

## **Sculpting from the Inside Out “ 540 Hidden Split Torus”.**

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### **Abstract**

Unlike most sculptors, I am only sculpting the inside of my stones, never the outside. In the beginning (from September 2003) I made simple forms as balls, lenses, rings and cubes inside stones. One of my major principles is that the integrity of the stones may never be damaged outside. My work is strongly influenced by Escher, and lately also by one of the world's leading sculptors Keizo Ushio. As the outside of the stones must remain as intact as possible, it is the end result that dictates the way of going into the stone. The working process of the making of the “Hidden Split Torus 540” is explained. During the Biennale (1-9 December 2007) in Florence Italy this sculpture was the topic of a talk by art critic Paul Lorenz from the Art Academy of San Francisco.

### **Karel Sculptor**

Although I grew up in the smell of oil painting I was never before touched by art. Quite surprisingly I only started sculpting on a blue Saturday morning in September 2003 at the age of 52 years after a short introduction on working in Stone. During this workshop they tried to teach me that I had to work on the outside of the stone, which I did not want to do. My goal was to separate a ball in the middle of the stone. It was not a great success, but what I did learn was that I needed precise measuring instruments and a good feeling of the 3-dimensions of what I wanted to produce within the stone. As I had to develop techniques to go into the stone, instead of staying on the outside, I started with simple forms within the stone such as balls, cubes and lenses. [Fig 1 – 6].

I am a self-taught sculptor. My way of sculpting can be seen as an exploration of the inside of the stone. While exploring the inside, I try to leave the outside of the stone as untouched as possible.



**Figure 1-6:** *Balls and cubes in different sculptures.*

I even excavated stones completely so that a sort of Buckeye Ball remained. Stone, in whatever form, is for me the most beautiful material to work in. The limited possibilities of the fragile material lead me to my own artistic boundaries. While exploring stones on the inside I was first strongly influenced by artists

Escher and Dali. Their drawing and paintings of peeled heads were an example to form peeled stone [Fig. 7] and later on the reversed version where the peeling is on the inside of the stone [Fig 8]. The different forms resulting from this process have a very organic appearance.



**Figure 7-8:** *External and internal peeling of the stones.*

The influence of Escher led me to the mathematical form of the trefoil knot [Fig 10]. As can be seen in Figure 9, it was Escher's drawing that served as an example for the Hidden Trefoil Knot that was carved in this Alabaster Bolo, hidden in the stone as if it was an archaeological finding. This one turned out to be extremely complicated to carve. There are more than 1001 possibilities to make the one terrible mistake, but fortunately this one was a success.



**Figure 9-10:** *Escher's Trefoil Knot served as an example for the Hidden Trefoil Knot..*

After all these experiments in stone I searched the internet to find other sculptors interested in the same geometrical or mathematical forms. It is not difficult to find Carlo Sequin this way, and next all the sculptors he collected on his site of the Berkeley University. It was especially the work of Keizo Ushio that gave new ideas for mathematical sculpting. At this moment I was very excited about the 540 Split Torus of Keizo Ushio [1]. With his "Dream Lens" in the Kobe Harbour, Keizo Ushio gives the impression as if it has been formed out of three different rings. It is however a 540 degrees Möbius band

that is splitting the torus in combination with a special surface texture that creates this remarkable sculpture. Working on an Alabaster Bolus, I tried to hide a 540 Split Torus [Fig. 11] inside the stone. And later on I made an even more complicated Hidden Split Torus 180 [Fig. 12 ].



**Figure 11:** *Hidden split Torus540.*

Intrigued by mathematical knots the next project was the a Borromean Knot, called after the famous 15<sup>th</sup> century architect from Italy. An example of this Borromean Knot was found on Carlo Sequin's website. This was the first sculpture that was not constructed completely on the inside of the stone. It is an assembly of 3 different Alabaster Stones that were shaped into 2 rings and a standing part with a ring included. One of the rings had to be opened and contains a precision locking system to hold the 2 parts precisely together. [Fig 13].



**Figure 12-13:** *Hidden split Torus 180. Partly Hidden Borromean Knot.*

## The Making of the Hidden Split Torus 540

Unlike classical sculpting procedures, for this kind of sculptings a sort of reversed thinking is needed to reach the final goal. One of the first problems is that the final form that will be left inside the stone has to fit rather precisely. If it does not fit, it will be practically impossible to carve it. In this case, the objective was that the Torus had to be split with a 540 degrees Möbius strip so the ring had to cross the borders of the stone on 3 different sides. At this moment it was impossible to predict how the eventual splitting process could be executed. So I decided to make openings on the top of the stone and on the bottom. As the stone is quite large, at a later moment the ring or torus had to be accessible on the inside of the stone. In this case an opening was predicted on the left side of the next image of the stone that you can see in [Fig. 14]. Without that, it would not be possible to do the splitting process in the end. The same problems and even worse appeared with the Split Torus 180 which was much more complicated to accomplish [Fig.12].



**Figure 14:** *Hidden split Torus, the beginning..*

Once the location of the openings was decided for, the stone was carefully measured to calculate the diameter of the Torus and from there to calculate the diameter of the tube that forms the Torus. In this case it was calculated that the Alabaster stone could contain a Torus of 33 cm wide. The thickness of the stone permitted a Tube forming the Torus of 11 cm and a central hole of again 11 cm.. From that moment on models could be made in carton and in wood for the diameter of the tube (11 cm), for the central hole (11 cm) and for the top of the ring (22 cm). They were necessary for quick verifications of dimensions during the carving process.

At first on one side of the stone a flat surface was made with a diameter of 22 cm which corresponds to the top of the torus. [Fig. 15] In the middle, a hole was drilled through the stone to mark the centre of the torus on the other side of the stone. Once the centre was marked on the other side of the stone a similar flat surface of 22 cm in diameter was created. [Fig. 16]. As can be seen in Fig. 16, a bent metal wire was used to draw a line on top of the torus with a diameter of 22 cm . As it rather difficult to measure the thickness of the disk formed by the two flat surfaces, for that reason a central hole was already drilled to do the measuring from the inside of the ring that was going to be formed. For this, with the aid of another

bended metal wire, the outline of the central hole was carved on both sides of the stone [Fig.17]. Next, with long small drills, several holes were drilled, enlarged, and the central segment taken out. [Fig. 18 and 19] Next using marble files the inner surface of the central hole could be smoothed whereby both carved circles of 11 cm were interconnected. Now it was possible to measure the thickness of the disk in all directions



**Figure 15 and 16** *It is the final form that dictates the working process.*



**Figure 17 -19** *It is the final form that dictates the working process.*

As was mentioned before, during the sculpting process the use of simple wooden and carton measuring tools facilitated the work. So a measuring tool for the diameter of the tube was made as well as a tool to maintain the 21 cm diameter outline of the torus. On the stone, landmarks marked the spots that had to remain intact including surrounding areas, in order to keep the integrity of the calculated form inside intact. Most sculptors work spontaneously and can recalculate the outcome of their work when dimensions do not turn out the way they had in mind. Leaving the sculpture inside the stone and not damaging the outside demands an exact calculation of the material that must remain intact inside the stone to form the final desired form. Dimensional shift is not permitted.

At this stage, the central disk is already clearly visible, both sides are flat and smooth, the central hole has been adjusted to its final dimensions. (first final step accomplished) As the disk with the central hole must have the same thickness all around, both sides must be parallel. This could easily be verified with visual inspection using 2 pieces of wood and the help of one of my daughters. [Fig 21]. As one can see,

some adjustments have to be made. Using this method we can also see if the correction is to be made on the left side or on the right side because using these pieces of wood we can also verify the alignment of the disk in the stone.[Fig. 20 and 21].



**Figure 20 an 21** *The central Hole neatly carved, parallelism of both sides can be measured easily using pieces of wood.*

After the parallel adjustments, the inner curvature was carved using chisels and marble rasps. In the top right corner of figure 22, a carton curvature stand can be seen which is used every 23 seconds to check for the proper inner curvature of the torus. After finishing the inner curvature, the predicted openings on the top and the bottom of the stone were made. Here measuring was extremely difficult. Using a wooden stand, [Fig. 23] this part of the work became less difficult.



**Figure 22** *Finishing the inner curvature using carton stands*  
**Figure 23** *Making the outer curvature of the torus using a wooden stand.*

In total this sculpture took more than 200 hours. It was a matter of carving, calculating, recalculating, and rather often a moment of absolute panic when things did not develop the way they should have. The outer ring was much more difficult than predicted. Despite the wooden and carton “measuring devices” it turned out extremely difficult. The stone itself was much more brittle than foreseen. This way of sculpting on this scale demands a stone that has a high tensile strength. Marble and granite are on this scale much too brittle. Whatever you try, it will not succeed. On a larger monumental scale, granite or marble will be the material of preference. Eventually as you may see in [Fig. 24], a nice smooth torus was created on the inside of the Alabaster Bolus. For splitting there was not yet enough space on the left wing of figure 24. The ultimate finding in this sculpture was to create a sort of second hidden torus in the “wingpart” of

the stone. [Fig 25.] This way, a splitting process would probably be possible. After so many hours of hard labour, it was quite a risk to proceed with the splitting process. Some of my artist friends said “Stop, take another stone and leave this one as it is,... because it is already beautiful”. They were right, but the goal was a 540 split torus so the process continued.



**Figure 24 and 25** *The torus finished and the ultimate finding , a second hidden torus for better access for the splitting process.*

Calculating the exact path of the splitting over the ring was much more difficult than the splitting process itself. What makes a 540 Split Torus so special is that there are specific geometric ‘landmarks’ which need to be placed on the ring before the splitting begins. I marked the 3 locations where the splitting occurs at 90 degree angles, seen from the side of the ring. Viewing the form from a distance, we can look through the stone ring at these 3 locations. These views through the split torus were located using an equilateral triangle [Fig. 26]



**Figure 26 and 27** *Calculating the locations for the split using an equilateral triangle. Miscalculation leads to almost irreversible non-parallel paths.*

The next step was to ‘calculate’ or ‘predict’ the path of the splitting on the inner and outer surface of the ring. Through a system of intuitive trial-and-error by displacing the 3 spots, a definitive ‘safe’ trajectory was selected for the final splitting. Once the definitive location of the 3 spots was decided, sculpting with the drill could begin. The intention was that the three holes in the stone should have been parallel. Somehow a small almost irreversible error was made. [Fig. 27] This imperfection had however no effect in the final work, I had a possibility of

correcting this error with the following larger drill. From this moment on there was no way back, the splitting path was drawn on the outside and inside of the polished torus. [Fig. 28 - 29]



**Figure 28- 29** *The drilling and splitting process progresses slowly and requires great patience and precision. The small scale makes every decision even more critical.*

The drilling and splitting felt much like a horror film. The fear of not being able to accomplish the process was nerve cracking. Viewing images of Keizo Ushio, it looks as if the splitting is easy and very predictable. In this sculpture it was the natural outer shell around the torus that bothered me more than expected. The inside of the ring is completely free. However, I had to make concessions on the outside of the ring to gain access to specific areas in the stone form.

### **Conclusions**

Much of the success of the sculpting process depends upon intuition and decisions taken at the right moment during the process. Overseeing the process and foreshadowing possible problems are important factors that influence the final result of the work. It is my personal view that the original form and integrity of the stone must remain recognizable and intact even after the work is concluded. As an artist I feel that I am uncovering the secret of the inner stone. Part creator but also as medium, I am giving the stone a voice and freeing its concealed character. Stone stands symbol for eternity and as mineral, it is a tangible link to physics and the forces driving the universe.

Characteristic of most all my work is that the original form of the stone can be restored by filling the sculpture with wet sand in the same color as the stone. A specially filmed, non stop-motion animation will probably be shown in my 'Bridge's Presentation' where the intriguing process will be revealed in a very surprising manner,....My secret..

### **References**

- [1] N.A. Friedman and C.H Sequin, *Keizo Ushio's Sculptures, Split Tori and Möbius Band*, Journal of Mathematics and Art 1, pp. 47-57. 2007.
- [2] Keizo Ushio, *Personal communication, October 2007*