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Computing the Past of Japan

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Kofun

- Keyhole-shaped tomb mounds
  (Front square and round back)
- 5000 mounds still remain all over the country
Mausoleum of the Emperor Keiko:
Length=289m
(in Tenri-shi)
Mausoleum of the Emperor Ojin (in Osaka)
Mausoleum of the Emperor Nintoku (in Osaka)
Kofun Period

- Early: 300 AD ~ 400 AD (4th century)
- Middle: 400 AD ~ 500 AD (5th century)
- Late: 500 AD ~ (6th century)

Queen Himiko’s envoy (239)
Building the database

- Data acquisition started in 1975.
- REDATO started to be operated in 1984. REDATO (Research Support System Complex with Databases of Japanese Ancient Tombs)
- REDATO was halted in 1994 (due to downsizing).
- Data acquisition restarted in 1995.
- The database of 5000 tombs has been released since March in 2002.
  http://www.ozlab.osakac.ac.jp/KOFUN/
Measuring longitudes and latitudes of Kofun
A display image of REDATO

Kofun longer than 100m are retrieved
A magnified image

Red lines show active faults
Magnifying a part of a distribution map

Red line shows an active fault
Contour map and the active fault
Analyzing the ancient patterns
Kofun varied their shapes

4th century  5th century  6th century
Analysis on shapes of Kofun

- Principal component analysis:
  - First component
    \[
    z_1 = \frac{0.70a + 3.58c + 1.79d}{b} + \frac{2.51g + 3.03f}{e} - 9.14
    \]
  - Second component
    \[
    z_2 = \frac{-4.83a + 1.74c - 0.73d}{b} + \frac{-0.05g + 1.61f}{e} + 7.26
    \]
Classification Map

- First component
- Second component

- Regions I to VII

Grid with labeled axes and data points indicating different clusters.
Applications of shape analysis

- Identification and classification of a given tomb mound
- Dating of a tomb mound
- Restoration of a tomb mound
Visualizing the Past

- Archaeological studies
- Education
- Museum
- Simulation for restoration of sites
- Others
Goshikzuka tomb (in Kobe)

(Physical restoration)
Goshikizuka tomb (in Kobe)

Aerial photograph

Photograph taken by K.Ozawa
Mausoleum of the Emperor Suinin (in Nara)
Visualized image of the mausoleum

(generated by K. Ozawa in 1987)
Hakusan tomb (in Kawasaki)

- Visualized in 1985 for Kawasaki City Museum
- Hakusan tomb:
  - (1) One of the biggest tombs in 4th century around Tokyo area.
  - (2) Destroyed in 1940.
  - (3) Surveyed and recorded in a document.
Restored mound on a hill
Visualized image of the Hakusan tomb mound

(generated by K. Ozawa in 1985)
Yoshinogari village site (in Saga)

- Visualized by an animated picture in 1991.
- Supported by Saga Prefecture (Prof C. Takashima)
- Yoshinogari village site is:
  One of the biggest village sites in Yayoi Period, which is estimated to be a capital of an ancient county in Kyushu region.
Visualized image of the Yoshinogari village

.generated by K.Ozawa and T.Kawai)
Mizokui site (in Osaka)

- Visualized in 1999.
- Mizokui site is:
  
  A complex of sites in successive periods from Yayoi to Edo Period. Among them, a site in Kofun Period is estimated to be largest.
Visualized Mizokui village in Kofun Period

 GENERATED IN 1999
Simulating the Past

- Beacon telecommunication network
- Visibility between special sites has been verified using 3D terrain data.
Beacon telecommunication network
Conclusion

- Computing the past of Japan:
  1. Building a Kofun database,
  2. Analyzing shapes of Kofun,
  3. Visualizing the past,
  4. Simulating the beacon telecommunication.

- Future problems:
  1. Integrating existing techniques to a system,
  2. Computer applications to other monuments.