quartzite, intercalated sillimanite-gneiss (complex of Mananpotsy), migmatites garnet and biotite-bearing ortho-amphibolite. The gem-bearing zone is mirrored in the West (approx. 48.50E) with a large intermediate zone of gneiss and amphibolite of the Beforona group and even large bodies of gabbro are found (48.45E and 18.37S). The main difference in the rocks at the mine itself is the presence of Nb-Ta mineralization. As the map shows, this indicates the presence of pegmatite. The Ambalavao rock suite surrounds the mining area and contains quite different rock types including anatectic granites and migmatites. They are partially melted rocks typical for a lower high-metamorphic continental crust. The sillimanite gneisses of Manatopsy corroborate the high grade of metamorphism of this area (high-temperature). The rock types that were predicted by the map (amphibolite, gneiss and quartz) were indeed found in the mining area (Fig.19). Signs for hydrothermal activity were also discovered (most probably in connection with an intrusion) by abundant Fe-Th-Pb-Bi-Zr-Ta-U-Y-Nb-oxide mineral occurrences (Fig. 20) and inclusions (Fig. 26A). Note: the expedition trail in the map and the location of studied outcrop (Fig. 18). The possible scenario of sapphire and ruby formation is different to that in Adranondambo (Madagascar) and Winza (Tanzania) (See Lit.1, 4) and may be related to fluids and/or melts deriving from plutonites and the metamorphism of Si-under saturated and Al-rich rocks at high metamorphic degrees. Because of the large-scale mapping (1 to 500,000), further small-scale geological studies are necessary for further clarification. The Mine location was added from our GPS data collected, and river systems potentially containing gems are indicated with names. Legend selectively edited and translated into English from French. Map cropped from Carte Métallogénique et de Prédiction des Gisments, Métaux de Base et Métaux Précieux, Feuille No 6-Toamasina (See Lit. 3).

Legend

Sedimentary and Volcanic Rocks (and metamorphic equivalents)

Qa — Non-specified alluvial rocks

Betsimisaraka Zone

Mananpotsy Complex

nPMPs, nPMPss — *Formation of Sakanila* Biotite-Gneiss ± hornblende and amphibolite with quartzite unites/ quarzite lenses, graphite lenses ± sillimanite ± garnet rocks and some calcsilicate marbles **Gneiss à sillimanite**

Antananarivo Zone

Mananpotsy Complex

nPMPz — Ambatondrazaka Formation Biotite-Gneiss (± sillimanite ± graphite) with lenses of quartzite and amphibolite

Tsaratanana Complex

Beforona Group

nATAfo — Migmatic plagioclase gneiss with biotite ± hornblende and granitogneiss with amphibolite lenses and porphyroblastic gneiss

nATAfz — Mafic biotite gneiss mafique, banded and locally sheared, with quartzite, amphibole and pyroxene, metagabbro and meta-ultramafitite

nATAfzag — Amphibole-gneiss

Cu

Ni, lateritic nickel, nickel sulfide non-specified

Be, Beryl-bearing pegmatite

Cr, deposit type not specified

Fe, deposit type not specified

Ni, deposit type not specified

EGP, Alluvial

REE, Rare earth element deposit type not specified

Sn, deposit type not specified

Nb-Ta, columbite-tantalite bearing non-specified pegmatite

Plutonic rocks (and metamorphic equivalents)

Antananarivo Zone

Ambalavao Series

€Agro — Anatectic granite, idiomorphic K-felspar Facies

€Agr — Anatectic granite/migmatized, not differentiated

Kiangara Series

nPKlsg — Alkali granite and syenite gneiss, polyphase stratified, coarse-grained and medium differentiated (biotite syenogranite, alcaline-leucogranite and quartz-bearing syenite).

Imorona-Itsindro Series

nPck — Granite charnocktic granites or charnockites (not assigned)

nPlleb — Gabbro

nPlleam — Gabbro Otheoamphibolite (not assigned)

Betsimisaraka Zone

Imorona-Itsindro Series

nPllom — Migmatic hornblende ± biotite garnet-orthoamphibolite

Betsiboka Series

nAMMgt — Hornblende-tonalite gneiss with ± clinopyroxene and amphibolite boudins ± garnet-bearing and pyroxene metadiorite; local charnockitisation

nAMMgtf — Mafic granofels/mafic rocks with gabbro-like composition

19:00 Hahn assisted by Eugene quickly set up camp with a professional 2-layer mountain tent and high-tech mosquito nets, and cleared rocks and sticks to level the ground. The torches attracted mosquitoes and flying insects. Humidity emanating from trees creates its own ecosystem in rainforests. The cold nights make rain inevitable. The porters took out their equipment and built a camp with a small sheet of plastic connected between trees offering some protection against the rain. That night, they placed sheets above the mosquito nets but it covered only about 60 percent of the area.

Friday, May 18, 2012

EARLY RISER Around midnight, a downpour started and the schedule needed to change. We decided to be up by 4am. The rain would have made the muddy trail hazardous. Peretti contracted some radiation exposure due to mistakenly using his backpack as a pillow containing the radioactive sample. Thankfully, no contamination occurred since the samples were sealed.

6am Like the flick of a switch, the darkness was replaced by light. It was an amazing event. The misty fog from last night's rain hovered over the hills. Majestic trees of stunning beauty dominated the scenery in this natural wonderland in Madagascar. It was an amazing sight. The area overlooked the place where the largest rubies and sapphires in the world were found – a paradise of exotic fauna and flora accompanied by calls of lemurs and rare birds.

GEOLOGICAL FIELD STUDY OF THE ROCK FORMATIONS

(http://www.gemresearch.ch/video/Didy3.htm)

Stunned by the wildly diverse and colorful rock formations (Fig. 18A/B) Peretti took dip and angles of gneiss formations and gathered rock samples. Several places on the trail bore signs of small mining activities, signaling that the miners identified this as mother-rock bearing sapphire or ruby. The rock formations were complex layered rocks with different chemistry; with some layers containing amphibole of pyroxene pockets but they were deeply weathered with no fresh specimens available. Interesting boudinage was seen in the rocks' layers. These lenses showed an increase of grain size, and promising to the formation of larger sapphires. The exact position of these rocks was recorded on the integrated handheld GPS, and the integrated GPS in the video camera producing valuable footage.

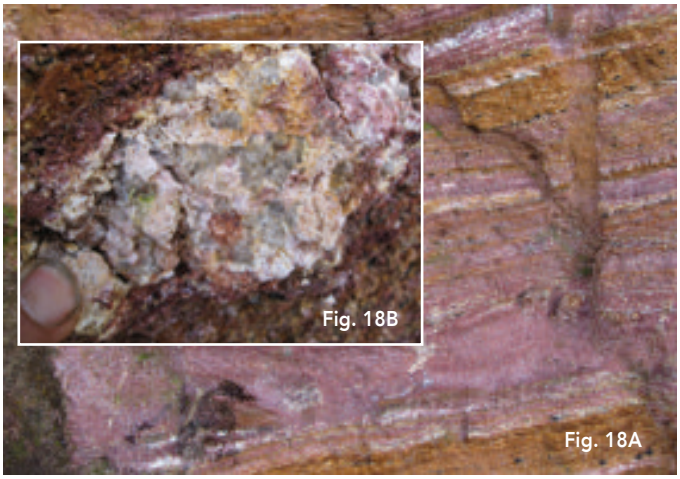

Fig. 18A: An outcrop several miles away from the mine on the hillside (marked in Fig. 5) exposes an extremely tectonized and stretched rock suite with a very inhomogeneous chemical composition shown by its weathered colors. Apart from a few minerals such as probably pyroxene or amphibole (see finger pointing), only quartz layers have survived the deep weathering.
Fig. 18B: The inserted picture shows a strong boudinage of the rocks during tectonics in certain areas with an increase in grain size. Such local occurrence in the rocks would be beneficial and necessary if the rubies and sapphires are formed by metamorphism. Miners did attempt mining at this spot and it seems their experience made them conclude it was not worth the effort.

Fig. 19: Amphibolites and gneiss rocks that were found in the riverbeds of the mines are shown. The rock-type was predicted by the geological mapping (Fig.17) and is a potential good culprit in the general scenario of sapphire and ruby formation. It is only part of the alluvial layer; a primary rock formation containing the gems was not exposed. (GRS Rock Collection.)

Rubies, Sapphires and Padparadscha from Didy, Madagascar
马达加斯加Didy 矿的红,蓝宝石和帕德玛刚玉

ROYAL BLUE SAPPHIRES | 皇家蓝蓝宝石

A set of sapphires from Didy ranging from 5 to over 10 ct. with the typical GRS-type "Royal Blue" colors, normally found solely in sapphires from Sri Lanka, Burma and Ilakaka (Madagascar).

VIVID RED RUBY | 明艳色调红宝石

A gem-quality rough (left) of over 60 ct. from Didy is faceted into an over 26 ct. magnificent ruby (right).

PADPARADSCHA | 帕德玛刚玉

On the left-hand side is an 85 ct. rough Padparadscha sapphire that is completely clean. Another example of a high-value faceted Padparadscha sapphire of 18 ct. is shown face-up and in profile position. This Padparadscha is loupe clean, has a perfectly mixed orange and pink color, is spared of thermal enhancement and does not show any color-zoning. It is one of the largest faceted magnificent Padparadscha sapphires ever tested by GRS.

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