Automated counting of fossil diatoms *Eucampia antarctica* using artificial intelligence software –verification of a new sea ice index–

*Saki Ishino[1], Takuya Itaki[1]

1. National Institute of Advanced Industrial Science and Technology

Eucampia antarctica, a species living in the Southern Ocean, has two varieties differing in chain length and biogeographical distribution: *E. antarctica* var. *recta* (Mangin) Fryxell & Prasad which forms short chains and is observed in the sea-ice zone, and *E. antarctica* var. *antarctica* (Castracane) Mangin which forms long chains and is reported from the Antarctic Polar Front. The ratio of two varieties is expressed as average chain length of *E. antarctica* (*Eucampia* Index). *Eucampia* Index calculated from fossil diatom assemblages has potential to be an indicator of sea ice coverage over the past millions of years. However, investigation of *Eucampia* Index calculated from modern diatom assemblages in sea surface and surface sediments have not been conducted widely in the Southern Ocean, and the reliability of the index is still unclear. One of reasons for this problem is that counting large amount of numbers of *E. antarctica* valves requires a lot of time compared to normal diatom assemblage analysis. In this study, we applied AI based automatic microfossil counting system (Itaki et al., 2018) to counting *E. antarctica* valves in diatom slide, and calculating *Eucampia* Index automatically and faster than manual analysis, in order to verify relationships between environmental factors such as sea ice coverage and *Eucampia* Index from large amount of assemblage data in the Southern Ocean.

Eucampia Index is defined as ratio of intercalary valves to total *E. antarctica* valves (i.e., intercalary and terminal valves) (Kaczmarska et al., 1993). In order to have automatic microfossil counting system identify three types of particles (terminal and intercalary valve, and other particles) from slides, 6,000 images were taken for each group and compiled to teacher data. A classification model was constructed based on the teacher data using deep learning software (RAPID machine learning, NEC).

In results of classification tests by the constructed model, 80–82% of the 100 images were correctly identified as terminal or intercalary valve. More than 88% of the identified images with high confidence value (0.90) by the model was correct. In this presentation we will show accuracy of *Eucampia* Index calculated by improved classification model.

Takuya Itaki, Masanobu Kawachi, Yosuke Taira, Naoki Kuwamori, Hitoshi Saito, Tatsuhiko Hoshino, 2018. JpGU meeting 2018, Abstract.
Kaczmarska, I., Barbrick, N.E., Ehrman, J.M., Cant, G.P., 1993. *Hydrobiologia*, 269(1), 103–112.

Keywords: Diatom, Sea ice, the Southern Ocean, Microfossils, Artificial intelligence, Paleoenvironment

