Case Studies Environmental Projects

Asbestos Pollution Mapping – NSW Australia

Objective of the Project:

Dimap was engaged to collect data in northern NSW over an old Asbestos Mine and the surrounding area to evaluate the toxicological situation and the distribution of wind transported dust components and water transported asbestos. The data will be used for further improvement sanitizing the asbestos mine and the surrounding areas.

Technical Solution:

Dimap was collecting the data with a multisensory plan using Lidar, Hyperspectral sensors and thermal camera. The resolution of all image data was 60cm with an accuracy of better than 1.5m. Additionally to the Lidar processing to DTM, DSM and Vegetation height there was also a Surface hydrology system processed to identify the directions of transport of Asbestos by rain water.

Using existing libraries the asbestos could be identified with classical method and the distribution on the former asbestos mines and the dumps but also in the surrounding mapped. The data showed the concentration of the remaining asbestos especially on the dumps.

The Hyperspectral and Lidar data fusion allowed the separation of the classified asbestos into the two transport forms water and dust by wind and showed the distribution of the asbestos especially on the higher trees east of the mine.

Achievements:

Within one flight operation all required data for the further planning of the sanitation of this old asbestos mine were collected. The data processing took less than 6 weeks and no ground surveys were necessary – therefor the risk for health was reduced. The technology can be also used further to identify results after further sanitation efforts.
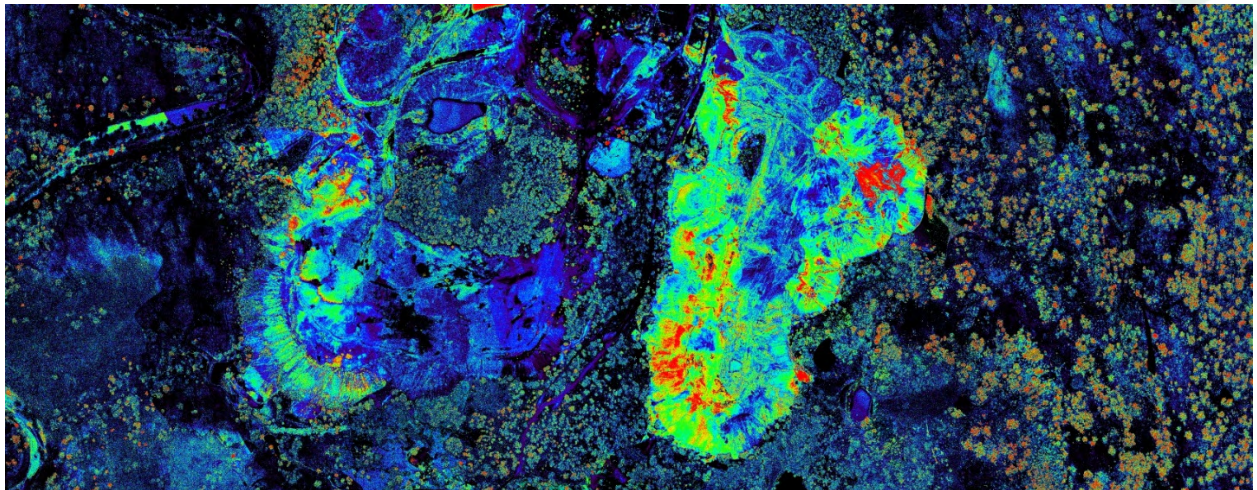

Figure 1: Asbestos (red) hyperspectrally mapped around an old asbestos mine. The red parts on the dumps shows asbestos open to transport by wind and rain water
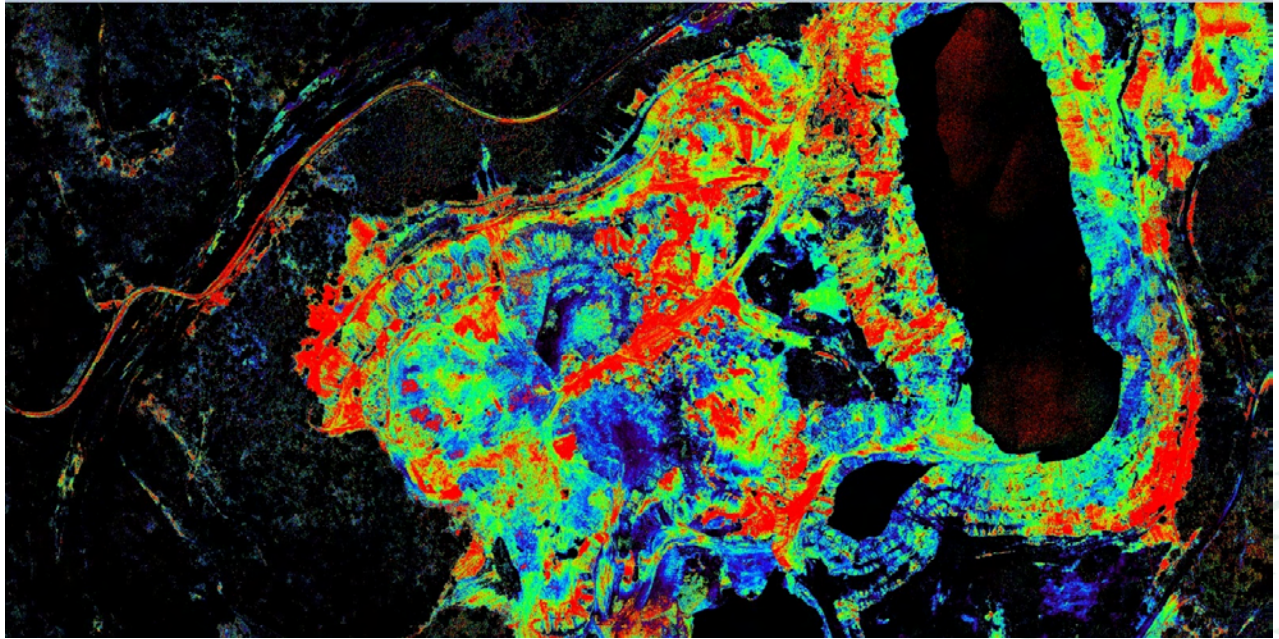
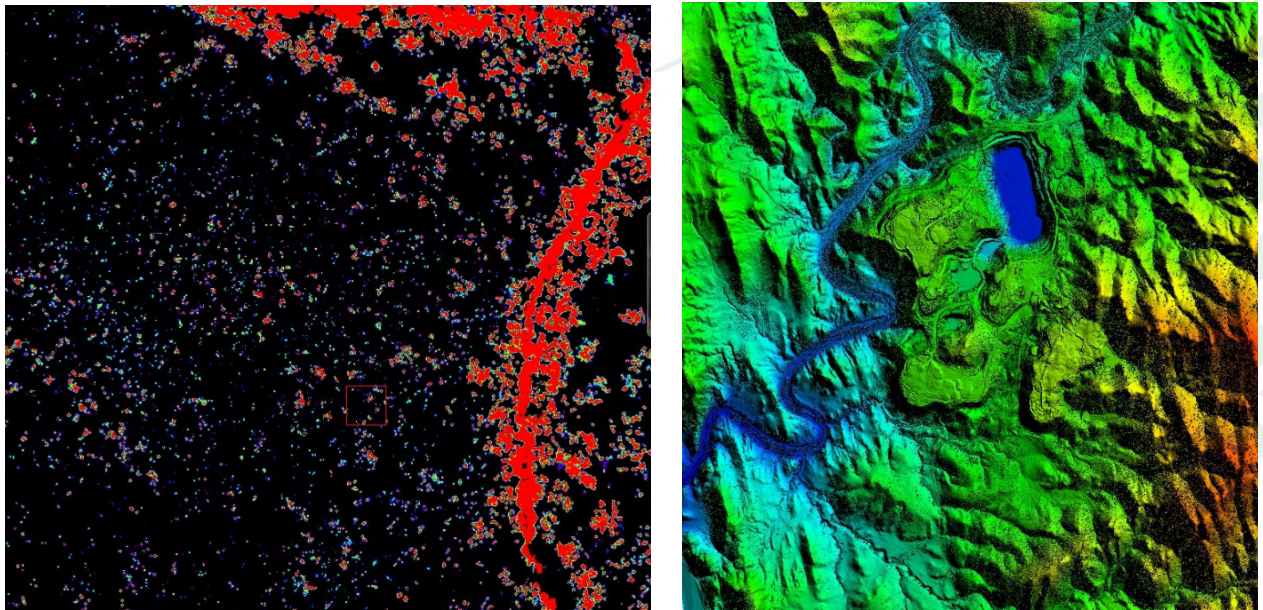**Figure 2: Detailed asbestos analysis around the mining operation area**

Figure 3: Asbestos dust component on vegetation and digital terrain model as base for the water transport component

Dust Pollution Mapping – Namibia

Objective of the Project:
The worldwide only smelter for copper processing ore containing arsen is based in Namibia north of Windhoek. For an study to clean and reduce the dust pollution Dimap was engaged to map typical dusts in their distribution over the area around the plant and to provide this data to the environmental consultants.

Technical Solution:
In a first phase in a ground study typical spectrograms for the main dust components were recorded in the surrounding of the plant. The data were then compared with lab samples for the same materials, recorded in the HK hyperspectral laboratory of Dimap.
In a second step Dimap was collecting data with airborne Hyperspectral sensors in the range between 400 and 2500nm with a pixel resolution of 50cm and 2m. The data were orthorectified and atmospheric corrected and afterwards processed with Mixed Tunes Matched Filtering and Spectral Angle Mapper to identify the abundance of the target materials within each pixels.

Achievements:
While the flight operations in the hot conditions were challenging the main dust pollutions could be mapped over the area. They are showing the effect of wind transport but even more of the transport based on truck traffic between the processing plant and the installations around like the railway station.
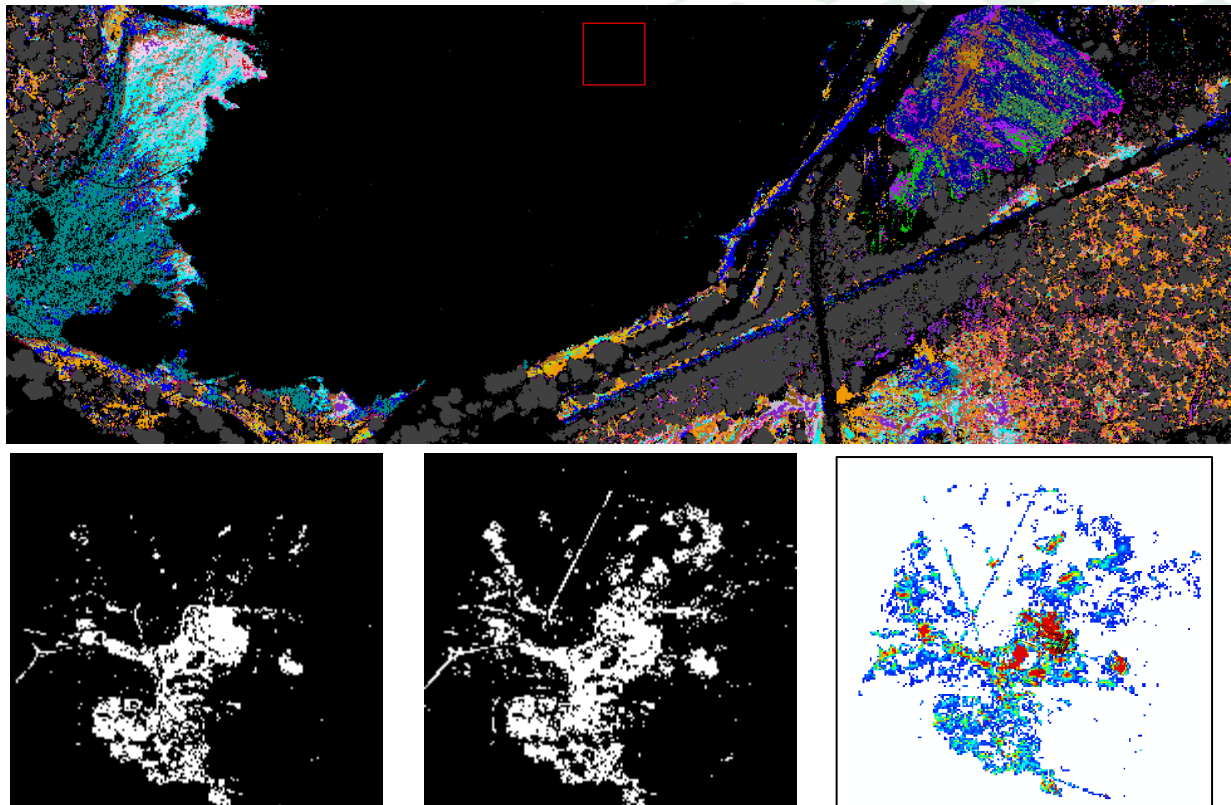

Figure 4: Top Material detection around Tiling Dams showing in the right top site a deposit of different plant waste and on the left site the open to wind transport materials of the tiling dam; little map showing distributions of different target spectra over the larger area with the plant in the centre and the urban area in the south. Infrastructures used by the plant are noticeable as well the centre of concentration of dusts around the installations and the railway station (red areas)

Water Pollution – Hong Kong open seas

Objective of the Project:

In August 2012 a container vessel lost in heavy seas during a typhoon in Hong Kong waters some container containing small plastic pellets. During the next weeks the containers got damaged and water and beaches in lama Island and Lantau polluted by the pellets. Dimap was engaged by the HK Marine Department to map the distribution of the pellets by an airborne operation.

Technical Solution:

In a one day operation using the Eurocopter of the Government flying service the waters south of Hong Kong were scanned with VNIR hyperspectral (400 to 1000nm) with a spatial resolution of 1m. Data collected were fast track orthorectified and the compared against laboratory spectra established in the Dimap Hyperspectral Laboratory. Anomaly detection and ACE Spectral Analysis allowed the detection of pellets in different scenarios.

Achievements:

The collected hyperspectral data allowed the mapping of pellets in the sea area within short time and were provided for the marine department for further action and clean up.
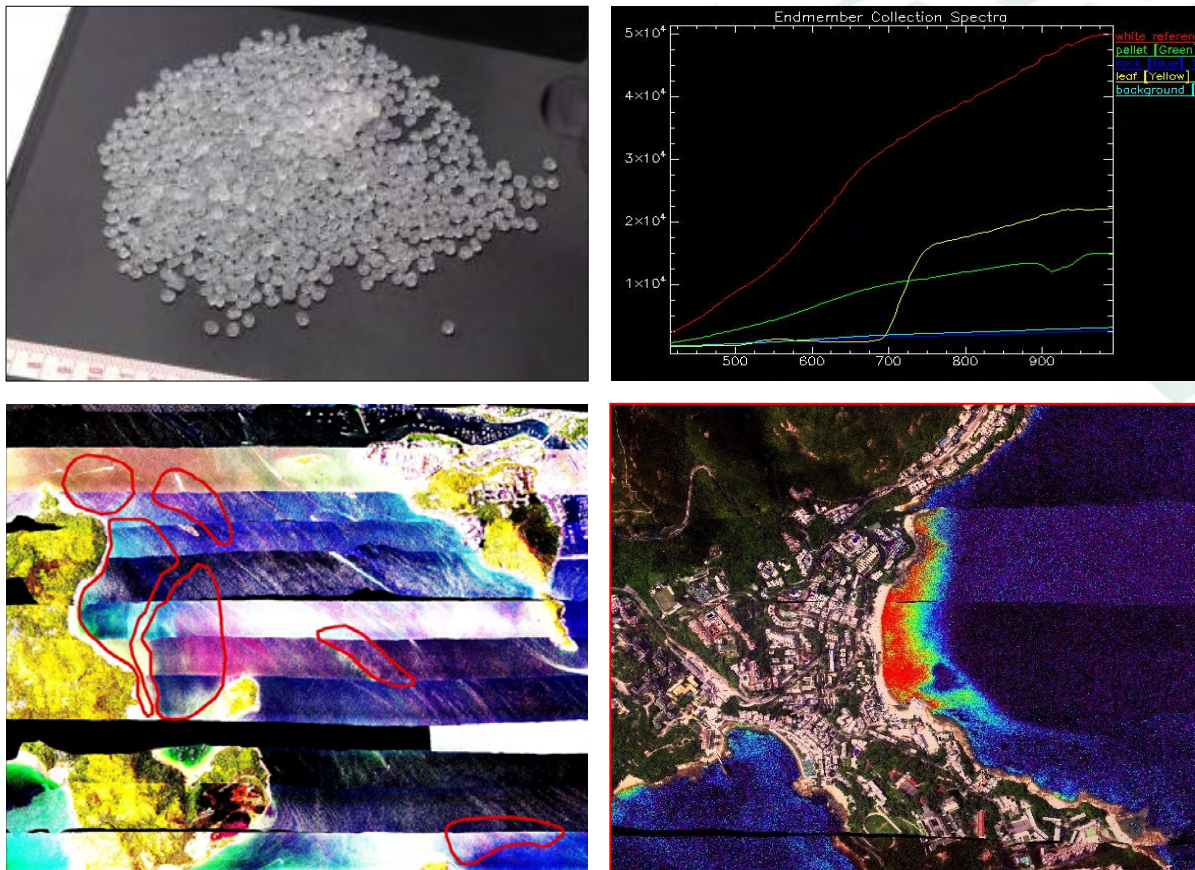

Figure 5: Top - Pellets on the laboratory table, spectra recorded in the laboratory (green shows the pellets) with a typical signature. Bottom left - results of fast anomaly detection showing areas with pellets in deeper water. Bottom right – pellets concentrated in a bay using ACE.