THE USE OF LASER SCANNING AND DIGITAL PHOTOGRAMMETRY FOR THE CREATION OF VIRTUAL GEOLOGICAL OUTCROPS

Andrij Bubniak, Ihor Bubniak, Maria Oliinyk, Anatoliy Vivat, Janina Zaczek-Peplinska

CONTENT

Introduction

LIDAR and SFM

Software for processing

Examples of investigations

Conclusions

VIRTUAL GEOLOGICAL OUTCROP

A digital outcrop model (DOM), or virtual outcrop model, is a digital 3D representation of the surface of an outcrop, typically in the form of a textured model or point cloud.

METHODS

LIDAR

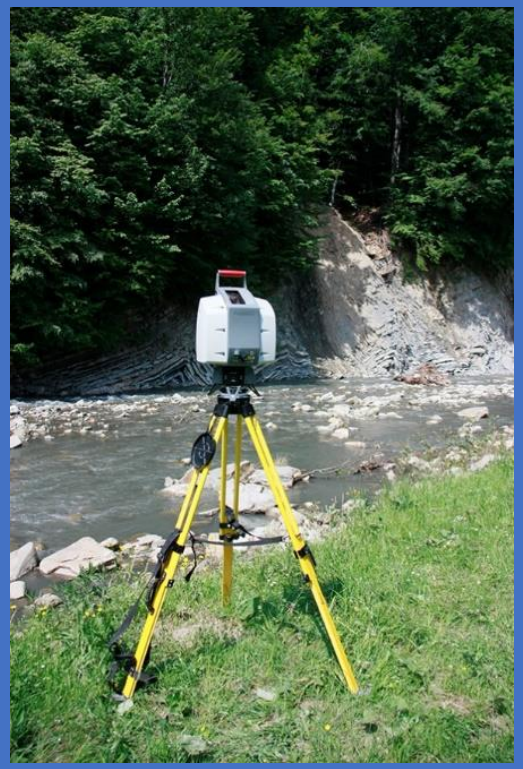
- **LIDAR** (*Light Identification, Detection and Ranging*) is surveying method that measures distance to a target by illuminating the target with pulsed laser light and measuring the reflected pulses with a sensor.

SFM

- **Structure from Motion (SfM)** is a technique which utilizes a series 2-dimensional images to reconstruct the 3-dimensional structure of a scene or object

TECHNOLOGIES FOR BUILDING VIRTUAL OUTCROPS

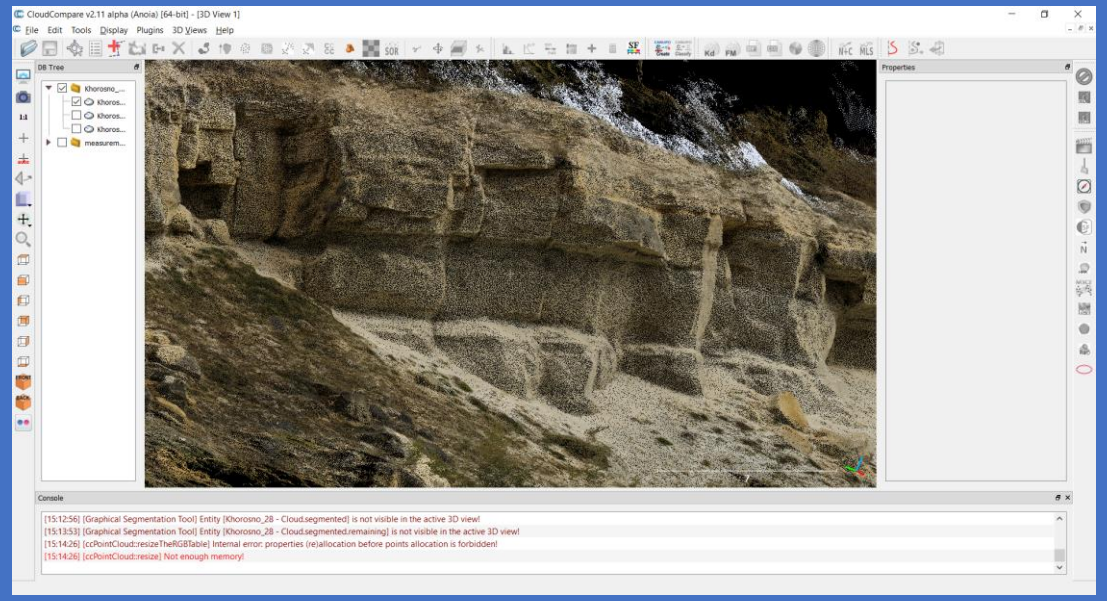
Laser scan (LIDAR)



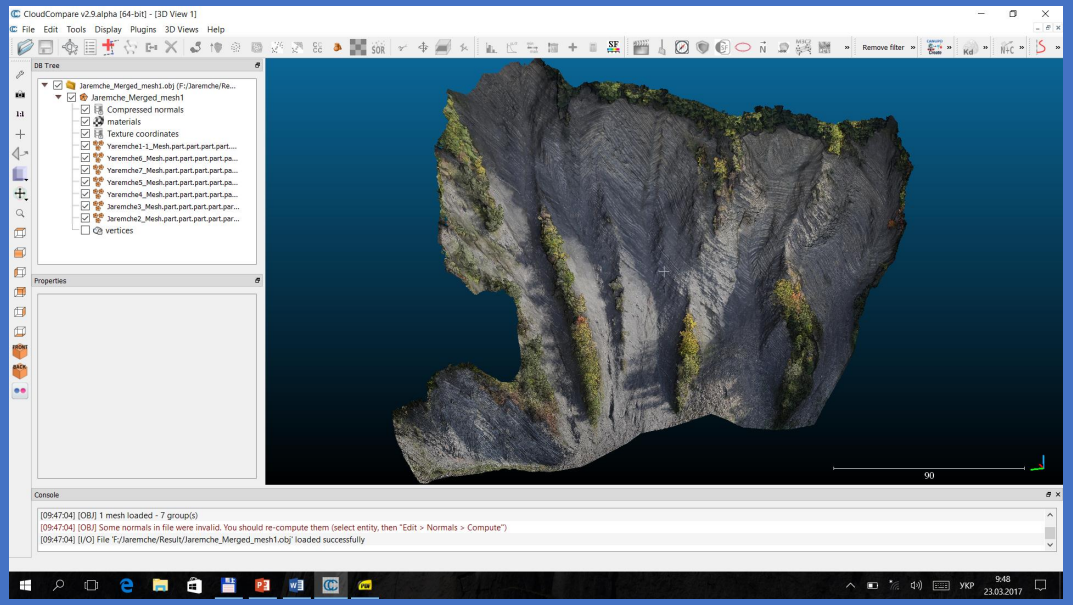
Digital photogrammetry

TWO TYPES OF MODELS

Cloud of points representing the investigated surface



Textured surface



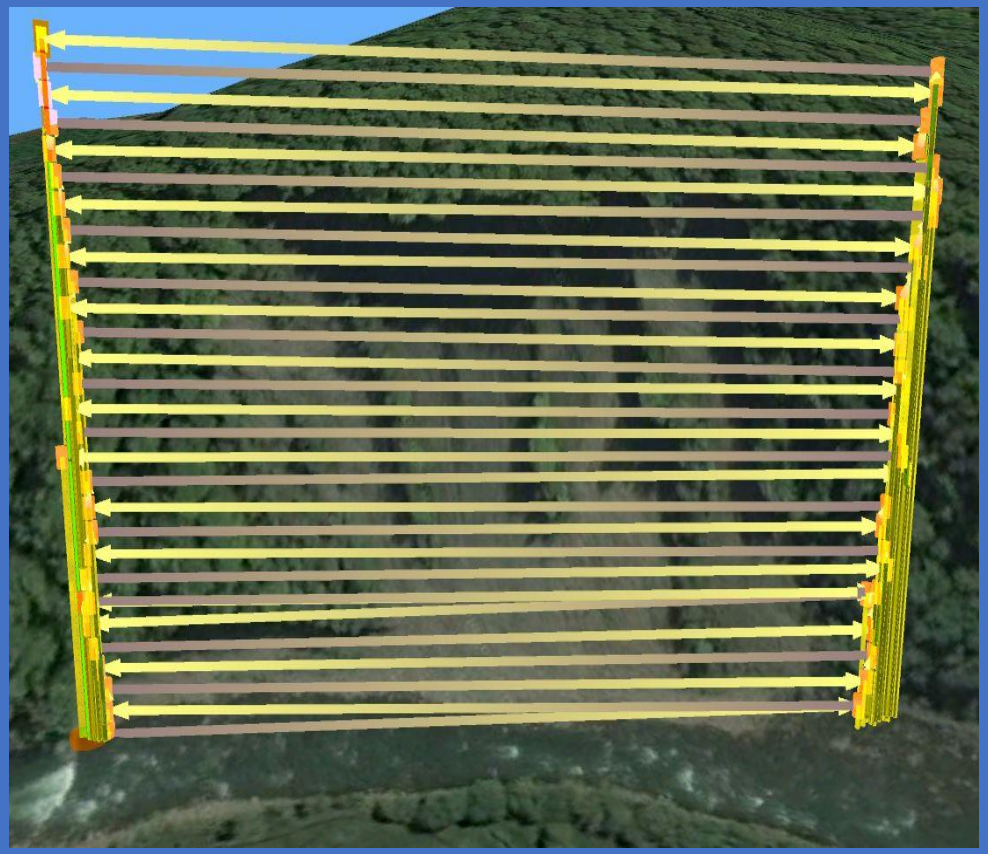
STAGES OF CREATION OF VIRTUAL OUTCROPS

- Preparatory
- Field
- Office room

PREPARATORY

- Select a research object
- The choice of research methods - laser scanning, photogrammetry, depending on the requirements for accuracy
- Choosing the software

FLIGHT PLAN AND PHOTOGRAPHY



FLIGHT PLAN DESIGN

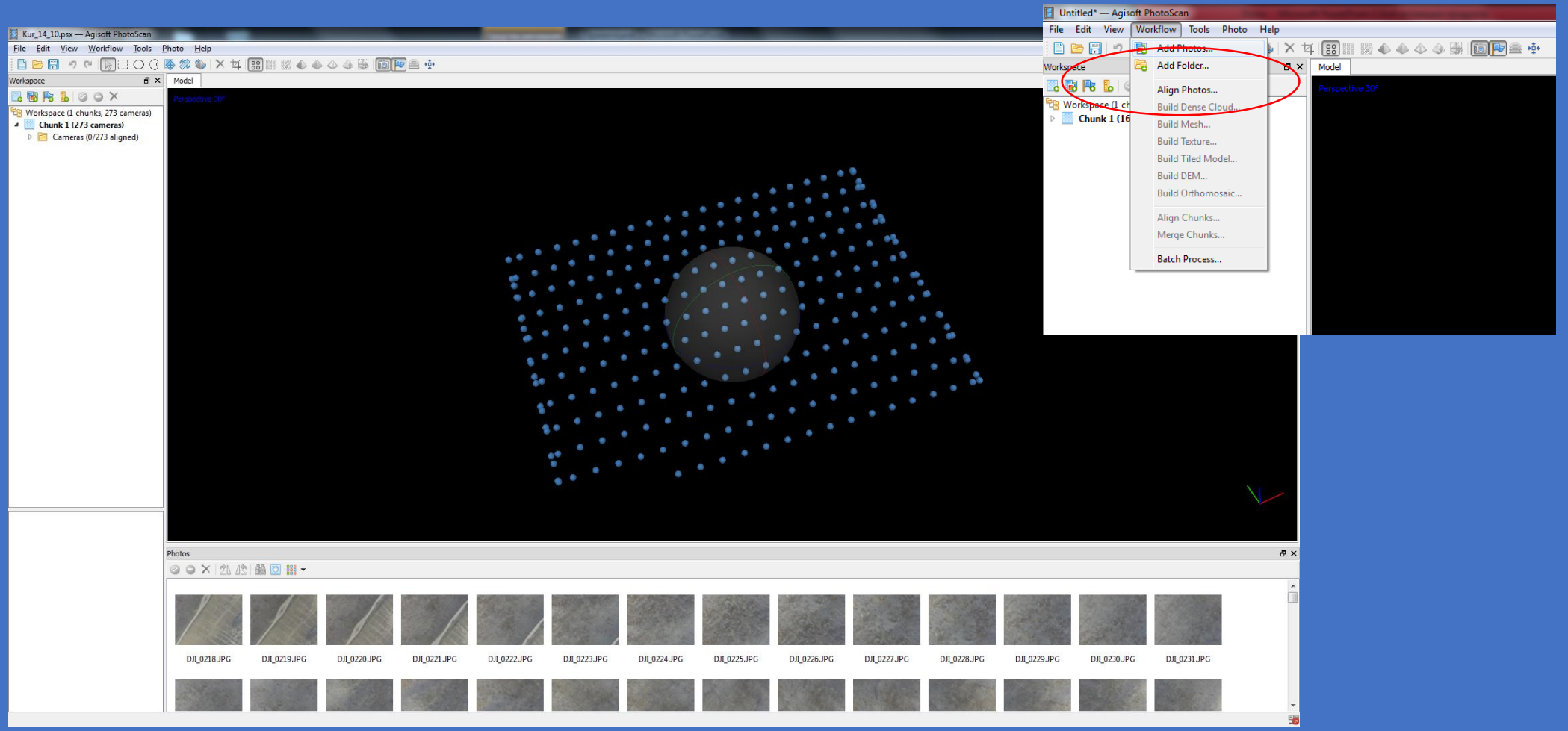
FIELD WORKS
(LIDAR)

FIELD WORKS
(DIGITAL PHOTOGRAMMETRY)

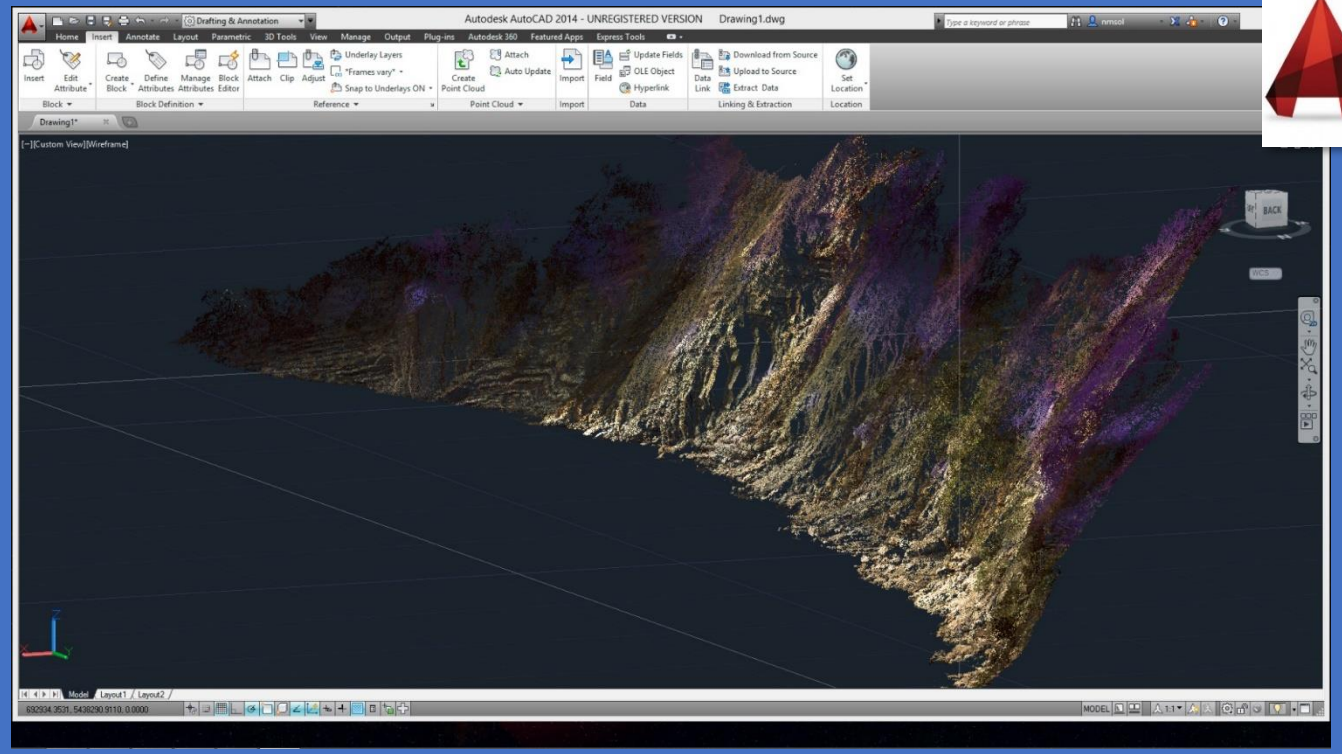
PROCESSING OF THE RESULTS OF SURVEY

- AGISOFT HPOTO SCAN
- Pix 4D Mapper
- Visual SFM
- Mash Lab

UPLOADING SURVEY RESULTS

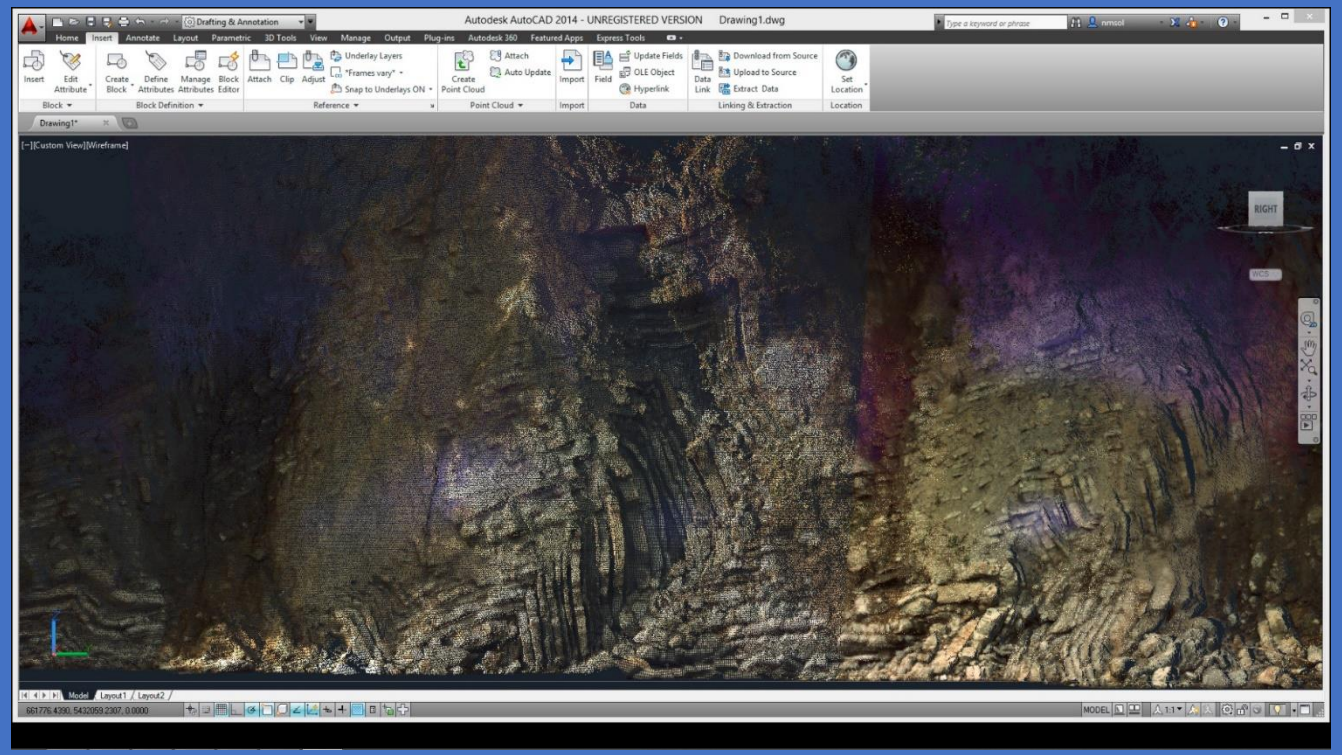


THE CLOUD OF POINTS OBTAINED AS A RESULT OF LASER SCANNING IS LOADED INTO AUTOCAD, BUKIVETS' FOLD

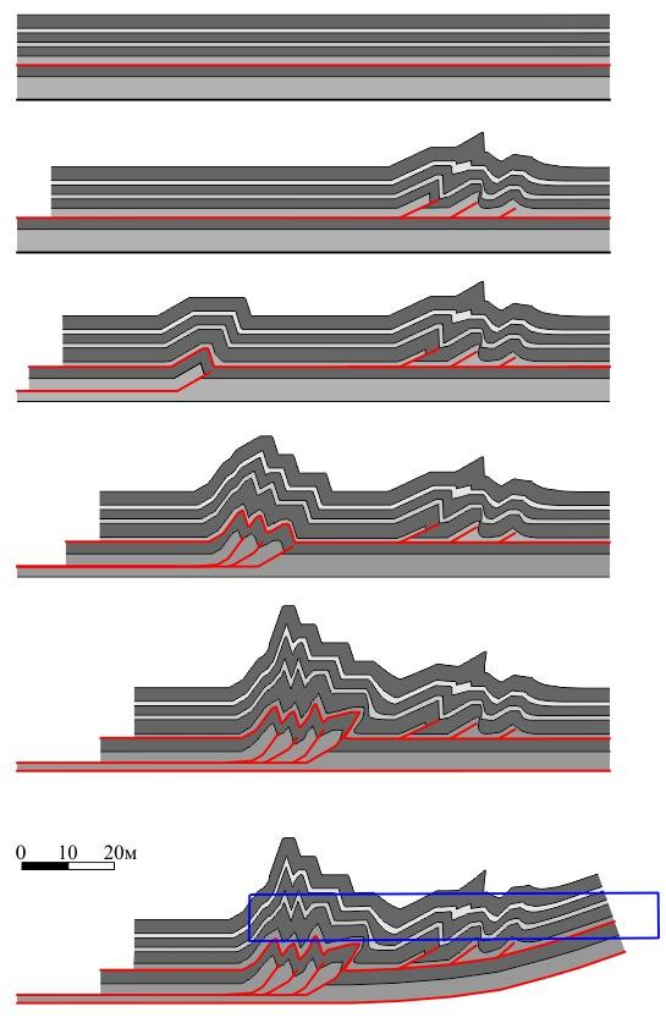


AUTODESK AUTOCAD 2014

BUKOVETS’ FOLDS, POINT CLOUD



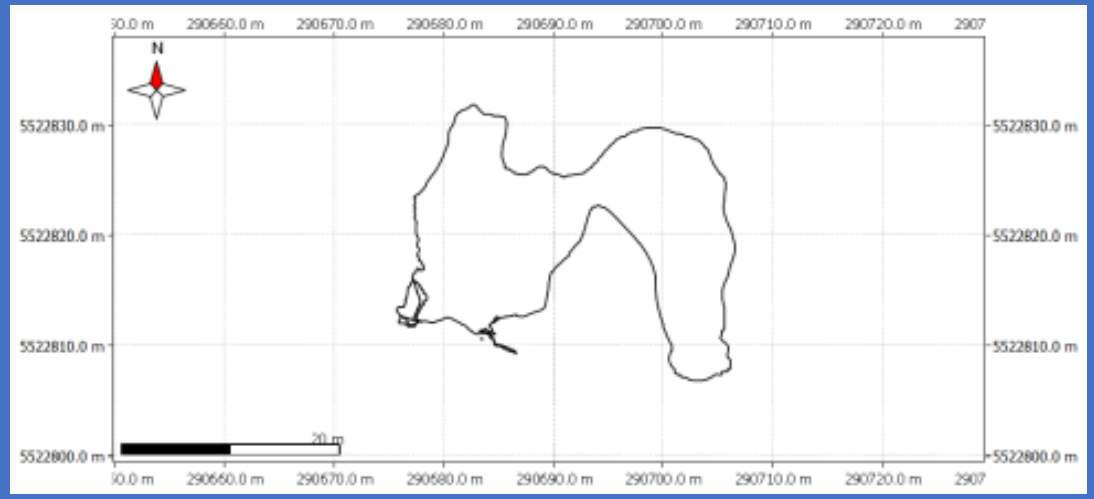
MODELING BY MOVE SOFTWARE



- Formation of the flysch strata
- Development of folds and thrusts with amplitude up to 4 m.
- Formation of the fold under the trishear mechanism
- Formation of modern structure

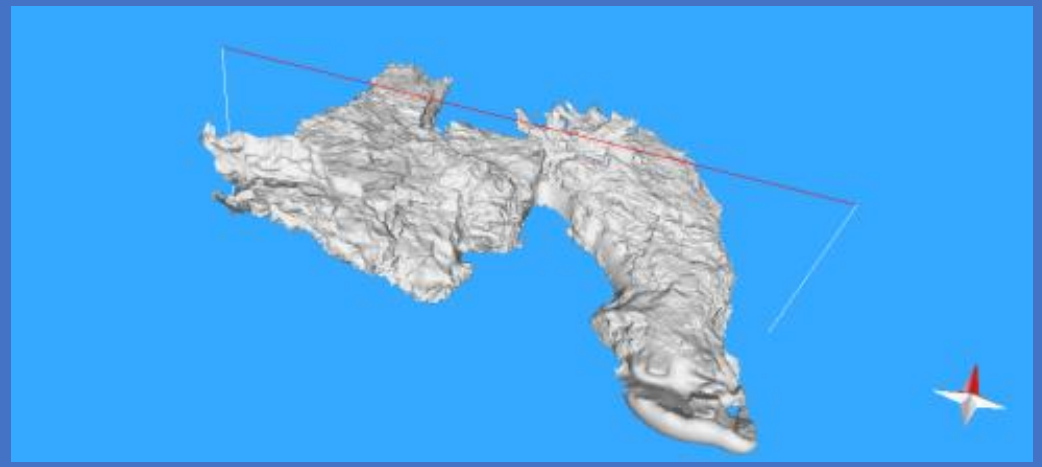
THE POSITION OF THE HONEY CAVE

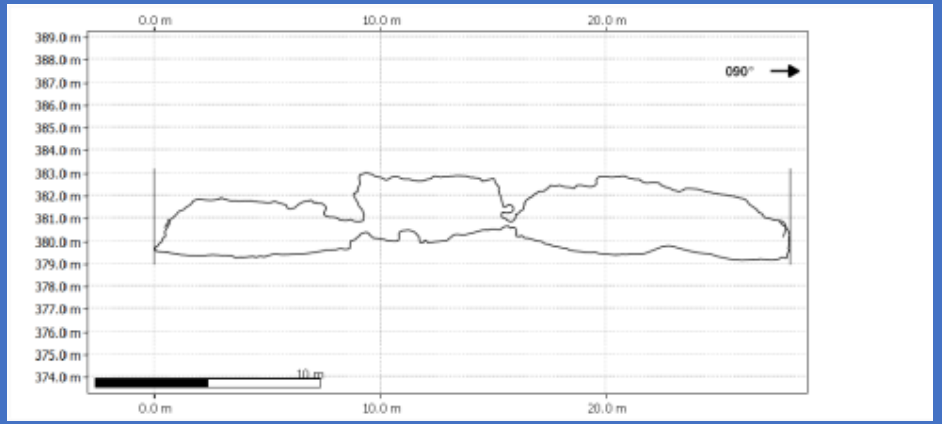
CONTOUR OF THE HONEY CAVE



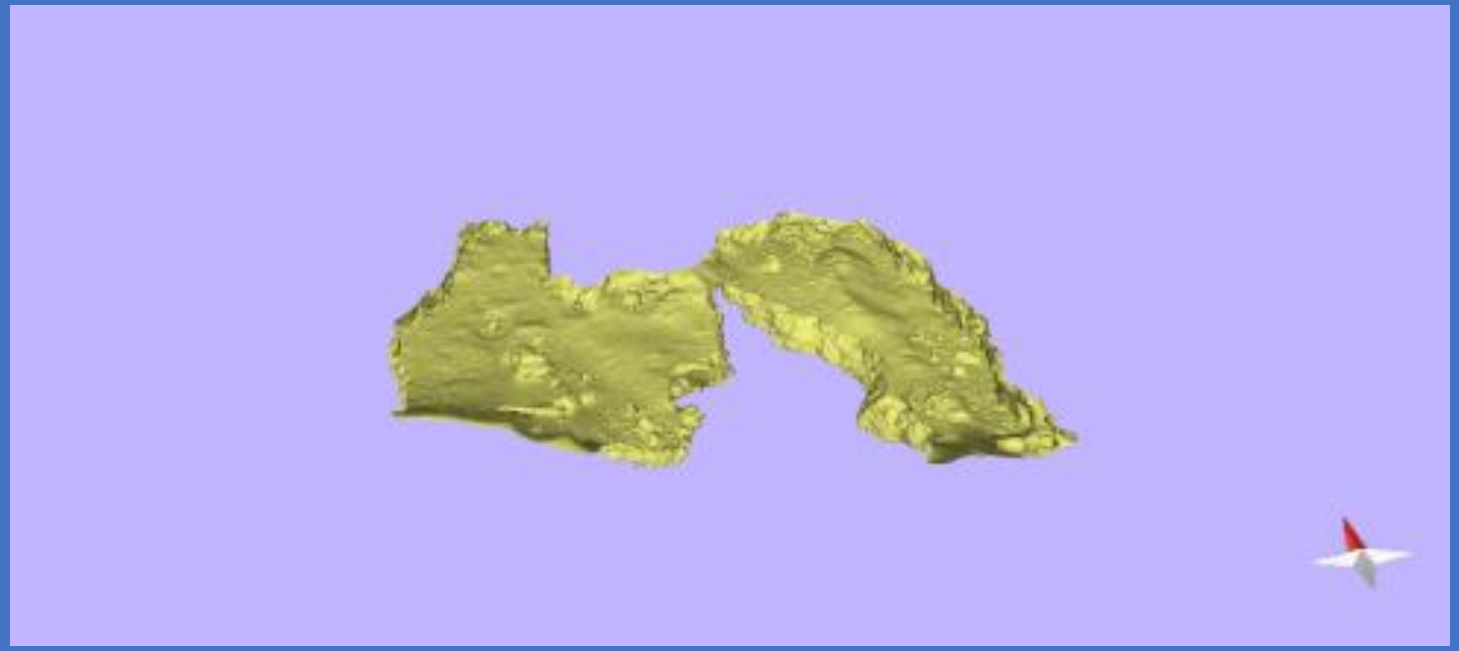
ENTRANCE TO THE HONEY CAVE

3D MODEL AND MAP

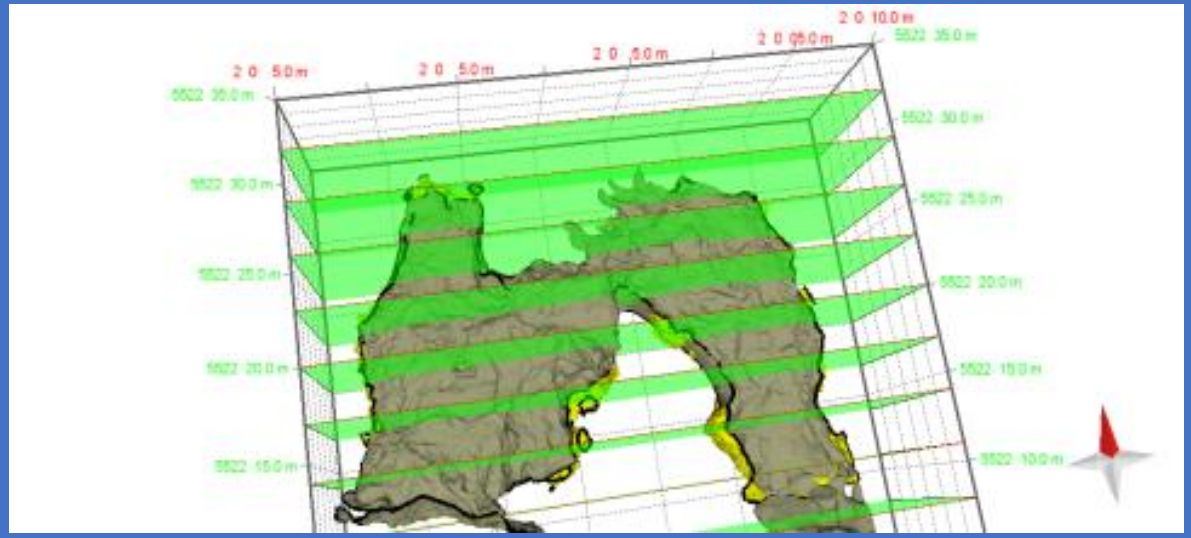




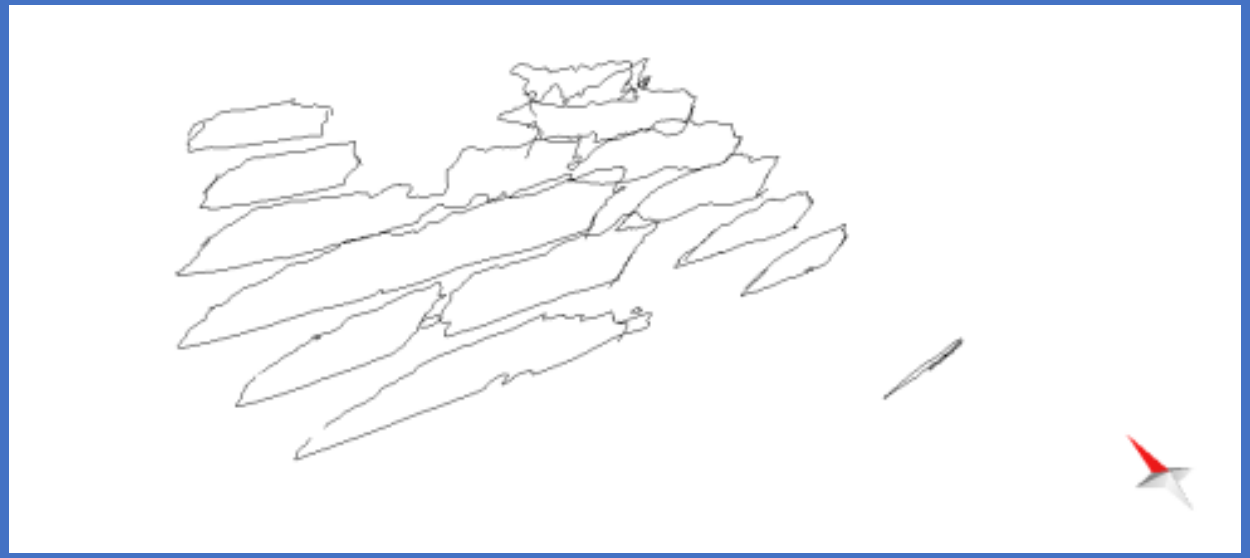
THE BOTTOM OF THE HONEY CAVE



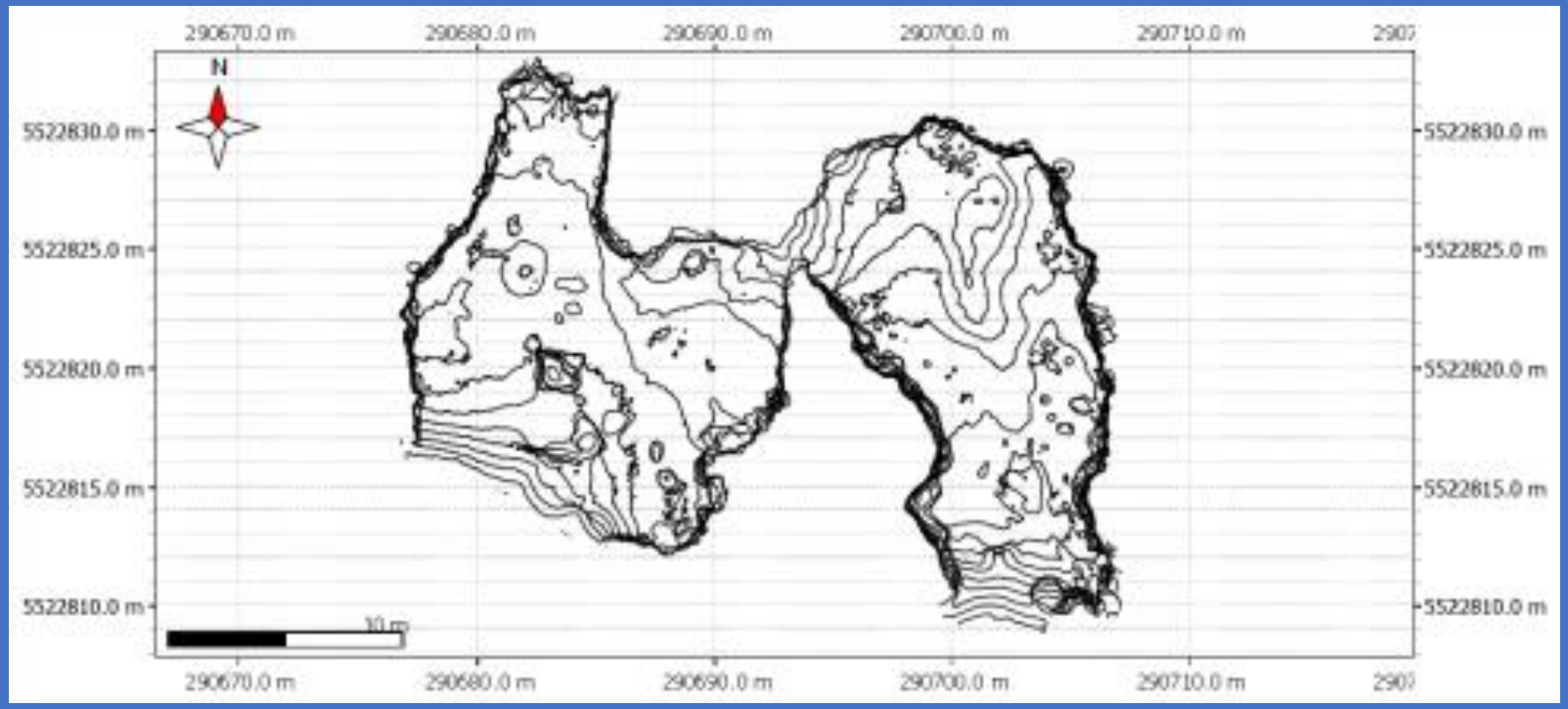
LOCATION OF SECTIONS OF THE HONEY CAVE



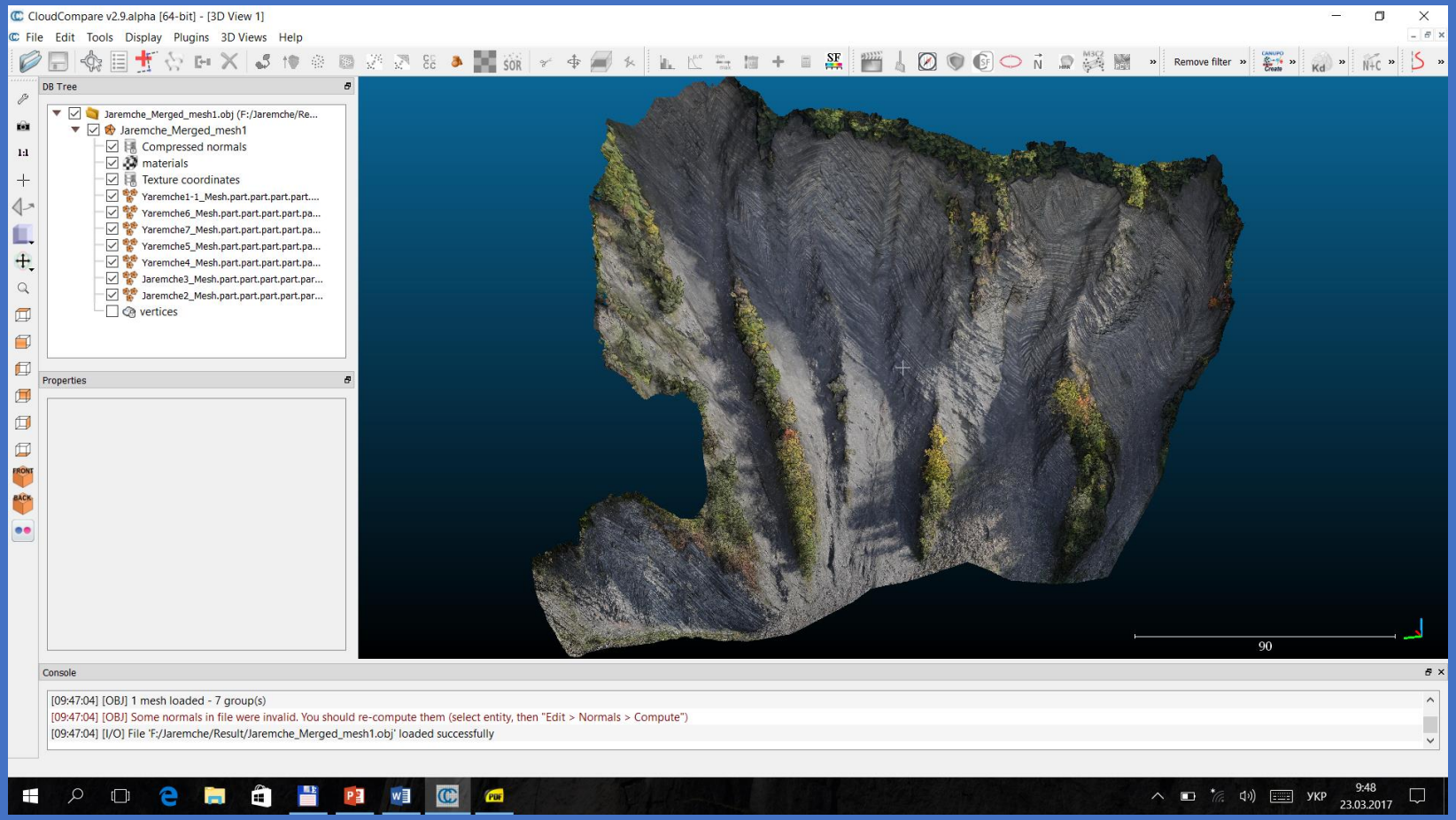
CROSSINGS OF THE CAVE THROUGH 6 METERS



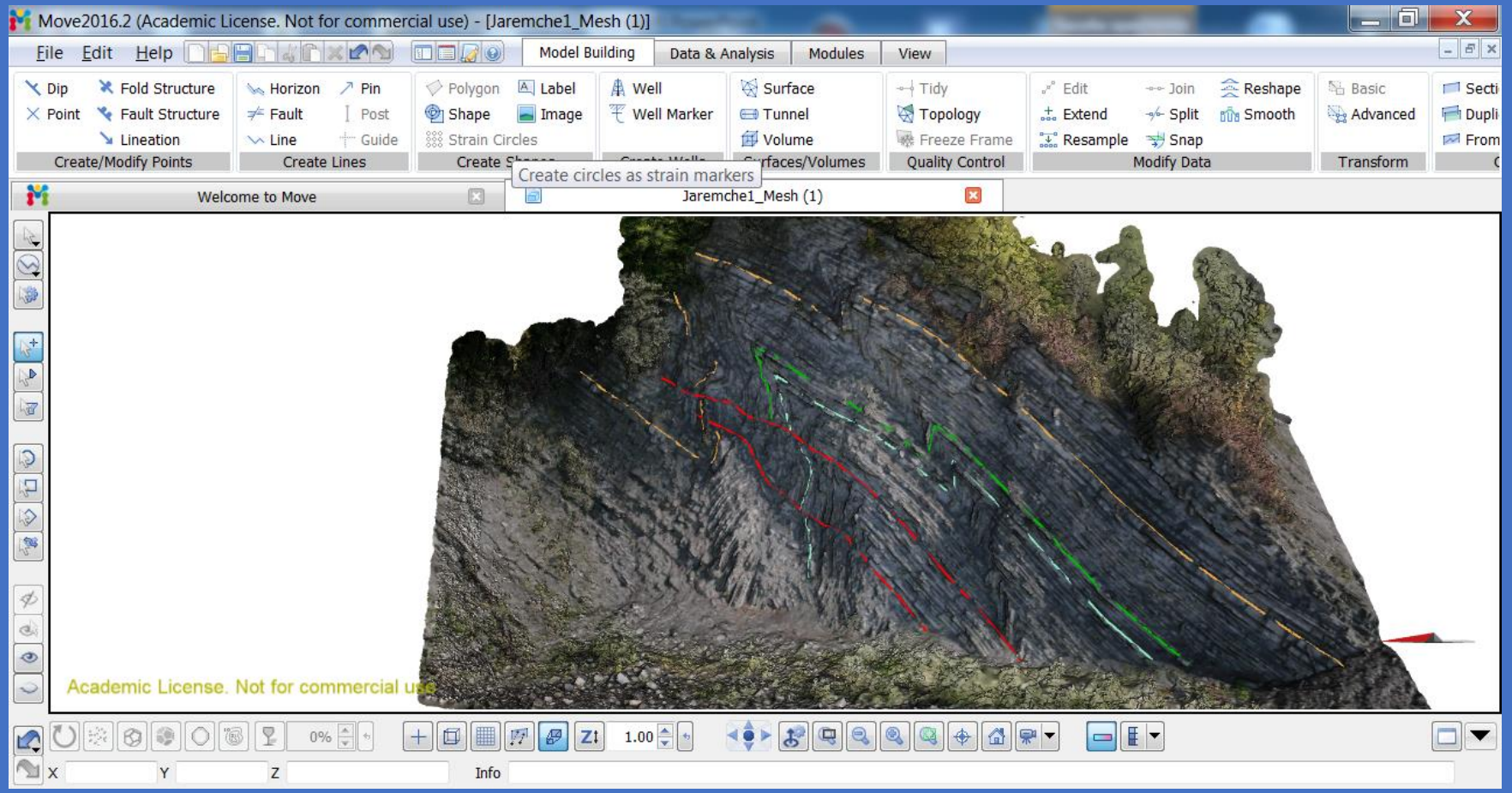
MAP OF HONEY CAVE



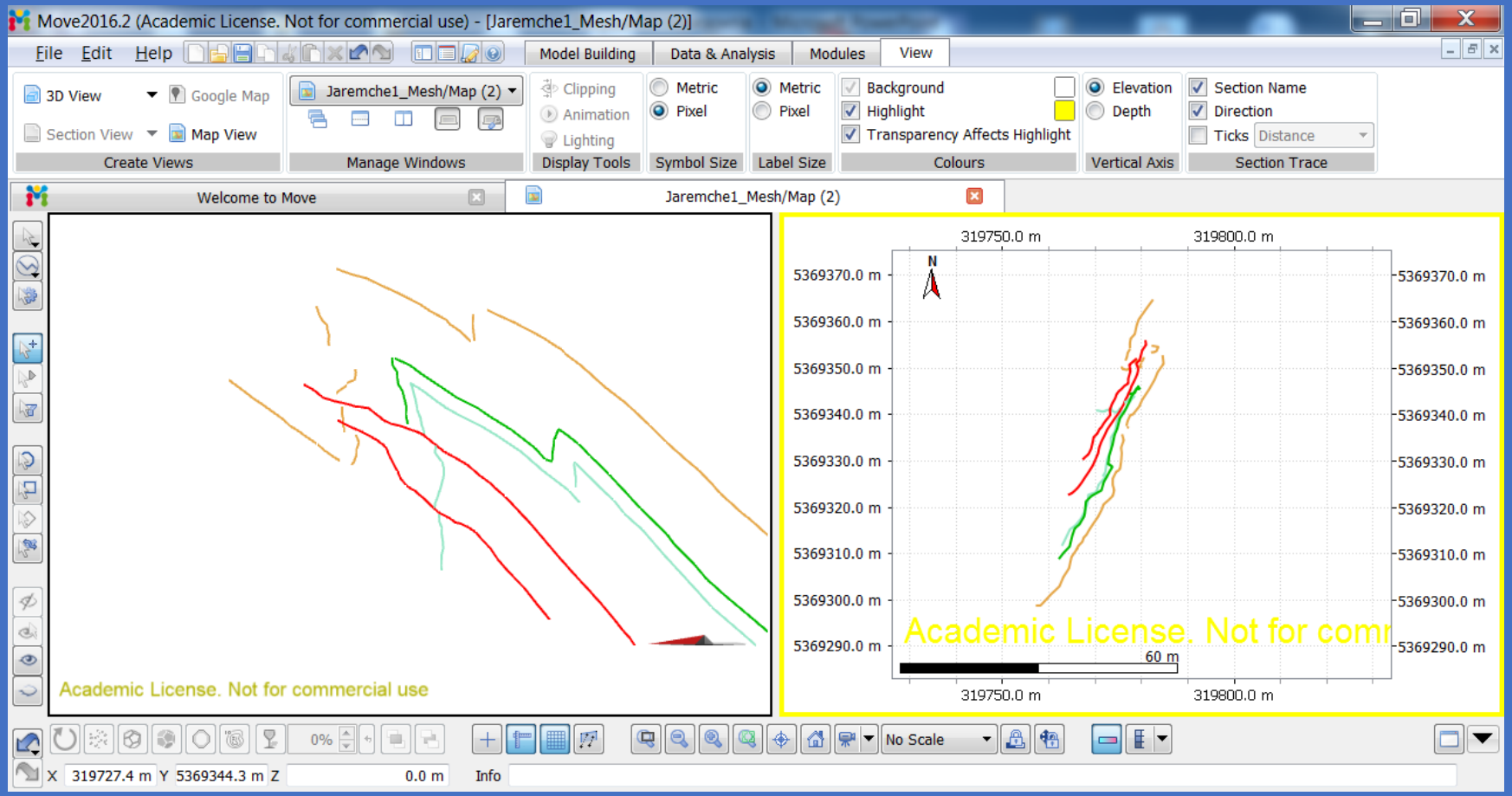
JAREMCHE FOLDS
(structural investigations)



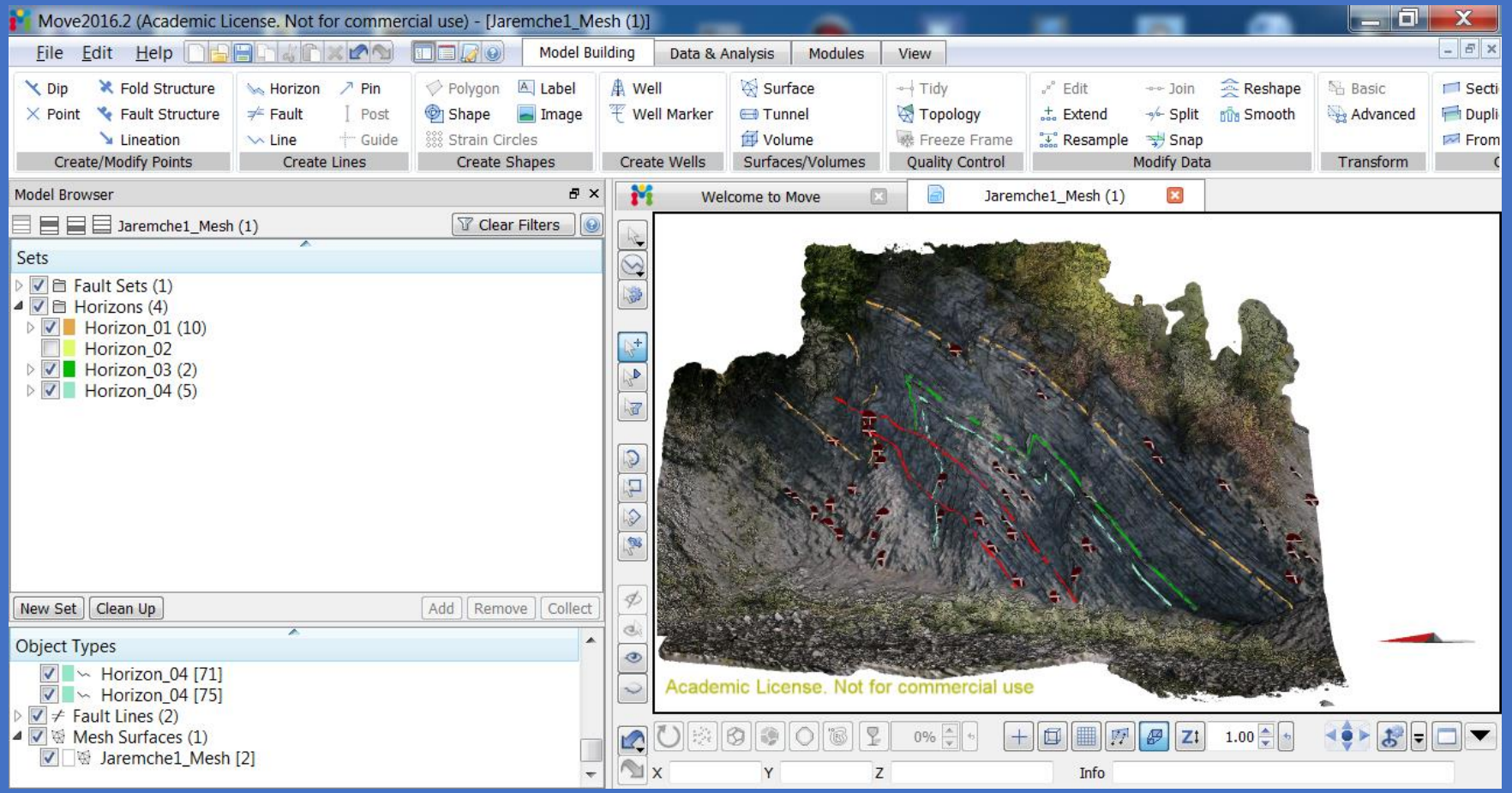
EXTRACTION OF HORIZONS FROM A TEXTURED MODEL



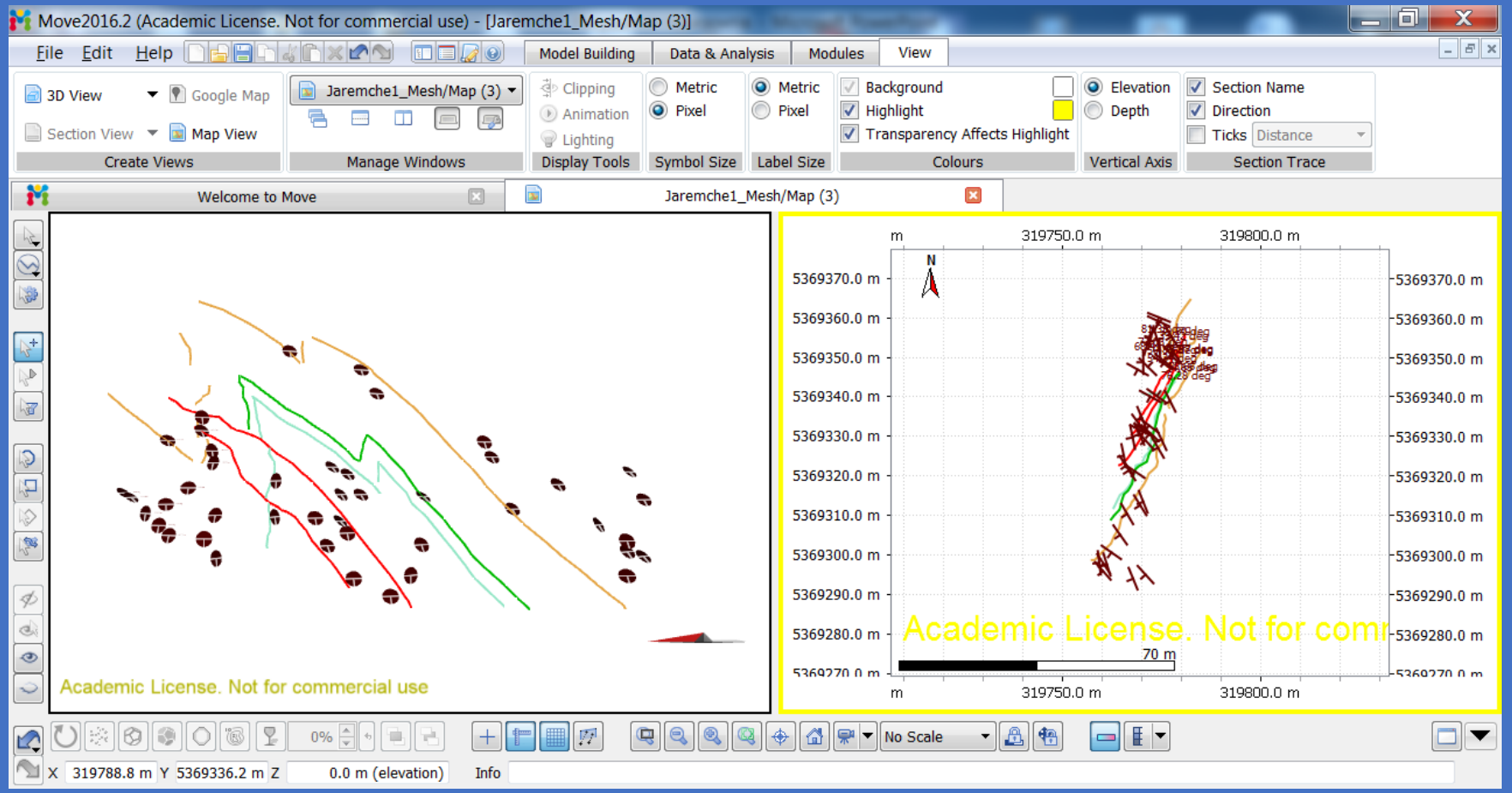
EXTRACTION OF HORIZONS FROM A TEXTURED MODEL



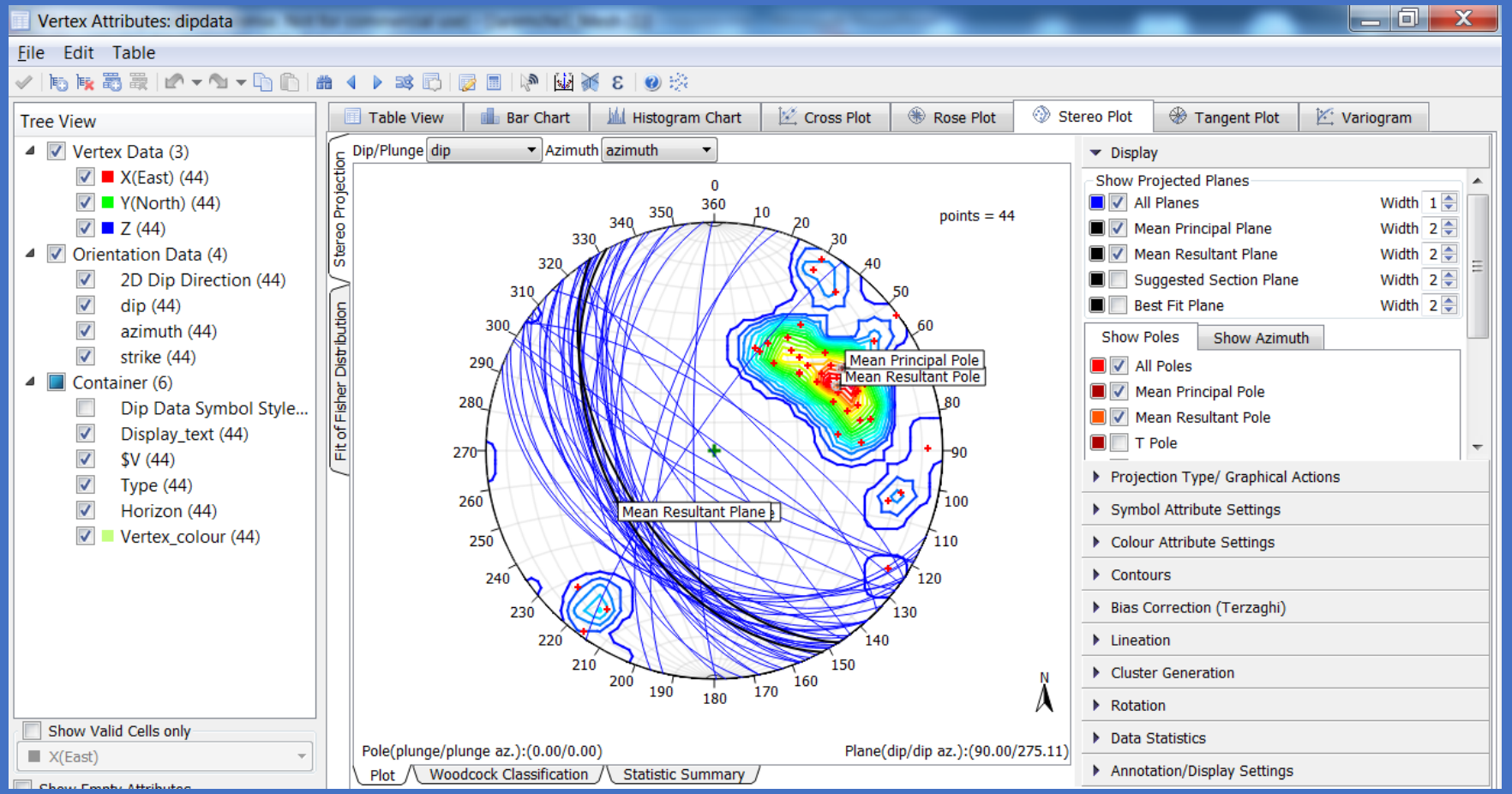
EXTRACTION OF DIP DATA



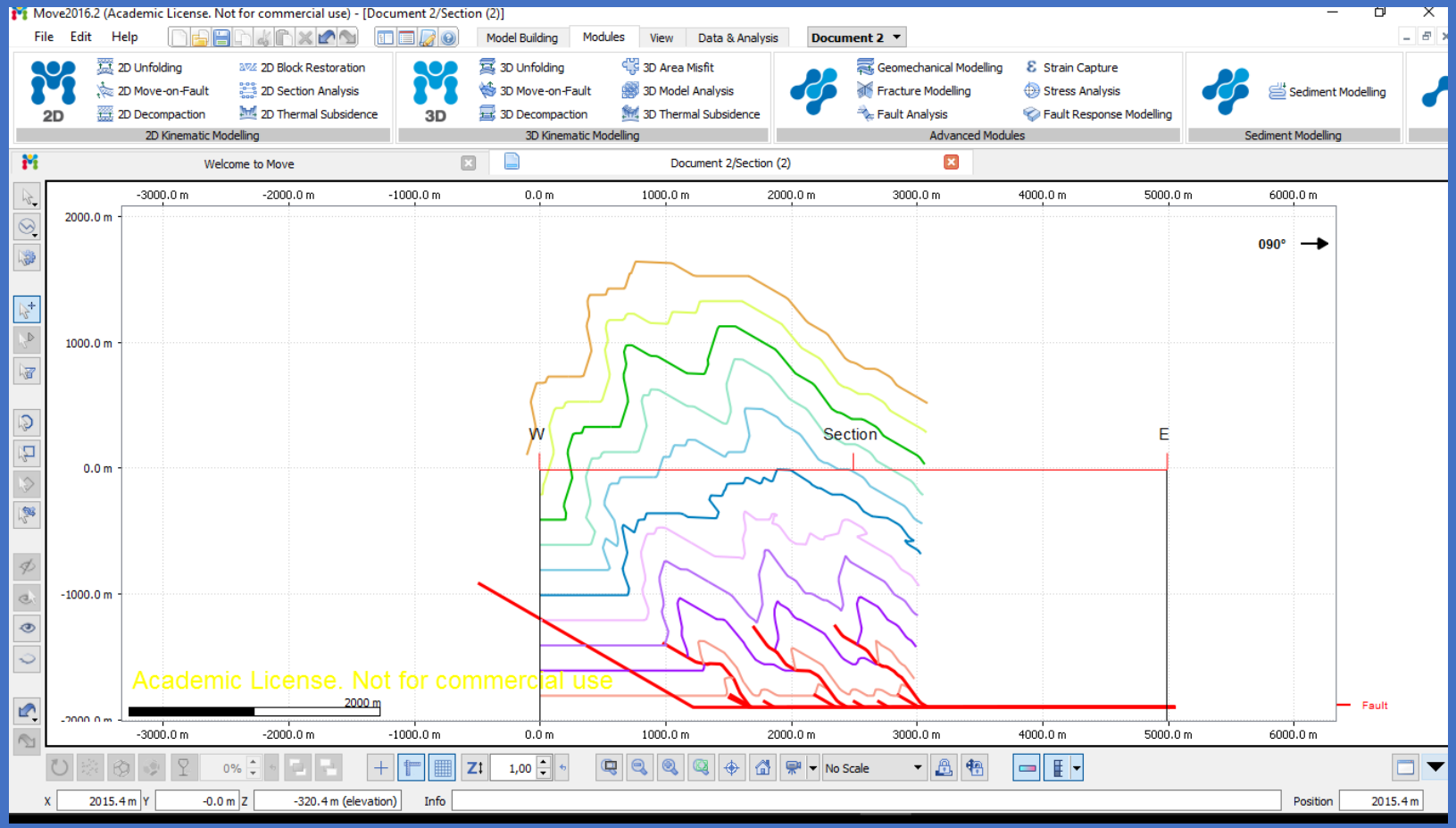
EXTRACTION **OF DIP DATA**



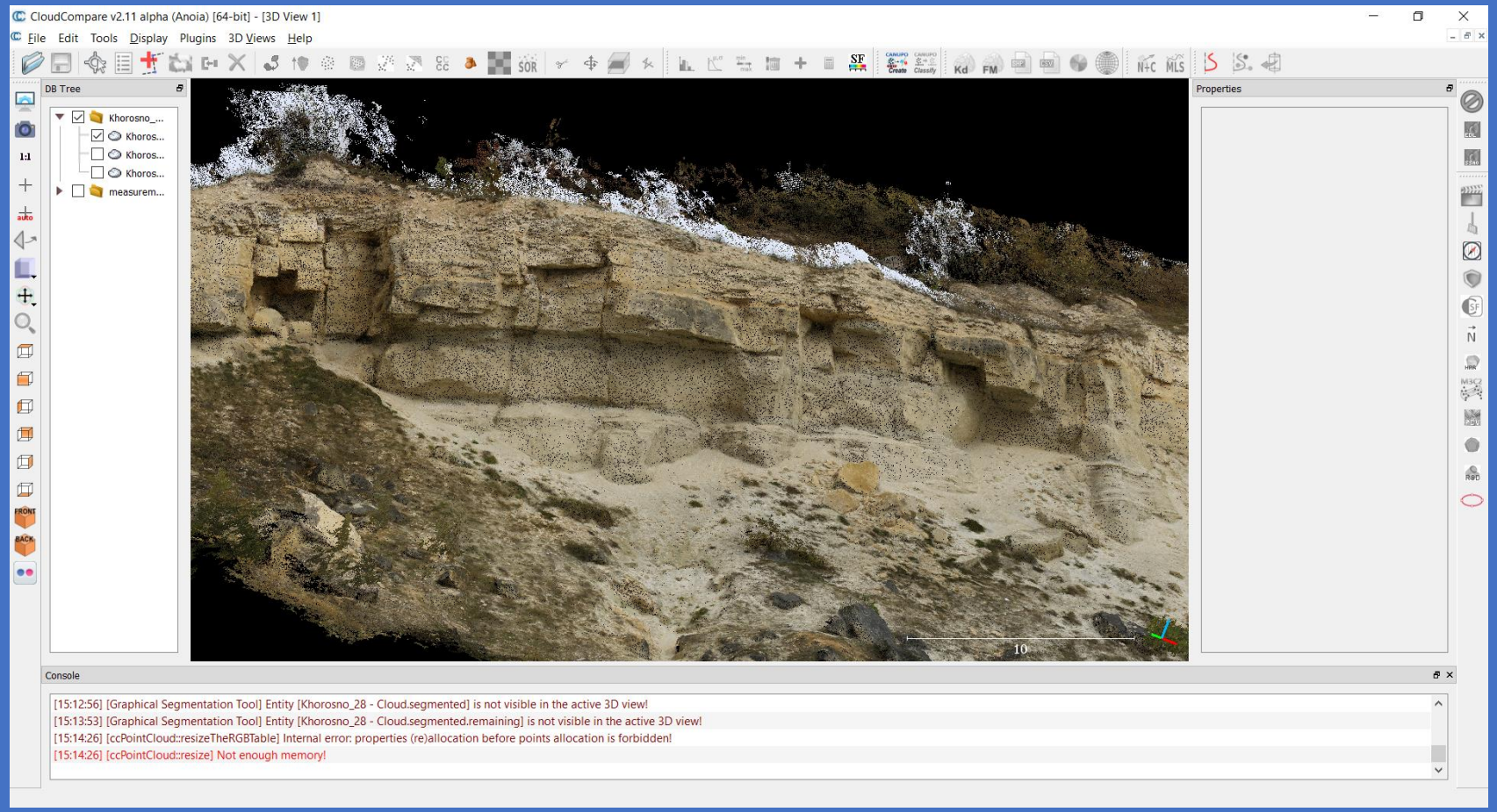
DIP DATA PRESENTED ON STEREONET



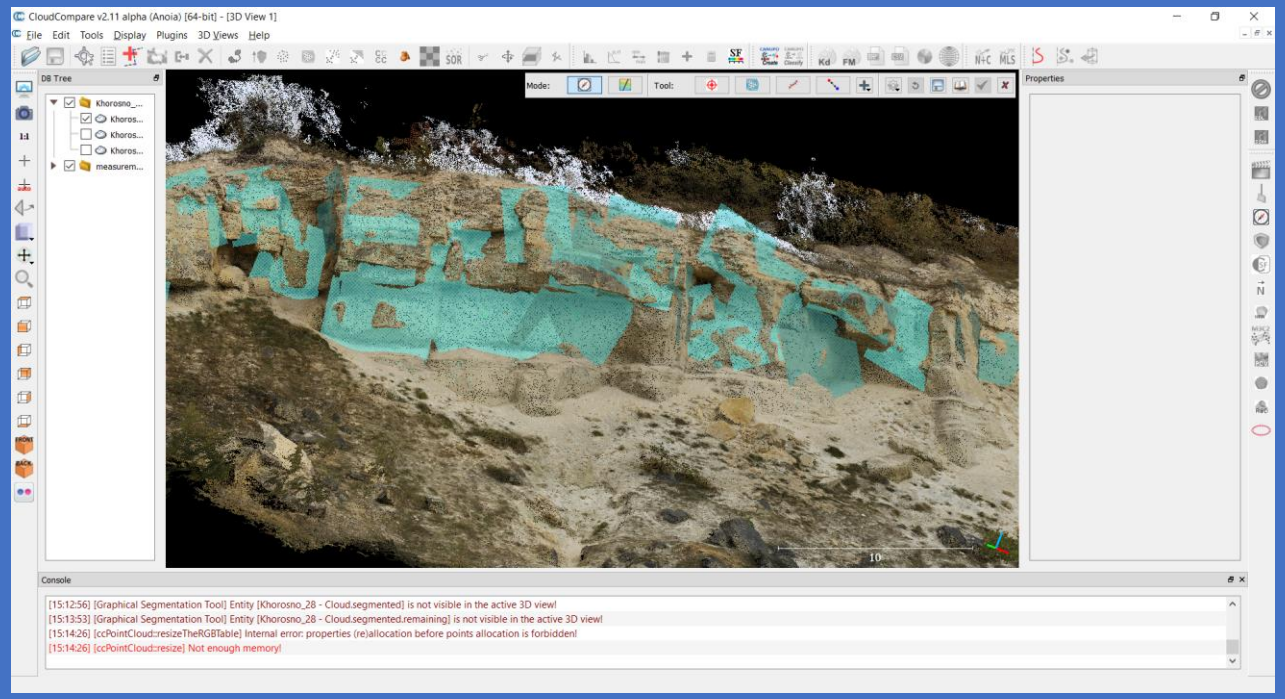
MODELING STRUCTURES IN MOVE



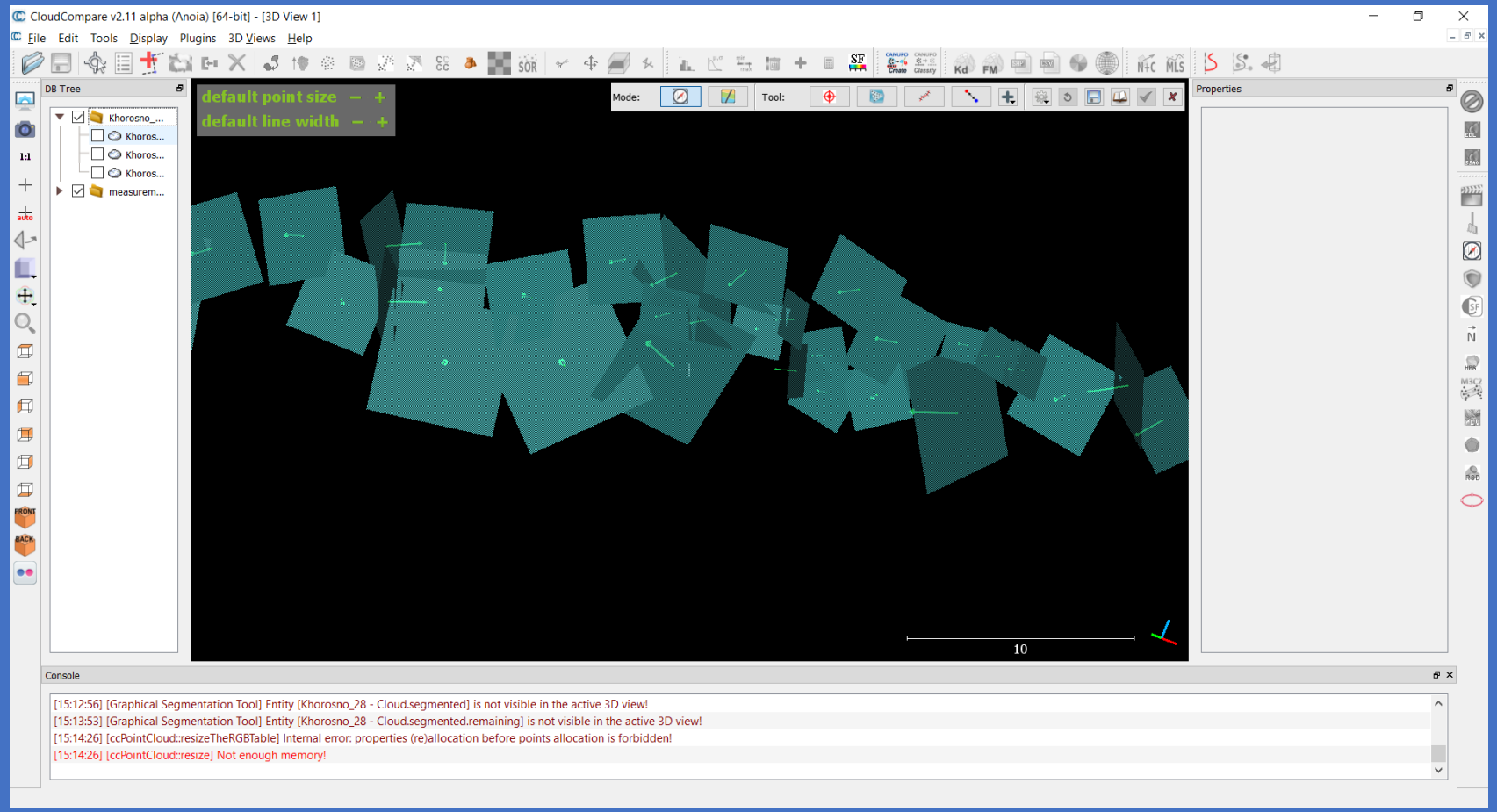
OUTCROP PRESENTED IN THE FORM OF CLOUD POINTS



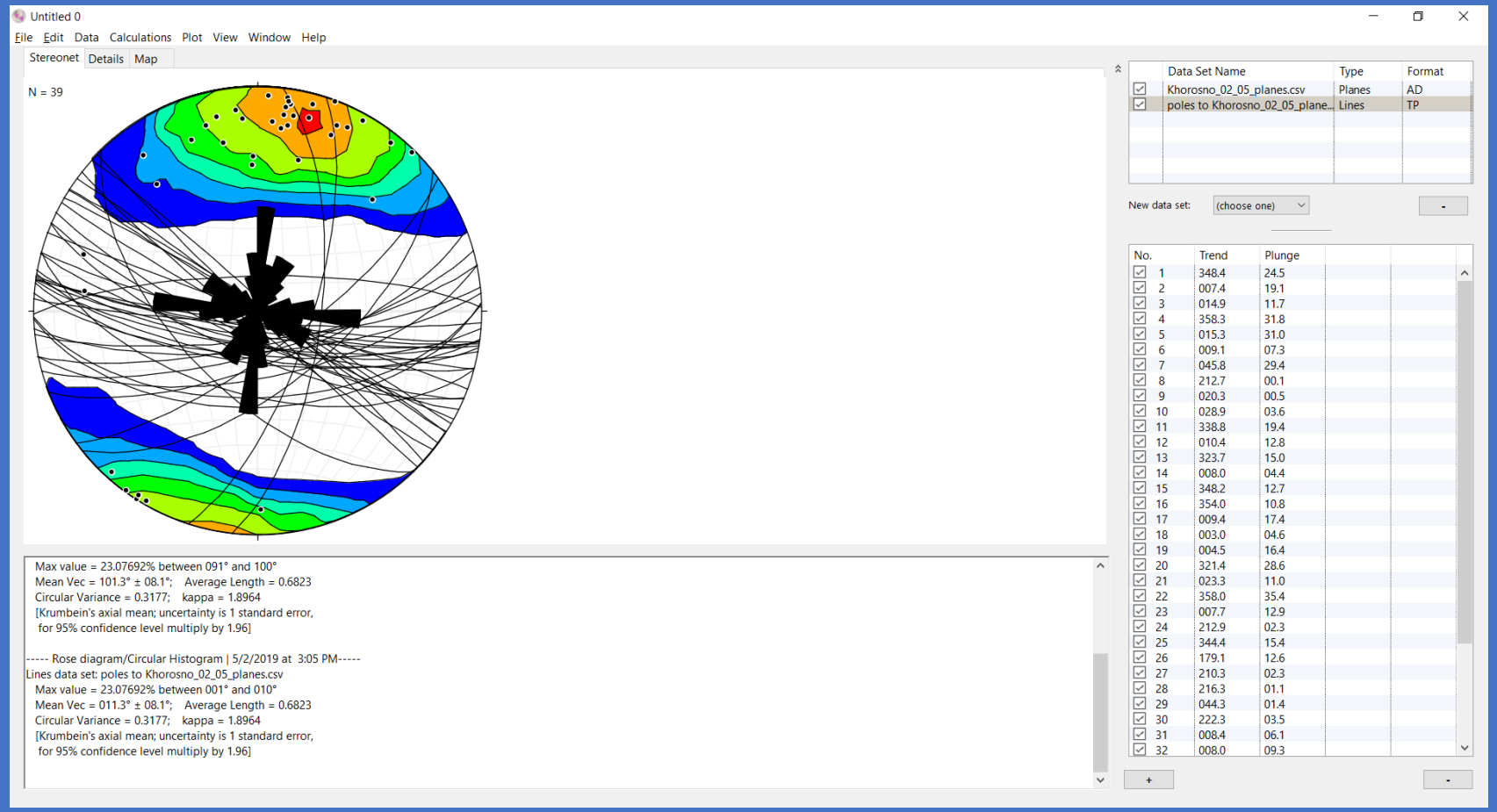
EXTRACTION OF CRACKS FROM CLOUD POINTS



PLANES CORRESPONDING TO CRACKS AND NORMAL TO THEM



THE POSITION OF THE CRACKS OF THE INVESTIGATED AREA IN SPACE ARE GIVEN ON A STEREONET



CONCLUSIONS

ADVANTAGES

- ✓Speed and accuracy
- ✓Possibility to survey unreachable places
- ✓Getting a lot of information in the office environment
- ✓Ability to work with outcrops for people with disabilities
- ✓Quickly exchange information with other researchers

DISADVANTAGES

- ❖Transportation of equipment is difficult in hard-to-reach places
- ❖Power Supply Problems for Hardware
- ❖Insufficient number of specialists who can work with equipment

THANK YOU VERY MUCH FOR
YOUR ATTENTION !!!