

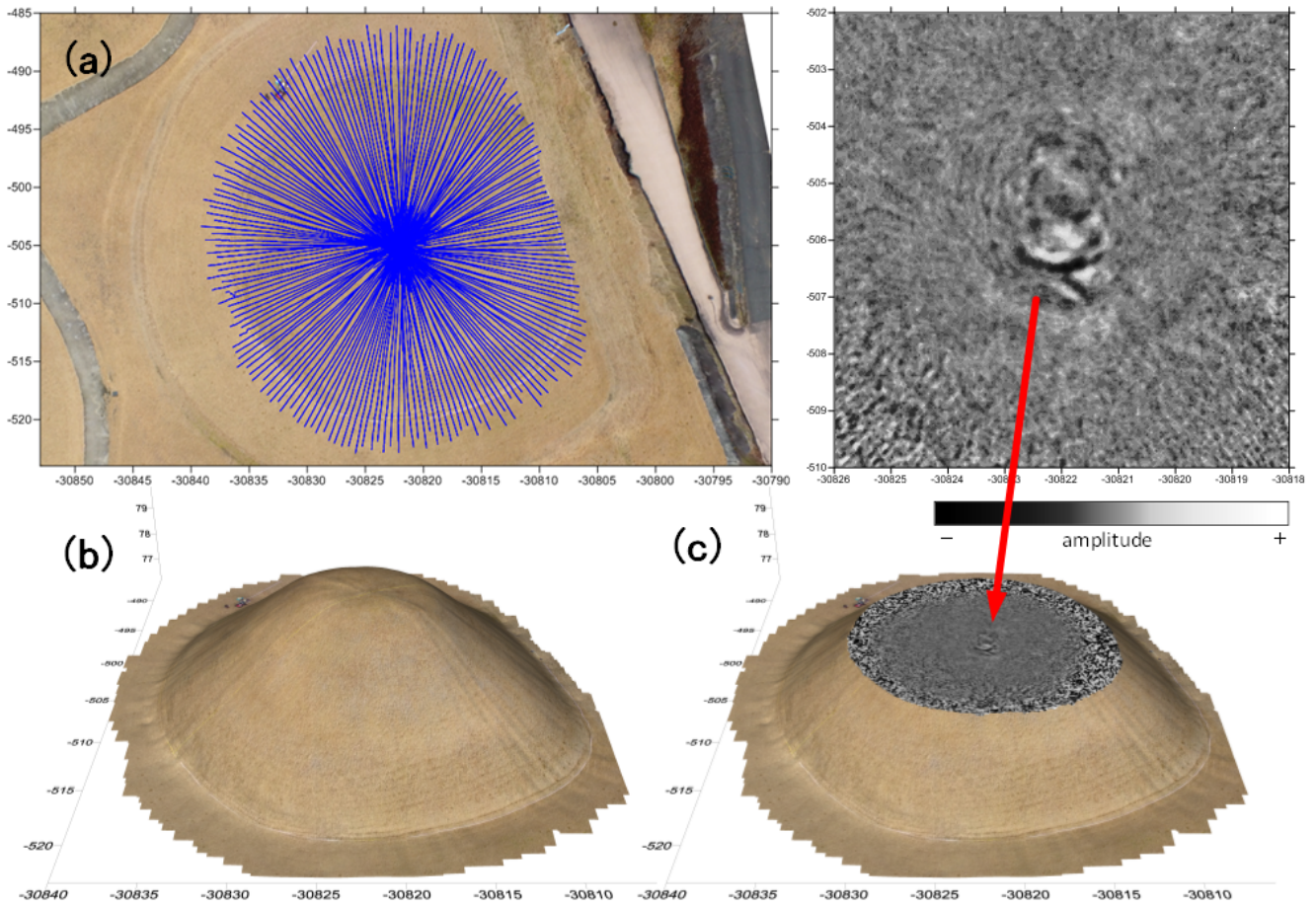
Structural imaging of an ancient burial mound by 3D migration using highly dense GPR data

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GPR, one of the nondestructive-survey, has been often utilized for archaeological survey so far. Since GPR is a high resolution method, it can be achieved to visualize three dimensional subsurface structures in detail by arranging the survey lines densely as covering an overall survey area. However, to analyze three dimensional GPR data effectively, it requires to trace the accurate positions of GPR antenna while GPR survey. Thus it has a limitation to operate a wide area with the large numbers of the survey lines manually. Yashima-kaihatsu Corporation, providing geological service in Kumamoto, is the first company in Kyusyu area of equipping GPR system combined with RTK-GNSS and HS350, have started the GPR services for archaeological survey. The RTK-GNSS enables us to determine the horizontal position of the GPR antenna within 1cm and the vertical position within 1.5cm in real time. HS350 is the GPR antenna, made by GSSI in the US, adopted real-time sampling, and signal to noise ratio of the antenna is being improved by stacking the GPR waveform with several hundred times. Since both devices synchronize, we can achieve effective survey operations. The authors applied the GPR survey at Umamukazu burial mound using the system. The site is located at the crowd of Iwabarū ancient burial mounds in Yamaga City, Kumamoto Pref. We measured 190 radial lines from the top to the bottom of the round burial mound with line-interval of 1.9 degrees. It took 4 hours to complete survey works. It is considered that a stone coffin which a dead body of regional powerful clan was placed is buried inside the round burial mound. And the survey lines of the GPR were arranged as surrounding the stone coffin from subsurface of the round burial mound. We calculated the emitted direction of radio waves if the surface of the round burial mound changed, and applied diffraction stacking method in three dimensional grids model using radially survey lines of 360 degrees. The results of the GPR imaging showed that remarkable reflections appeared in the depth range of 1.2m to 1.7m beneath the top of the round burial mound. Furthermore, we re-calculated focusing on the remarkable reflectors area with the 4cm horizontal grid size and 5cm vertical grid size. Since the shapes of the remarkable reflectors considered as a stone coffin were complicated, we estimated that it might be traces after robbers excavated.

Keywords: ground penetrating radar, migration, archeology



(a) the distribution of the survey lines, (b) the surface model of the round burial mound, (c) the horizontal slice image at the depth of 1.7m from top of the round burial mound