

The *Real* Sword in the Stone

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The Sword in the Stone of St. Galgano, a twelfth-century Tuscan hermit, has been investigated, and the striking coincidences between his life and parts of the Arthurian legends are examined.

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Most people are familiar with the legend of the Sword in the Stone, the sword that young Arthur succeeded in pulling out, thus becoming the king of England. The first written form of this legend was told by the author Robert de Boron in a French verse tale called *Merlin* (1200 A.D.)

However, a genuine, ancient metal sword plunged into a rock (figure 1) does exist and is located in Tuscany (Italy). It can be admired in the center of a beautiful round chapel (figure 2) on top of a small hill, surrounded by the wild woods of this region, near the village of Chiusdino (Siena). At the foot of the hill, the ruins of a roofless Gothic abbey, where the grass has replaced the flagstones of the naves

(figure 3), add to the mystic fascination of this site.

The sword is attributed to Saint Galgano, a knight turned hermit, who died in 1181. Therefore, the sword would date back to the same period as King's Arthur legend.

St. Galgano

The figure of Galgano Guidotti, who is believed to have been born in Chiusdino in 1148, is shrouded in mystery and legend. Evidence of his historical identity has never been found and no records exist in documents dating back to the time in which he lived.

Galgano was said to have been an arrogant and dissolute young man who became a knight after seeing a vision of the Archangel Michael. Later, during a second dream, Galgano was led by St. Michael across a narrow bridge over dangerous waters, to a wonderful field filled with flowers and thence through a dark underground passage into a round building where he met twelve individuals (the Apostles? the Knights?) and was shown a book that he was not able to read (the Holy Grail?) and had a vision of God's majesty.

Shortly afterward, while riding in the woods near his home town, his horse suddenly stopped, and Galgano recognized the place he had visited during his vision.

Here, on a small hill named Montesiepi, he thrust his sword into a rock—where it remains to this day—giving up a life of war and violence for that of a hermit and adoring the upside-down sword which resembled a Christian cross. One year later, in 1181, he died at the age of thirty-three and was canonized four years later.

Galgano's gesture is identical (and opposite) to that of the future King Arthur, signifying peace and humility; however, there are other obvious similarities between the two stories. Galwan was the name of one of the knights of the Round Table, and some features of Galgano's story and second vision can also be found in the later *Perceval* and *Lancelot* novels by Chretien de Troyes.

Galgano's real life was fading away into these legends when, in 1189, the Cistercian monks built a round chapel (the Rotonda) where his hut had been, and shortly afterwards (from 1218) a magnificent Gothic abbey in a clearing near the hill.

The body of St. Galgano is said to have been buried "near his sword," but nowadays nobody knows the precise spot. His remains were unearthed some years after his death, and his skull—still on display in the church of the nearby village of Chiusdino—is the only remaining official relic. Not even a tiny relic from the rest of his body is known of, owing to the fact that he was reburied. All that is left of this fascinating saint, therefore, is his skull, his sword, the round chapel, and a number of stunning coincidences between his legend and those of the Arthurian stories.

In 2001 I had the opportunity to coordinate a number of scientific investigations undertaken to shed light on the riddle of St. Galgano by collecting objective, concrete data from these remains.

Scientific investigations

1) Radar scanning: The saint's lost grave?

One of our first tasks was to use a special Ground Penetrating Radar (GPR or georadar) to scan beneath the floor inside and around the round chapel. This equipment operates much like a normal radar, as it sends bursts of microwaves under the ground and picks up their reflections to generate an image of hidden objects and structures.

The analysis was performed by pulling the wheel-mounted instrument along a grid of paths about 40–50 cm apart, and storing the data in a computer imaging program.

GPR analysis revealed that beneath the floor around the sword there is just gravel and earth, with one important exception: an artificial structure (2 meters by 1 meter and 1–2 meters deep), possibly a burial recess or a sarcophagus, was identified near the north side of the chapel (figure 4).

Unfortunately, even this is probably not the long sought-after grave of St. Galgano, (it must contain a skeleton without a skull, since the head is the only existing relic from the saint's body). Further searches at the State Archive in Florence found records of an excavation that took place in 1694, when a brick-walled burial recess was discovered there, reportedly containing earth and mixed human bones.

2) Dating of the buildings: A further puzzle

During the following centuries further buildings were added to the original core of the round chapel (1182–1185). Thus, we thought it would be useful to try to confirm the presumed historical dating of the small entrance (ca. 1200 A.D.), the frescoed side chapel (1300), the bell tower (1300?) and the rectory (1700) by means of instrumental data that can be obtained using the thermoluminescence (TL) method.

TL allows us to date certain materials that contain minerals like quartz or feldspar, such as bricks, pottery, and glass by determining when they were fired in the kiln.

As it turned out, TL dating confirmed the presumed historical age: the entrance was probably erected between 1140 ± 1160 A.D., and the bell tower between 1420 ± 1450 A.D.; the material of the frescoed chapel was not suitable for analysis, but from historical documents we know that it was built around 1340.

The Round chapel, the original core, came as quite a surprise. It dated back to 985 ± 50 A.D., therefore about one and a half centuries earlier than expected, although bricks from older buildings may have been used in its construction. However, before 1000 A.D. the use of bricks was not very common in Tuscany, since most buildings were made of stone.

3) The sword in the stone

The style of the sword is consistent with that of other similar weapons from the same time, and—based upon Ewart Oakeshott's widely accepted classification of medieval swords—we can even label it as an Xa-type sword, typical of the late twelfth century.

Written and pictorial records confirm the actual presence of a sword in that stone since at least 1270 A.D. The sword is rep-

resented in a golden case that used to contain Galgano's head; it is also depicted in a fresco on a wall of the Rotonda's side chapel. In 1576 a marble altar covered the sword and the stone, leaving a hole through which they could be seen. In 1832 they were protected by a metal cage or grating, still there in 1924. An eyewitness (born in 1915) has reported to us that in those years the sword could actually be pulled out from the crack into which had been pushed. In that same year molten lead was poured into the slit to jam the blade, and the metal cage was removed.

In the 1960s, an unknown person broke the blade in an attempt to remove the sword from the stone. The broken part was then fixed back into place with concrete, and a second layer was later added to match the color of the rock. On March 21, 1991, the sword was pulled out once again by a vandal (soon captured by the police) and was fixed back.

In 2001, the reconstruction of all these events was extremely difficult. To make matters worse, rumor had it that the sword was a nineteenth century fake, or that it had been switched in the 1920s, and even that there was no blade in the rock.

We decided to inspect the artifact. A vertical hole (approximately 11 mm in diameter) was drilled, running parallel to the presumed position of the blade, in the hope of reaching the cavity or the mass of lead in it. We inspected the hole with a fiber optics endoscope, but saw only plain rock.

Some of the concrete was then removed, and the upper part of the sword was freed and pulled out (figure 5). A second, shorter hole was drilled on a slant and actually came to a metallic object (the rest of the blade). The concrete layer was then further removed, until approximately one inch of the buried blade emerged.

The two pieces (whose edges fit together perfectly, thus confirming that they are part of the same object) are now held in position, for aesthetic reasons, by a small unobtrusive metal clamp.

Small rusty iron fragments coming from the lower part of the blade were collected with a magnet when the concrete was removed and were chemically analyzed for trace metals contained within the iron. These analyses were performed at the University of Pavia, both by Atomic Absorption Spectroscopy and by neutron activation at the Triga Mark II type research reactor at the LENA center, University of Pavia.

Although iron artifacts cannot be unequivocally dated (as in Carbon-14 or TL methods), the composition of the metal did not reveal that modern alloys had been used, and so it is fully compatible with a medieval origin. A still different and standard metallographic analysis has yet to be performed, and would consist of examining a small polished area of the object (less than 1 cm²) with an optical stereomicroscope after chemical etching. The shape, deformation, and composition of the "grains" within the wrought iron would provide further evidence as to how the object was manufactured.

In 1999 a team of Spanish researchers analyzed a sword from the same period that had belonged to El Cid Campeador, the Spanish hero. They determined its geographical origin thanks to the presence of particular trace elements within the

iron. Unfortunately, such an analysis could not be performed in our case. However, we compared the “fingerprints” of trace elements within the sword’s metal with that of pieces of iron slag that can still be found around the great abbey of St. Galgano. This slag is the waste from the small foundries used by the monks to manufacture their small iron objects, using local iron ore.

If the fingerprints of the slag matched those of the sword, we might ascertain that the sword was made locally. On the other hand, if they did *not* match, nothing could be established since we do not actually know how impurities concentrate in slag or in iron during the foundry process. As often happens, this was the case. The “fingerprints” of the slag matched each other, but did not match those of the sword. Still further analyses come to mind: for example, a radiography (X-ray) of the sword in search of inscriptions which are now invisible but that might have been etched or engraved—as was customary—at the top of the blade near the guard, and that were often the “trademark” of the manufacturer.

4) Macabre relics

Other objects of an organic nature, such as timber from a dismantled roof, and some pieces of wood (conserved inside a small lead box that had been buried under a floor tile near the sword in 1694) have been carbon-dated by Beta Analytica, Florida. All these remains turned out to date back to the nineteenth century. However, a gruesome pair of mummified arms (figure 7) of unknown origin, traditionally on display in an old glass cabinet near the sword, were also examined. Old chronicles tell that, when St. Galgano was still alive but away from his hut, on his way to Rome to see the Pope, three men tried to pull out the sword, and (so goes the prophetic legend) broke it. When Galgano returned, he miraculously fixed the sword, but meanwhile the villains had been cruelly punished: one was struck by lightning, the second drowned in a river, and the third was attacked by wolves and had his arms torn off. These ghastly remains, believed to be late (and fake) pious relics to the moral edification of worshippers, were also carbon-dated and (surprisingly) turned out to date back to the twelfth century, therefore to the same period in which the saint lived. They were never considered to be Galgano’s arms, however. Most probably they were unearthed in 1694, when excavations were performed in search of the saint’s grave, and belonged to one of his early followers, a hermit buried in the Rotonda chapel. The mummified arms are now safe inside an iron, bullet-proof windowed relic case.

The Knights Templar

The first of the military-religious orders, the Knights were founded in 1118 to protect pilgrims in the Holy Land. Their rule, attributed to St. Bernard of Clairvaux, was approved in 1128 and generous donors granted them numerous properties in Europe.

It is well known that their order, having acquired too much power, was abolished in 1312 by Pope Clement V, after King Philip the Fair of France in 1307 conducted a mass arrest—and

later burned about 120 of them, including Grand Master Jacques de Molay. But during Galgano's lifetime, the order was in full force, and still had a mansion in Frosini, a few kilometers away from Chiusdino. There are traces of Templar symbols in some of the great abbey's stones, and even at the entrance to the Rotonda at Montesiepi there is a painted "patent cross" (a typical shape used by the Knights Templar) near an engraved shell (pilgrims to Jerusalem used to drink from a sea shell, which became their symbol, and that of one of the Knights, too). Was St. Galgano a Knight Templar, before becoming a hermit? There is no evidence to suggest that he was, albeit in at least one chronicle of his life, when he reportedly begs for money to build a chapel on Montesiepi, he is told by his old friends "to go away beyond the sea." As a pilgrim, so as not to bother them any longer, or as a Knight, to earn fame and wealth?

William of Malavalle, the Hermit: The Roots of the Holy Grail's Myth?

In 2002 I took part in an investigation of the bone relics belonging to still another hermit and saint: St William of Malavalle. He died in 1157—at the age of about sixty—when Galgano was still a child, and was made a saint near Grosseto, 80 km from Galgano's chapel.

Legends claim that before committing himself to a life of penitence and becoming a hermit (he also slayed a dragon: see figure 6), he was Duke William X of Aquitaine: the father of Eleanor of Aquitaine, "the queen of the Troubadours." Eleanor was one of the foremost figures in medieval history: spouse to Louis VII of France, then to Henry of England, to whom she gave eight sons and daughters—among them Richard the Lion Hearted. It was in her court, in southern France, and in that of his daughter Marie de Champagne, where artists like Chretien de Troyes who were creating the Arthurian cycle (between 1160 and 1190) were protected and encouraged. A team of paleoanthropologists has now analyzed William of Malavalle's bones to determine his gender, age, health, diet, etc. DNA analysis and even a facial reconstruction have been attempted.

I have analyzed some iron relics conserved alongside his bones in the glass case—including an iron ring mail, a penitence belt, a penitence helmet, etc.—that are clearly made of ancient medieval wrought iron.

In short, all these analyses seem to point to a male, who died at the age of about 50 or 60. The long leg bones show the typical marks of a person who used to ride for long periods of his life, and his cranial measurements match those of an average individual from southern France. Of course, these results provide just clues and not evidence; but they do not disagree with what the legends say about the noble origins of William of Malavalle, the hermit.

So, could he be the link between Tuscany's Sword in the Stone and the Arthurian cycle? Although the cycle's first novels appeared in written form as early as 1155, could it have partly originated in the peaceful gesture of a Galgano, renouncing violence and war and symbolically thrusting his sword into the ground? Or rather, were the tales of the Arthurian cycle used to embellish the feats of an obscure her-

mit and boost his cult when the Cistercian monks took over in that area soon after Galgano's death? If this is the case, is the sword itself a very early fake, put there by the monks in the first years of the thirteenth century?

Further evidence may lie underneath the rock and in a careful analysis of the sword and of Galgano's skull; the Arthurian link through William of Malavalle/Aquitaine may be virtually impossible to prove and will remain one of the many mysteries that surround St. Galgano. More multidisciplinary studies are clearly needed to understand what the hill of Montesiepi hides.

But where science meets its limits, and when the language of old stones is silent, we will continue to look with awe on these fascinating ruins and try to guess the meaning behind all the magic stories.

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Figure 1—The sword in the stone

Figure 2 - The Rotonda Chapel on the hill of Montesiepi

Figure 3— The ruins of the Abbey of St Galgano

Figure 4—Georadar scanning

Figure 5—The extracted sword

Figure 6—The mummified arms

Figure 7—William of Malavalle, the dragon slayer hermit: aka the Duke of Aquitaine?

