Calcite Crystals in Amethyst Vugs

Collector ***Reinhard Balzer*** *from Marburg, Germany visits a famous amethyst locality that happens to boast a surprising number of calcite habits.*

The mining town of Irai, in the northwestern corner of the Brazilian state of Rio Grande do Sul, is well known for producing wonderful amethyst geode specimens. In the not so distant past, however, miners blasted the gem-rich cavities out of the local volcanic rocks, smashed them and collected the violet crystals that bedecked the walls, without regard for the concerns of specimen collectors. Miners were commissioned only to produce as much amethyst gem rough as possible.

In the early 1990s, however, things began to change. More attention was paid to working large geodes, that contain beautifully formed amethyst druses, out of the host rock in one piece. These geodes are now widely available on the mineral market where they often bring a higher price than they would have brought as gem rough. When such a vug includes a choice group of calcite crystals perched on amethyst, it is even more valuable.

The German Influence

Rio Grande do Sul is the most southern state in the Republic of Brazil. It shares its northern border with the state of Santa Catarina, its southern border with Uruguay and its western border with Argentina; in the east, it borders on the Atlantic Ocean. Porto Alegre is its capital, with Rio Grande its most important port. The climate of the state is temperate to subtropical, but it can get quite cold in the winter months, and it even snows in the mountains from time to time. Geologically, Rio Grande do Sul is part of the Parana Basin, which stretches north to south from Parana, through Santa Catarina and into Uruguay.

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Because its landscape is in many ways similar to that of Germany's central mountains, it is not surprising that Rio Grande do Sul was one of the most significant emigration destinations for 18th and 19th century Germans. A large portion of these German emigrants came from the Hunsrück, Eifel and Pfalz regions. The dialects of the homeland are still spoken in Rio Grande do Sul, in spite of their prohibited use during WW II.

In the early 19th century, abject poverty reigned in many parts of Germany, especially in the west, driving masses of people into the hands of promoters who organized emigrations to destinations around the world. Emigrations often ended in misery and disappointment, as the flights were often badly organized and did not lead to the promised ends.

Poverty and romantic preconceptions of distant paradise, however, were not the only attractions of emigration. In his 1989 book *Auswanderung von Hunsrück nach Brasilien* (Emigration from Hunsrück to Brazil), August Meter writes, "Decades of war, robbery and plunder by French armies, exploitation of the country by duties and taxes, as well as forced recruitment of young men into the Napoleonic army on its way to Russia, brought unspeakable harm to Germany, and the Hunsrück, Pfalz and Eifel in particular. The causes of the emigration from this region have to be understood in light of the economic and political conditions after the Napoleonic wars and the French revolution."

The Cutters Emigrate

At the beginning of the 19th century, lapidary centers Idar and Oberstein as well as villages that surrounded them had exhausted the local sources of cutting rough. Some families emigrated especially to the state of Rio Grande do Sul in Brazil to earn their living in a new homeland. Most cutters were farmers in the old country, and they found the climate and soil conditions in southern Brazil ideal for planting. A thriving agriculture quickly developed, and thanks to these industrious people, Rio Grande do Sul is today the breadbasket of Brazil.

In 1827, the son of an emigrant cutter from the Hunsrück found, quite by accident, a familiar stone in a riverbed: a piece of fine quality agate, a gift from heaven. By 1834 the first shipment of agate was carried by ship across the Atlantic, by barge up the Rhein and by oxcart into the Hunsrück.

The lapidary industry in Germany was saved, and the following decades saw rapid growth. Systematic prospecting began immediately in Rio Grande do Sul, and large reserves of amethyst, citrine, smoky quartz and gemstones were uncovered in addition to the coveted agate.

Irai, Rio Grande do Sul, Brazil

Landscape Similar to that of Idar-Oberstein

View from a calcite-amethyst mine of the rolling hills near Irai

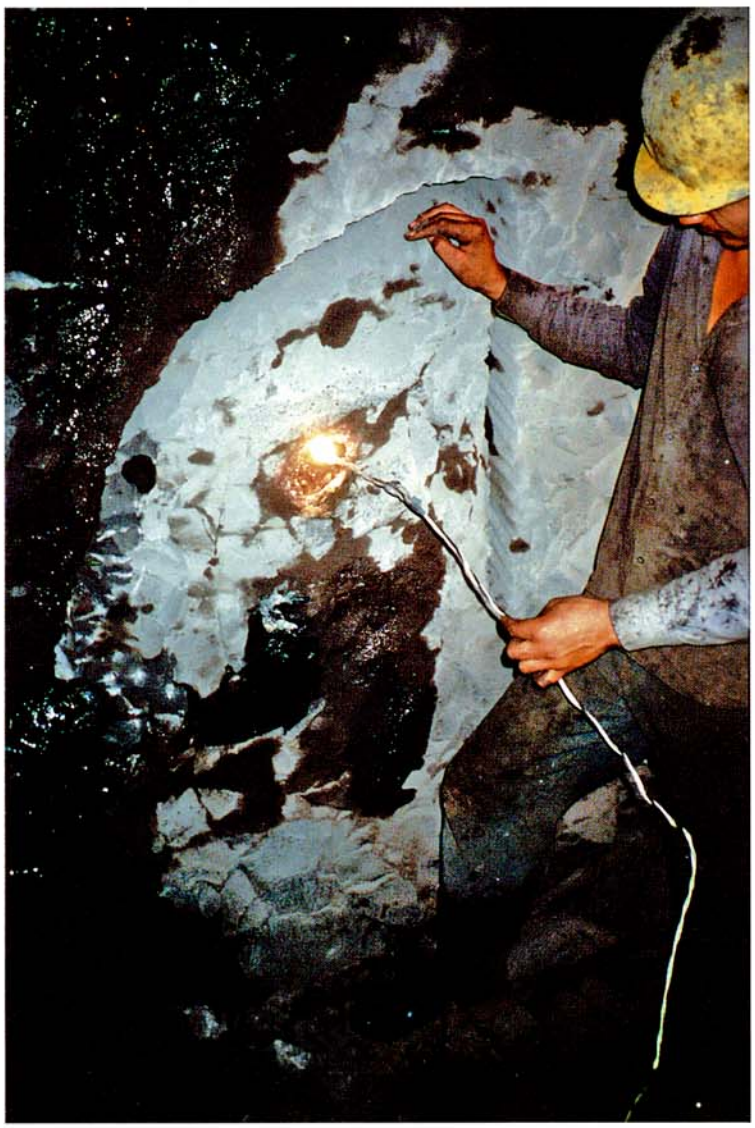
Right: *A collector's dream, the quarry walls are peppered with vugs.*

Left: *Big finds can come from small quarries.*

Photos by Reinhard Balzer

The Creative Power of Volcanoes

Rio Grande do Sul is blanketed by old lava flows. Sometimes numerous individual flows lie on top of one another, separated by intercalated sedimentary deposits. These *lava series* have varying thicknesses that can reach up to 1 kilometer and are roughly 90 to 100 million years old. Cavities left by the outgassing of the lava were lined and filled with minerals, principally quartz in the form of agate and amethyst. Calcite and gypsum crystals are more recent growths.



Vugs that were completely filled with agate are known as *amygdules*. Those that are lined with crystals are referred to as *druses*. Cavities can reach 4 meters in length and more than 1 meter in diameter. The exterior shapes of complete vugs that are extracted from the host rock reflect the interplay between the escaping gasses that formed them and the flow of the lava that surrounds them.

If the uppermost layer of lava is near the surface of the ground, the deposit is worked through an open pit, an option that is easier and less dangerous than mining underground. Where underground workings are warranted, adits are mechanically dug along the productive layers of rock. Homemade black powder serves as the explosive, as commercially available dynamite is far too strong and would destroy the delicate crystals, especially the calcite.

When a vug is encountered and partially exposed, a peephole is carefully driven into it. Probing it with a light, miners assess the vug deciding whether to extract it. If the quality of the crystals does not warrant extraction of the vug as a whole, it is broken up for gem rough.

Buried Treasure in Irai

Upper left: *Celadonite is included in the crystals of this 13 cm wide calcite group. Collection Terry Huizing; photo Jeff Scovil*

Left: *After carefully making a small opening, a miner checks the vug to discover whether it is durable enough to endure a blast. Photo Reinhard Balzer*

Above: *This 8.1 cm wide calcite twin on $\{10\bar{1}1\}$ is a part of Victor Yount's extensive calcite collection. Photo Jeff Scovil*

From Vugs in Volcanic Rocks

Dream Specimen from Irai: *This 18 x 9 cm "floater" consists entirely of calcite crystals. Photo by Hartmut Meyer*

The Calcite

More than 350 distinct habits of calcite have come from the amethyst vugs of Rio Grande do Sul (pers. comm., Victor Yount, 2003). The largest and most beautiful calcite is found around the northern towns of Frederico Westphalen, Plan Alto and Irai, where there are innumerable outcrops and dozens of productive localities.

The underground workings in the area of Irai produce the most notable crystals. These are typically elongated scalenohedral crystals that often taper to a point at both ends. Numerous small points sticking out of the crystal faces sometimes give the impression that big crystals are built from many smaller ones. The overall crystals can be as long as 20 centimeters and often stand in bizarre groups aggregated in the hollow cavity of the amethyst geode. The groups are sometimes chaotically and sometimes radially organized. Calcite also occurs in compact, rounded habits. These too are often formed from numerous tiny crystals. Although the scalenohedron form predominates, calcite of a prismatic habit and terminated by the pinacoid, occurs. Remnants of these crystals are sometimes preserved as hollow, quartz covered, encrustation pseudomorphs.

Calcite crystals from Irai are generally colorless and milky, though they sometimes have a yellow tinge. Their faces often have a fine, silky luster. While amethyst is constantly being mined at Rio Grande do Sul, good calcite specimens on amethyst are found more sporadically, and really super finds turn up only every couple years.

The green mineral that is omnipresent on the outer surface of the vugs is *celadonite*, a dioctahedral potassium, iron, magnesium mica. Celadonite is also the included mineral found as green *phantoms* within calcite crystals (Carl Francis, pers. com.). A point of caution, buyers

Left: Calcite Corsage

This 10.8 cm high calcite arrangement was being offered for sale in 2002 by Fine Minerals International. Jeff Scovil photo

of the large crystal-lined vugs should be aware that it now seems to be common practice to apply a liberal coating of celadonite-color paint over the outer surface to conceal areas chipped or damaged in the extraction process.

Calcite is not the only byproduct of amethyst mining. Magnificent gypsum aggregates, though rarer than calcite specimens, are also found in the vugs. Notably, not every vug contains the classic violet amethyst crystals; smoky brown quartz and natural citrine crystals also line the cavities, but these are great rarities. Amethyst from these mines, both individual crystals and whole druses, are often burned in ovens until they are yellow, at which point they are sold as *citrine*; however, this process produces a characteristic honey-yellow color that the trained eye can immediately distinguish from natural citrine.

Of course, calcite in amethyst geodes is found in localities outside of Rio Grande do Sul. In principle, specimens of this nature can occur in any deposit that is geologically similar to those mined in Brazil. The occurrences at Fischbachtal and other localities near

A 7 cm high yellow calcite crystal sits in an amethyst vug from Irai. This specimen, from the collection Reinhard Balzer, is on display at the Mineralogical Museum in Marburg, Germany. Hartmut Meyer photo

Idar-Oberstein have produced similar specimens that have been sought by collectors for years. The prizes from these Old World localities include complex calcite crystals in amethyst and smoky quartz druses. Respectable calcite specimens have also turned up in the spherical amethyst-containing geodes from Chihuahua, Mexico.

The expansive amethyst belt in Uruguay (Catalan district and others) from time to time produces, among other things, the famous *skunks*, large white to yellow calcite crystals to 13 centimeters with overgrowths of deep purple amethyst and zoned inclusions of a black mineral, coupled with oriented overgrowths of small, steep, white, second-generation calcite crystals. The amethyst overgrowths are arranged like stripes a couple of centimeters wide running from the termination down the center of the steep rhombohedron faces.

Massachusetts artist Frederick C. Wilda's watercolor rendering of a dream amethyst on calcite "skunk." The specimen that inspired this portrait was found in town of Artigas in the Uruguayan province of Artigas and is in the collection of long time dealer/ collector Rock Currier. A photograph of the actual specimen graced the March/April 1997 issue of Rocks & Minerals.