DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 2016/35

Digital Elevation Model and orthophotos from Moriusaq, North-West Greenland: processing and technical description

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Introduction

GEUS was contracted by Blue Jay Mining Ltd. (later, early 2016, changed to FinnAust Mining Ltd.) in late 2015 to process oblique stereo-images were collected during fieldwork at Moriusaq, north-west of Pittuffik/Thule Airbase, North-West Greenland, using handheld digital single lens reflex (dslr) cameras with the purpose of stereoscopic feature mapping, digital surface model generation and orthophoto production.

The images were acquired from a B212 helicopter (sliding-door detached) using handheld cameras that were pointed downwards during data acquisition (Fig. 1). Orthophotos from the entire coast from west of Moriusaq to Salibury Gletscher was acquired and processed (Fig. 2).

Figure 1. *Acquisition of oblique stereo-images using two handheld cameras by taken photos out of the open Air Greenland B212 helicopter door at 1000 m altitude.*

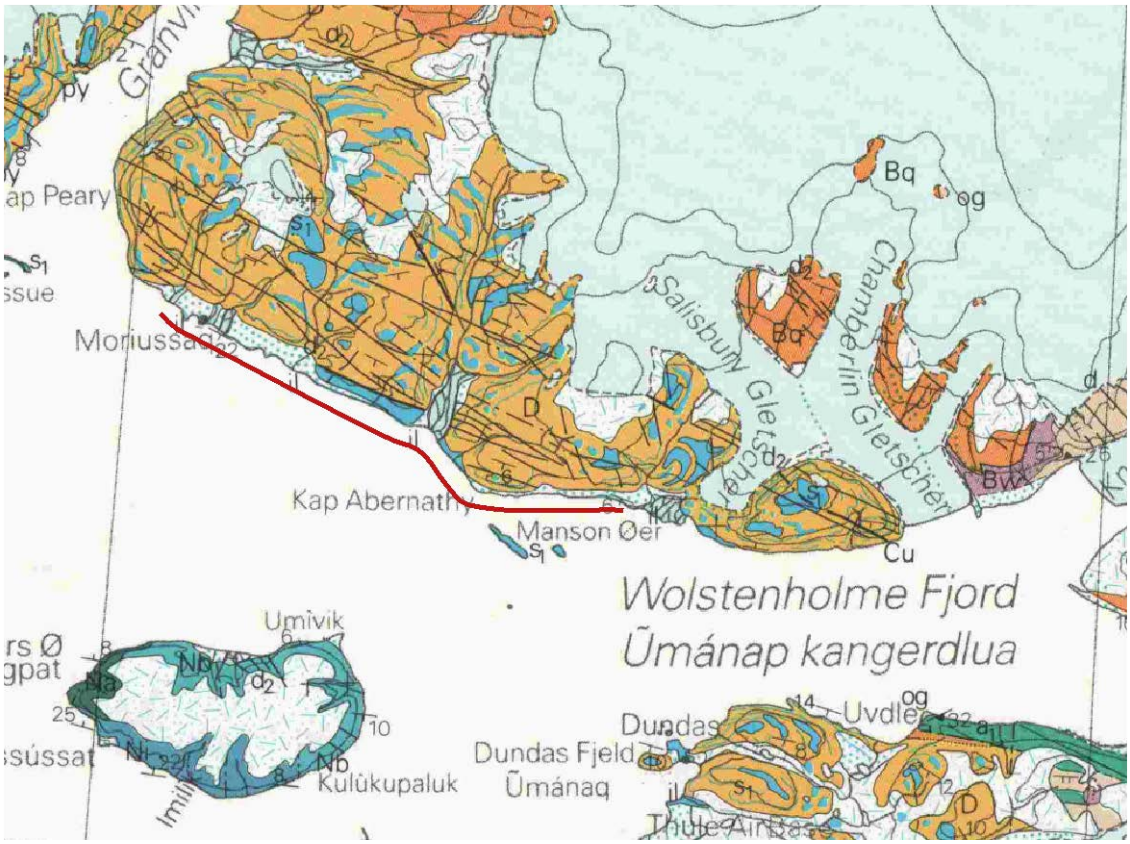

Figure 2. Geological map of the area covered during the 2015 fieldwork. Red line shows the stretch of coast that was surveyed by oblique photos.

Two camera systems were deployed during data acquisition (Table 1). The camera systems were calibrated prior to field work using a theodolite surveyed steel frame located at the Technical University of Denmark (DTU). The result of the calibration is given in Table 2 and the accuracy is estimated to around 1/3 a pixel.

Figure 3. *Example of one of the individual processed orthophoto, with the abandonned town of Moriusaq (see Fig. 2 and 4) in the right part of the photo, taken from the B212 helicopter at an altitude of 1000 m.*

Table 1. Summary of cameras used during data acquisition.

Camera	Lens	Calibrated focal length (36 mm width)	Principle point offset		Principle point symmetry offset		Symmetrical lens distortion (odd order polygonal coeficients)			
			X [mm]	Y [mm]	x [mm]	y [mm]	K0	K1	K2	K3
Canon EOS 5D Mark II	EF 35mm f/1.4L USM with CIR polarizer	34.332 mm	-0.010	0.038	-0.010	-0.038	0	-8,73 E-05	-9,40 E-08	0,00 E+00
Nikon D800E	Zeiss Distagon 1.4/35 ZF.2 with CIR polarizer	36.024 mm	0.035	0.059	0.035	0.059	0	-3,95 E-05	-1,28 E-06	-1,46 E-08

Preparation of the images

In order to use the images for quantitative mapping purposes, 637 individual images were processed using a photogrammetric work flow consisting of 1) tie point measurement 2) pass point measurement 3) triangulation (bundle adjustment) (Fig. 3).

Tie points were measured using Agisoft Photoscan Professional software. The raw tie point matches were subsequently imported into 3D StereoBlend for triangulation. The root mean square (RMS) error on the triangulation in image space is around 1/3 a pixel or 2 µm.

Pass points were measured in 3D StereoBlend using monochrome aerial photographs (1:150.000) as control source. The monochrome aerial photographs are oriented using the aero triangulation by the National Survey and Cadastre (Geodatastyrelsen). The error on the pass point (absolute positioning), which is an estimation of how well the images align to the monochrome aerial photographs, is around 2 m (x,y and z).

Resulting products

Digital Elevation Model

The digital elevation model was generated using Agisoft Photoscan software and delivered as gridded 1x1 m digital surface elevation model.

Orthophoto

The orthophoto was also produced using Agisoft Photoscan and delivered as an 1 m orthophoto.

Figure 4. *Resulting mosaic of the individual processed and stitched orthophotos from Moriusaq (marked with an M).*

Data delivery

All individual oblique photos, the digtal surface model and the orthophoto was delivered to FinnAust Mining Ltd. in digital format and is archived at GEUS.