2018

Side Scan Sonar Data Interpretation

ER 3942 – OCEANOGRAPHY FIELD VISITS

D.R.M. ATHUKORALA	140803D
A.M.H.S.M. ATHAPATHTHU	140802A
S.M.S. CHATHURANGA	140807T
B.D.N.M. BATAPOLA	140805K
H.M.D. CHATHURANGA	140806N
W.S. DALUWATTA	140809C
A.M.G.B. ATTANAYAKE	140804G

Oceanography Field Visits – ER 3942

Group A – Side Scan Sonar

Introduction

Side scan sonar is a technique that uses sound waves to detect and locate objects under water and to investigate the bathymetry of sea floor or any other water body floor. There is an instrument called side scan sonar for that purpose. The word SONAR means that **SO**und, **Na**vigation and **Ra**nging. Side scan sonar uses a sonar device that emits conical or fan – shaped pulses down towards the bottom of the water body. It is across a wide angle perpendicular to the path of the sensor through the water. This fan – shaped beam hits the bottom of the water body and the acoustic reflections are formed. Then those reflections are detected by the receiver in the side scan sonar instrument and the intensity of the reflections is recorded in a series of cross - track slices. When these slices are stitched together along the direction of motion, they form an image of the sea bottom within the swath of the beam.

The two types of sonars used are Imaginex sportscan sonar and C max sonar. The imaginex sportscan sonar is the most commonly used sonar type because it is light, easy to transport to remote locations, used from inflatable boats to larger hard boats, and only needs a laptop and and 12v power supply. Also this can be towed or pole mounted. But C max sonar is a much larger and heavier instrument which can be pole mounted or towed using its own 24V winch.

Imaginex Sportscan Side scan sonar

The imaginex sportscan is an affordable dual channel, high resolution, and digital side scan sonar. Sportscan sonar can be operated directly from a laptop and the only necessity is 12V DC power source. Also a GPS is connected to the laptop to obtain the longitudes and latitudes while investigating the sea floor.

There are certain specifications for this imaginex side scan sonar device. They are mentioned below.

Underwater Hardware and Software Specifications

FREQUENCY	330 kHz or 330 / 800 kHz
TRANSDUCER	One transducer per side, tilted down 20°
TRANSDUCER BEAM WIDTH	330 kHz: 1.8° x 60°
	800 kHz: 0.7° x 30°
RANGE RESOLUTION	Both sides displayed: Range scale ÷ 250
	Single side displayed: Range scale ÷ 500
MAX. OPERATING DEPTH	30 m (100')
MAX. CABLE LENGTH	60 m (200')
INTERFACE	RS-232 serial interface @ 115.2 kbps
CONNECTOR	Wet mateable (Impulse LPMBH-4-MP)
POWER SUPPLY	10 – 16 VDC at 300 mA max.
DIMENSIONS	114 mm (4.5") diameter x 833 mm (32.8") length
WEIGHT: In Air	4.5 kg (10 lbs)
	not including ballast
In Water	1.2 kg (2.7 lbs)
BALLAST	Standard diver belt weights (readily available at dive shops)
MATERIALS	Polyurethane & 6061-T6 Aluminum
FINISH	Clear anodized

SOFTWARE SPECIFICATIONS:	Win881ss.exe
WINDOWS™ OPERATING SYSTEM	Windows™ XP, Vista, 7, 8, 10
MODES	Side Scan
RANGE SCALES	15 m, 30 m, 60 m, 90 m, and 120 m (50', 100', 200', 300', and 400')
FILE FORMAT	(filename).81s
GPS INPUT (4800, N, 8, 1) NMEA 0183 FORMATS:	GLL, GGA, VTG, RMC
RECOMMENDED MINIMUM COMPUTER REQUIREMENTS:	100 MHz Pentium 16 MB RAM 1 GB Hard Disk 800 x 600 x 256 colour graphics

There are some features that make the imaginex sportscan the most commonly used side scan sonar. They are;

1. Very user friendly
2. Light weight and extremely portable
3. Inexpensive
4. 23m tow cable included
5. High resolution
6. Up to 240m total coverage
7. GPS interface
8. Speed correction
9. Height and length measurements
10. Four user selectable colour tables
11. XTF conversion program (Optional)

Applications

1. Underwater archeology
2. Sunken timber recovery
3. Search & recovery
4. Surveying
5. Law enforcement work
6. Scientific research
7. Environmental survey

Study Area

Side Scan Sonar
The study was carried out on either sides of the shown bridge.

Legend
The two ends of the bridge

Coordinates of L1 and L2

Point	Easting	Northing
L1	395077.00 m E	696071.00 m N
L2	395411.00 m E	696109.00 m N

Coordinates are in Universal Transverse Mercator

Ground length between L1 and L2 is 335.61 m.

Data Acquisition

The data acquisition was carried out along parallel lines with a rough offset of about 5m apart on either side of the steel bridge.

Software used for data acquisition – Imaginex SporScan

Data Acquisition parameters and conditions

Average speed of the fish moving – 3.5 knots

Generic recording format - .81s

Group 1

- Sample per channel: 250
- SlantRange: 30.0m
- Sensor altitude: NA
- Start time: 13/05/2018 08:41:37
- Stop time: 13/05/2018 10:15:23
- Initial coordinate: x = 80.0517 y = 6.2965
- Final coordinate: x = 80.0549 y = 6.298
- Distance: 385.41 m
- NumPings: 63542

Group 2

- Sample per channel: 250
- SlantRange: 30.0m
- Sensor altitude: NA
- Start time: 13/05/2018 13:04:44
- Stop time: 13/05/2018 13:59:50
- Initial coordinate: x = 80.0544 y = 6.2968
- Final coordinate: x = 80.0515 y = 6.2946
- Distance: 403.62 m
- NumPings: 37338

Data Processing Software used.

1. DeepView FLV
2. Global Mapper v18.2
3. ImageJ for XTF (Java)

1. DeepView FV visualization.

DeepView FV is a free XTF file visualizer. DeepView pro has the ability to post process but DeepView FV is only intended for visualization purposes. However it is a very powerful tool for visualization compared to other software available.

Visualization using different color ramps.
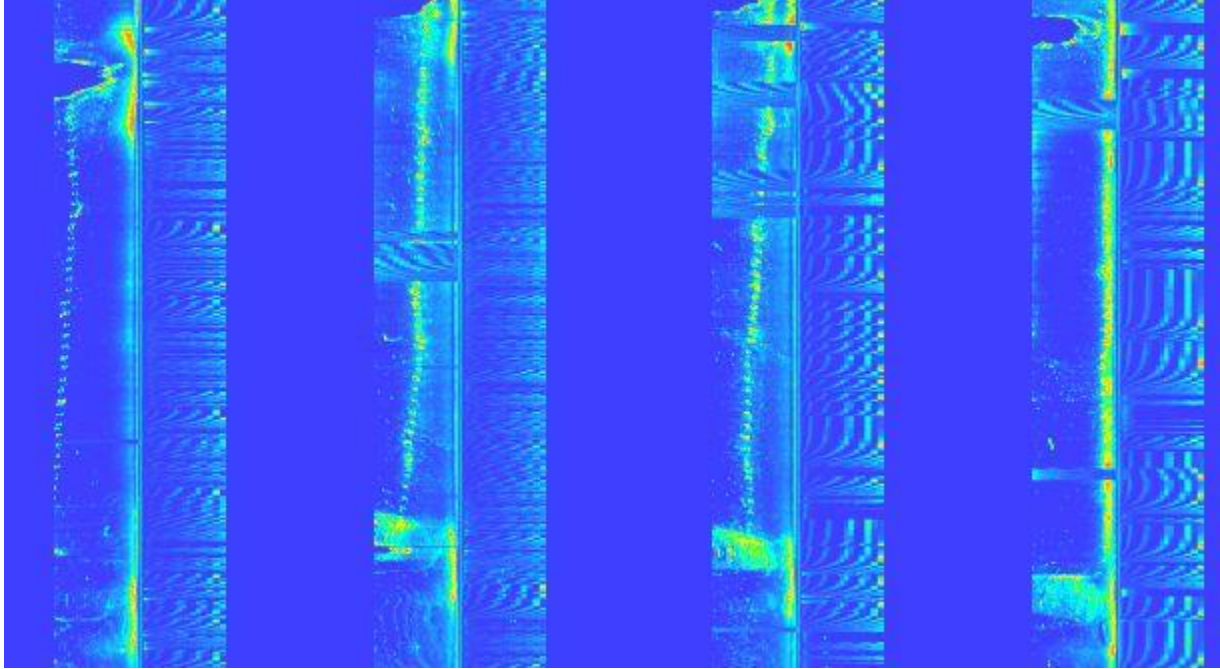
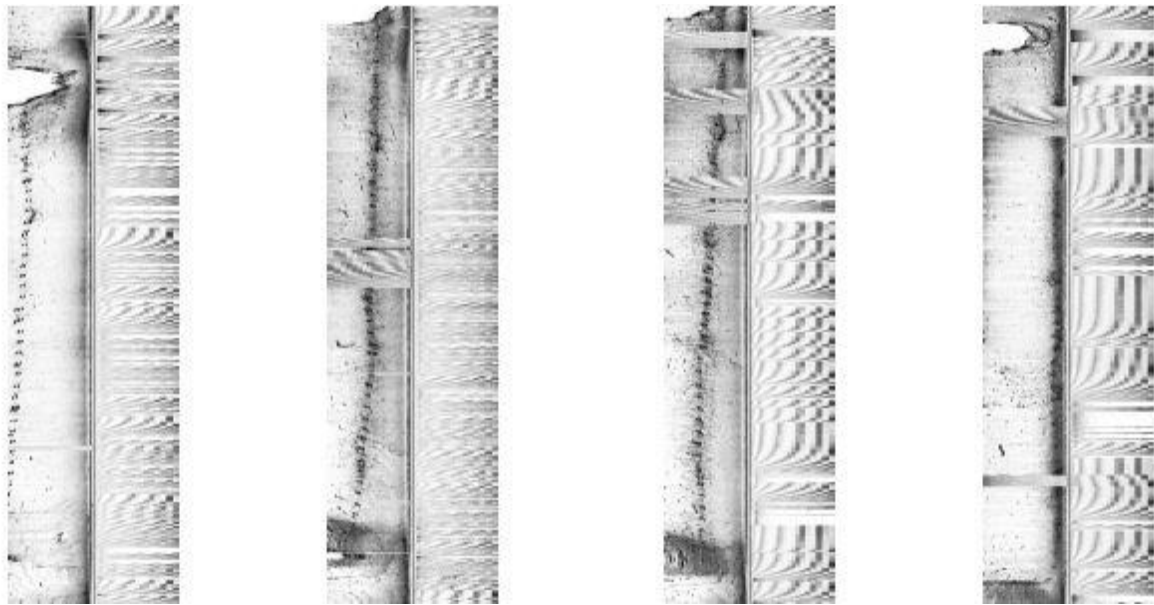*Figure 1 - Depth color ramp*
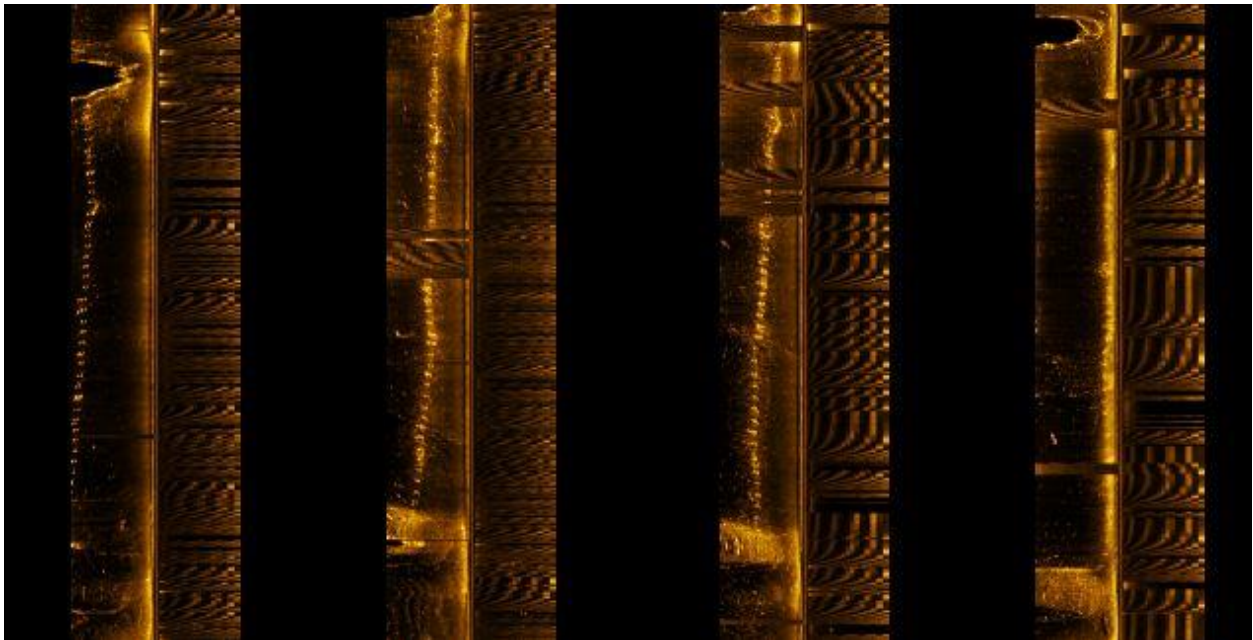
Figure 2 - Gold color ramp

Figure 3 - Inverted gray color ramp

From the column right to left the dotted line denotes the steel bridge workings underwater increasing its distance from the main line while moving away from the bridge.
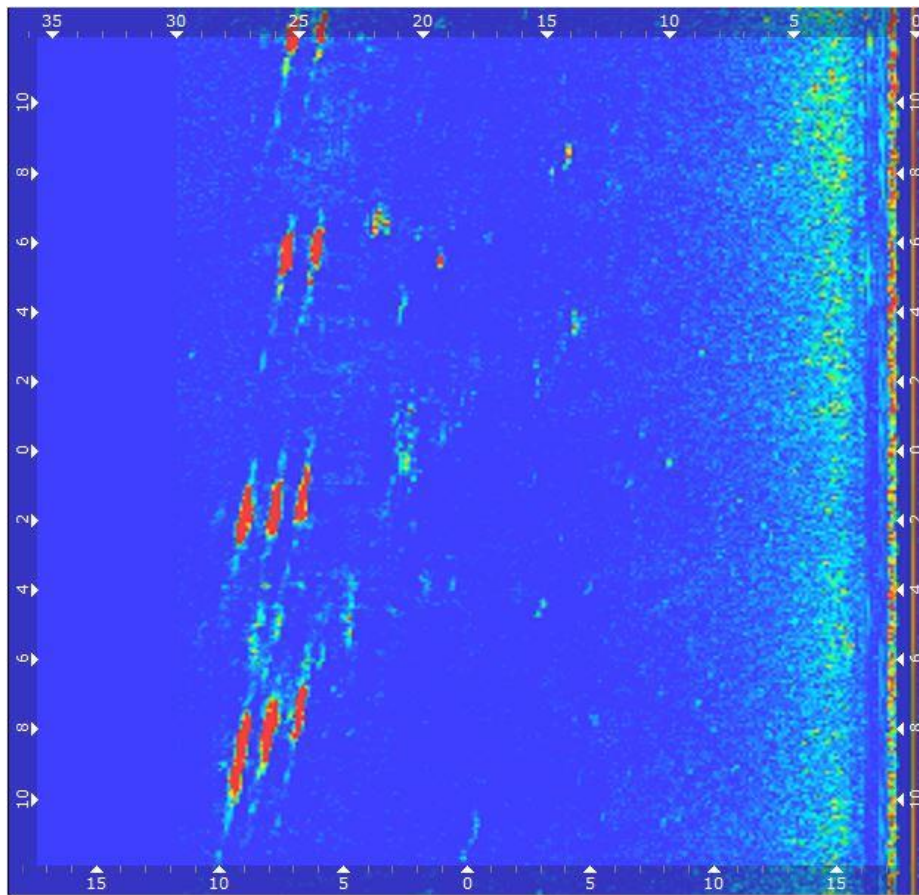

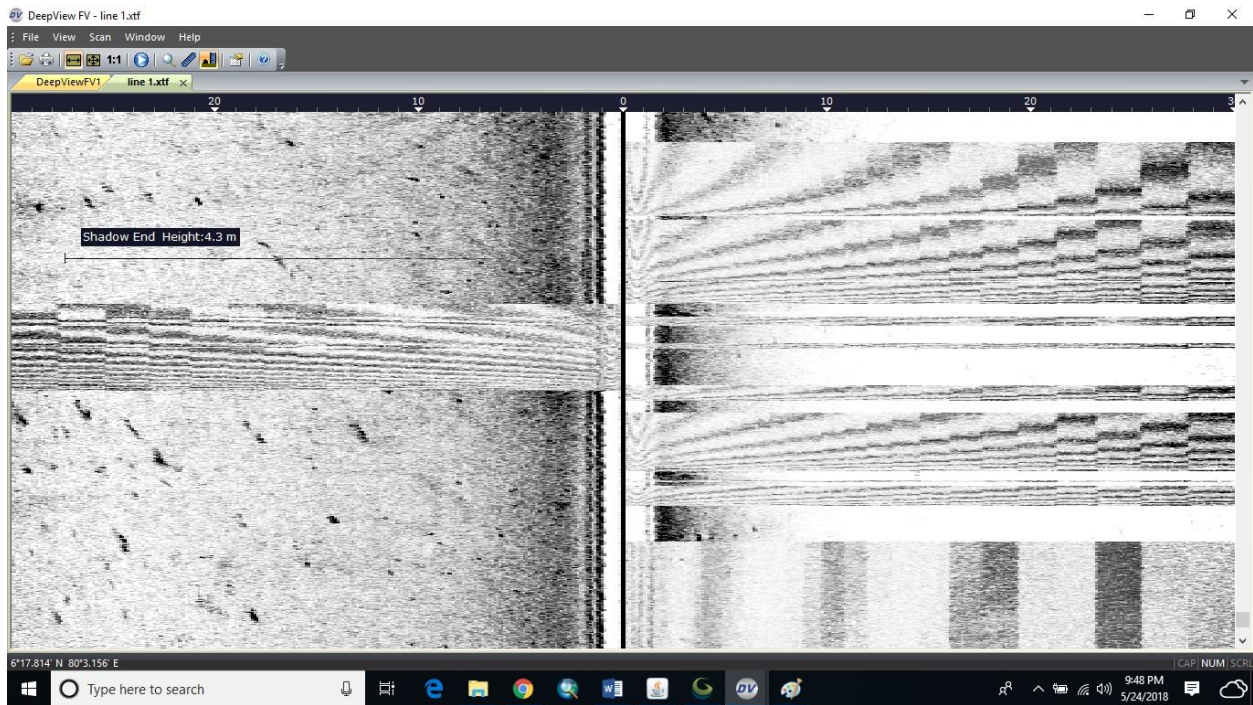*Figure 4 - The three posts of the bridge where the trishaws pass*

Figure 5 - Measuring a shadow

2. Global Mapper Visualization

Global mapper is not the most convenient software for the interpretation of XTF files since it has not many options specialized for XTF. However it is a useful software for tracking the path and creating heat maps.
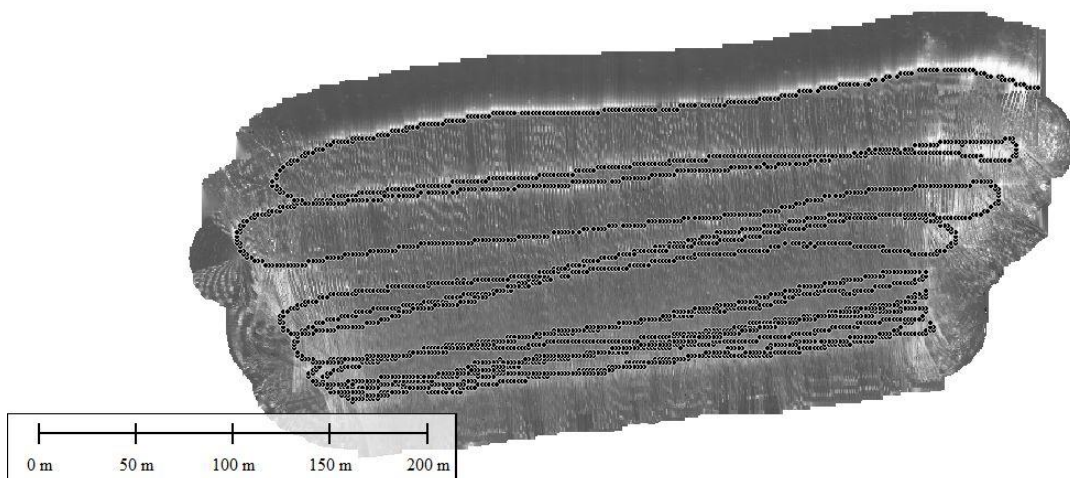

Figure 6 - GlobalMapper moving path

3. ImageJ for XTF

This Java software is a powerful tool in processing XTF files. It has so many abilities for analyzing the XTF files.

- o Resize
- o Apply filters
- o Georeference
- o Apply grids
- o Save as different file formats

Tiff...
Gif...
Jpeg...
Text Image...
ZIP...
Raw Data...
Image Sequence...
AVI...
BMP...
PNG...
PGM...
FITS...
LUT...
Selection...
XY Coordinates...
Results...
Text...

Plotting profiles

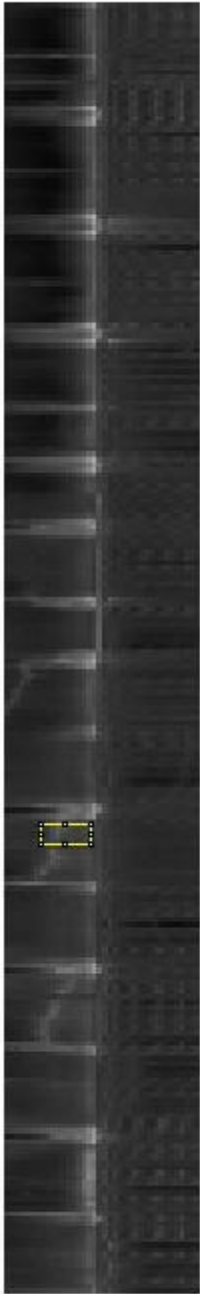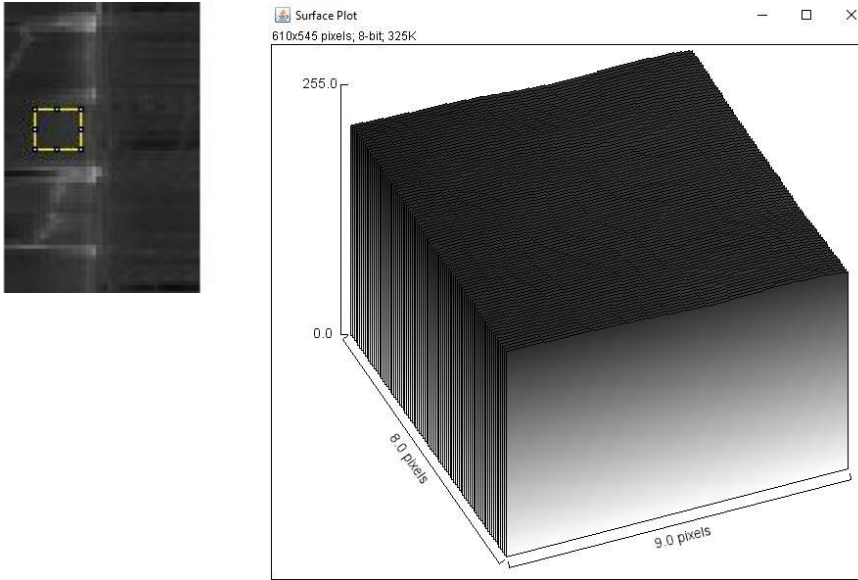ImageJ has the ability to plot the profile of a selection which is useful for interpretations.

Figure 7 - The profile plot

Figure 8 - Selection of the area

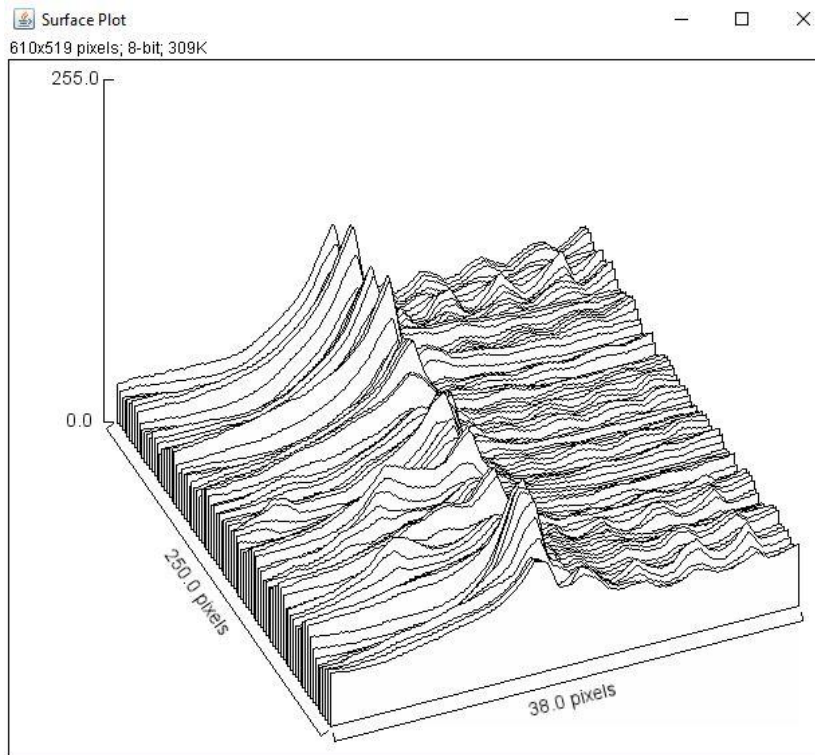# Plotting surfaces

ImageJ has also the ability to plot the sub bottom surface using the gradient of the grey values with the background.

Condition 1 – With a selection of a certain area with a relatively flat surface

Condition 2 – the surface plot for the continuous data acquired for the whole section.

The peaks of the bridge posts can be clearly seen here.