

## Mapping the Taitao ophiolite using remote sensing data revealed surface geology of inaccessible outcrops

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The Taitao ophiolite is 5.7 Ma to 5.1 Ma young ophiolite exposed just 50 km southeast of the Chile triple junction where a spreading center of the Chile ridge system is subducting underneath the South American plate at present, and hence geologically important area. Although, several expedition teams (American, French, and Japanese groups) tried to map out the geology of this area in last two decades, heavy weather conditions (it blows almost every day (!) and annual precipitation is over 4,000 mm) and dense vegetation inhibited them from detailed mapping. Many of small outcrops in mountain area are in practice inaccessible even from the sky. The geological mapping of this ophiolite was still far from sufficient by these reasons. In such occasion, remote sensing technique can provide extremely useful information prior to geological survey. Such information is complementary with the results of the fieldworks.

In this study, we use an optical sensor ASTER (Advanced Spaceborne Thermal Emission and Reflection radiometer) that equipped many bands not only in VNIR range but also in SWIR and TIR range, which is highly effective in geological research. We differentiated rocks of the Taitao ophiolite using combination of five bands that have the most useful information to discriminate one rock type from the other. This is possible because each mineral that composes rocks has its specific reflection spectra. Based on the component minerals defining each rock type, we estimate the distribution of rocks of the ophiolite on the ASTER image. We also examined the optimum band combination for each target mineral to extract.

In the remote sensing technique, band ratio analysis is used as a conventional method for mineral mapping. In this study, we employed the Principal Component Analysis (PCA), and obtained the good results compared with the band ratio analysis. Principal Component Analysis (PCA) is one of the multivariate statistics. It can be used for dimensionality reduction in a data set by retaining those characteristics of the data set that contribute most to its variance, by keeping lower-order principal components and ignoring higher-order ones. To extract the target mineral, we focused on the eigenvalues and its sign (+ or -) at each order in this study. The obtained results were compared with field results. Matching of peridotites and gabbros were excellent with over 90 % accuracy where ground observation data are available. Thus, the remote sensing technique is proven to be a powerful tool to map surface geology of inaccessible areas.