University of Warsaw Geology Department uses SMARTTECH 3D scanner to discover the secrets of earth

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Abstract

Researches provided on University of Warsaw Geology Department uses a 3D scanner to make advanced analysis of quartz crystals found on different places on Earth. Quartz crystals are formed in the same process for millions of years. They usually grow in regions of active volcanoes and earthquakes. Their final shape and color depend from number of external factors such as for example pressure, and temperature. Precise 3D scan of quartz crystals made with sub millimeter accuracy gives scientists unique possibilities of researching the condition under which the crystal was formed and discovering the earth condition from hundred thousand years ago.

KEYWORDS: **3D scanner, cloud of points, analysis, quartz crystals**

From scientific point of view

Grain is the beginning of crystal formation. It appears when under high temperature and pressure, a single Si atom connects to two oxygen atoms originating from hot water. Combined atoms form a single silicon dioxide of crystalline cell. Environment that produces quartz must contain the proper proportions of silicon and water or pressurized steam, interacting under high pressure. When the liquid materials flow around the first silicon dioxide cell, it starts to reproduce, and complex crystal structure is being formed: by adding subsequent layers of atoms.

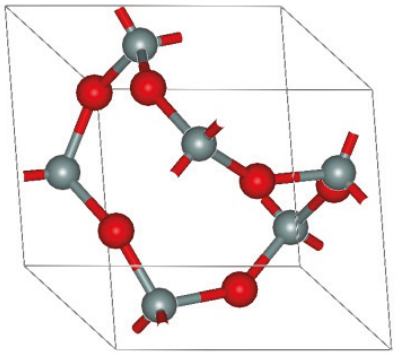

Fig. 1. *This diagram shows the crystal structure of quartz – silicon atoms are grey and oxygen atoms are red*

Each cell is built according to the same pattern and is, in itself, a tiny crystal. Every cell reproduces the pattern, according to previous one. In this way the crystal forms a complex three-dimensional structure, called the crystal lattice of perfect geometric regularity.

Fig. 2. *Quartz crystals*

The research over the crystals shape over the years has been conducted with optical goniometer involving the analysis reflected through the prism of crystal light. It required not only a lot of experience, was prone to human error and inaccurate measurement device itself - explains Msc. ing. Adrianna Augustyniak - quartz analysis specialist on Geology Department.

3D scanning in service of geology researchers

3D scanning is a new method of research which helps to determine shape of crystal with bigger precision and enables researchers to conduct additional analysis within just one click basing of gathered data.

Geology Department of Warsaw University owns 3D scanner scan3D Universe 5MPix which is used for basic measurements of stone formations. However for this application more accurate device was needed and tested. Research has been conducted

on newest SMARTTECH3D mini desktop device. This is a 10 MPix scanner dedicated for automated measurement of small sized object with accuracy of 0,01 mm and resolution of over 4000 point/mm^2. This was possible without additional costs and with full support from SMARTTECH thanks to SMARTTECH3D EDU program in which Geology Department is involved.

Fig. 3. *3D scanning of quartz crystal using SMARTTECH mini*

The method of scanning 3D by SMARTTECH 3D scanners is contact less. It involves displaying straight fringes on the object and analysis of the strain on visible surfaces. Acquired cloud of points (CoP) matches the shape of the object with an accuracy of up to ten microns, which significantly exceeds the capabilities of traditional methods. All cracks and small deformations can be visible and then analyzed thanks to ultra-high resolution (density of measure points) offered by SMARTTECH 3D scanners.

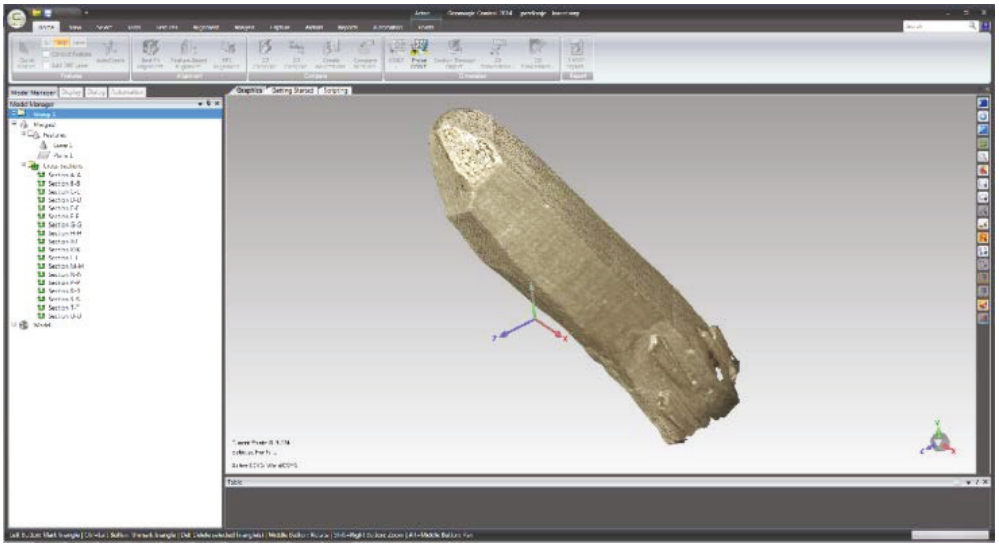

Fig. 4. *Results of 3D scanning*

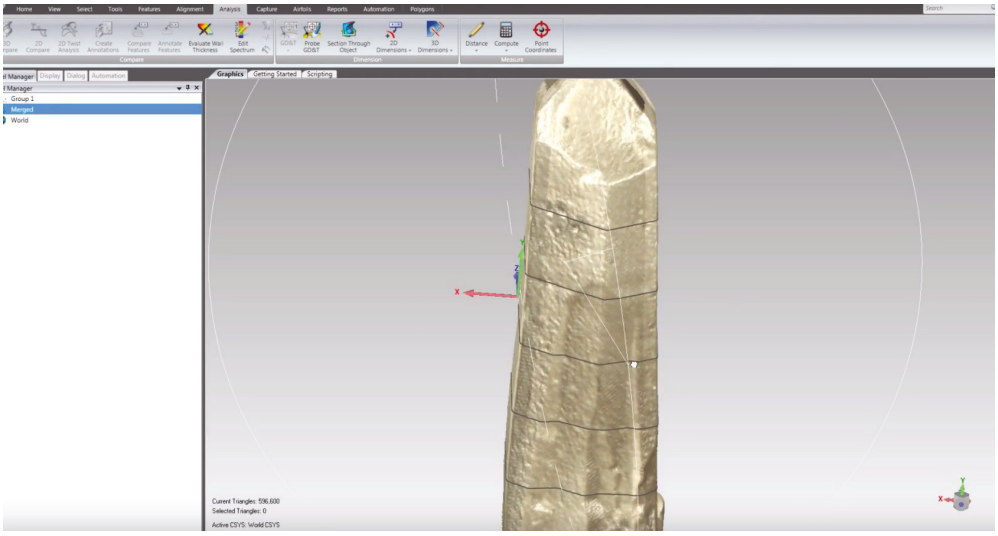

Fig. 5. *Creating cross-sections*

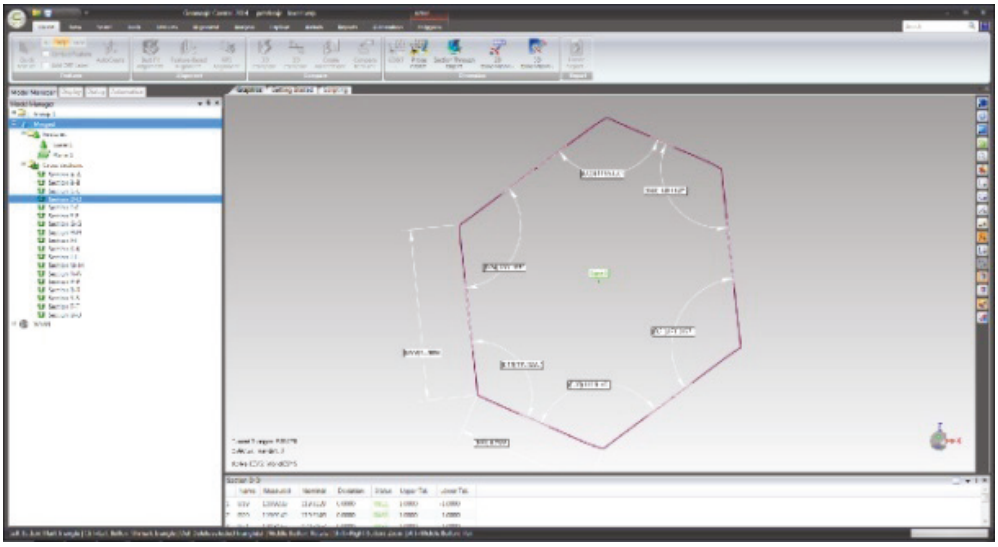

Fig. 6. *Cross-section dimensional analysis*

The model obtained from 3D scanning process thanks to proven metrology accuracy is a reliable and easy to work with data. Here is how users themselves describe the possibilities:

"I can randomly turn the figure, give it a specific color which is helpful to raise the profile in certain details of morphology, but what is most important I can create cross-sections perpendicular to the edge of the walls, which allows to make measurements of real angles between them and conduct distance measurement of length and volume of the object with an accuracy of 4 decimal places."

"On this basis (scanned data), we can identify and confirm the existence of concrete walls previously known in the literature, and also identify potentially new undiscovered surface structures. The method also allows for study on crystal morphology,

analyzing stages of their growth and possibly identifying the indications of the environment and the genesis of its creation. Having the information about the angles between different surfaces we can define the conditions of it's origin like pressure and temperature. Therefore we are able to discover the earth conditions from hundred thousand years ago."

Using the SMARTTECH 3D scanner, Department of Geology of University of Warsaw is at the forefront of educational units, which, thanks to the use of modern technology are able to present research results available so far affecting the perception of geodetic science around the world. Moreover being SMARTTECH customer they can count on long term cooperation in internship, research and business cooperation.

References

1. www.smarttech3dscanner.com (access: 15.01.2016 r.).