【Grant-in-Aid for Scientific Research (S)】

Broad Section A

Title of Project： **Interdisciplinary research on the structure of monumental royal-class mounded tombs**

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Research Project Number: 20H05634 Researcher Number：40303995

Keyword: Muography, Royal tombs, Kibi region, Kofun period, Interdisciplinary research

【Purpose and Background of the Research】

Through a collaboration between advanced scientific methods and archaeology, this project aims to establish a new, systematic method of survey for monumental royal-class mounded tombs that does not require excavation and to utilize the data on their internal structure to reconsider the nature of the ancient central polity. It aims to develop a new field of "cosmic-ray archaeology" based on a combination of muography and detailed 3D measurements of tomb mounds and their external features, including *haniwa*. An interdisciplinary team will implement these new methods at a tomb undergoing excavation. Additionally, research utilizing both archaeological and ceramic-petrological methods will allow for the presentation of new approaches to *haniwa* studies. Through these diverse and novel methods, we will clarify the structure of the three largest tombs in Okayama and develop a new understanding of these ancient tombs.

【Research Methods】

The muography unit will build a muon receptor suitable for a giant tomb and develop the necessary methodology. Development and experiments will be carried out at the Tobiotsuka tomb in Okayama. After the apparatus has been prepared, surveys will be conducted at the Zōzan, Sakuzan, and Ryōgūzan tombs, each of which measures over 200m in length, rivaling the royal tombs of the central polity. FY2020 will consist primarily of device development, experimentation, and alignment. Zōzan will be surveyed in FY2021 and Sakuzan and Ryōgūzan in FY2022.

The mounded tomb unit will conduct LiDar mapping of the tombs and produce detailed 3D measurements. The maps will be used to compare the three largest tombs in Okayama with the royal tombs of the central polity.

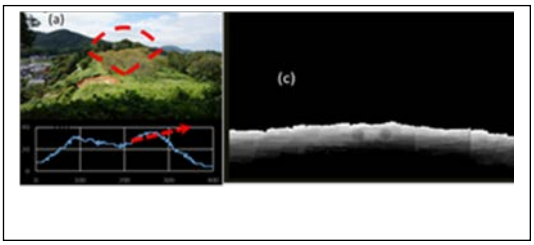

Figure 1 Simulation of a muography survey at Zōzan

The *haniwa* unit will conduct compositional analysis of the clay from the *haniwa* from each tomb, in addition to typological analysis. Through a combination of scientific and traditional archaeological methods, it will present an innovative approach to *haniwa* research.

【Expected Research Achievements and Scientific Significance】

Successful completion of this research is expected to lead to the establishment of survey methods not relying on excavation for monumental royal-class tombs that are otherwise off-limits; this is expected to reveal a significant amount about their internal structure and contents.

Additionally, clarification of the internal structure of the three largest tombs in Okayama will reveal much about similar monumental royal-class tombs, allowing for a new understanding of such tombs. A comparison of their mounds will reveal the nature of the relationship between the central polity and the ancient Okayama region.

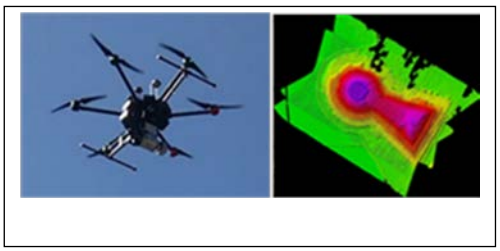

Figure 2 Drone and LiDar map of Zōzan

【Publications Relevant to the Project】

・ Seike, A., (2019). Giant mounded tombs in the Kofun period. In S. Fukunaga & N. Ueda (Eds.), *International comparative approach to the relationship between mounded-tomb building and society utilizing the resources of Japan's kofun research* (pp. 19-32). Osaka University. (In Japanese)

・ Nagamine, K. (2016). Radiography with cosmic-ray and compact accelerator muons; exploring inner-structure of large-scale objects and landforms. *Proc. Jpn. Acad., Ser. B., 92*(8), 265-289.

【Term of Project】 FY2020- 2024

【Budget Allocation】 150,500 Thousand Yen

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