U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Preliminary Map of Peak Horizontal Ground Acceleration for the Hanshin-Awaji Earthquake of January 17, 1995, Japan

(Part A of 2 - The Map)

digitally compiled by
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from

preliminary information kindly provided by
the primary agencies and investigators in Japan

Open-File Report 95-259A

1995

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Introduction

The Hanshin-Awaji earthquake of January 17, 1995, near Kobe, Japan, offers a valuable dataset for a strong nearby event in a region that contains extensive soft-soil deposits.

A small-scale map has been prepared that shows strong motion stations and recorded accelerations together with general contours of those accelerations over a background of the regional geology. A similar map is available for the Northridge earthquake (Wentworth, Borcherdt, Mark, and Boore, 1994; and World Wide Web at http://wrgis.wr.usgs.gov). Note that the Hanshin-Awaji ground motion data are preliminary, the contours are very general and represent a sparse dataset, and the background geology is derived from a generalized map of Japan prepared at the country scale of 1:1,000,000.

The peak acceleration map was prepared digitally and the parts assembled in ARC/INFO, a commercial geographic information system. It is included here as a colored page-sized illustration (fig. 1) and is also available in digital form as a poster-sized (30x21 inch) postscript image. Broader description and discussion of the data are provided in the companion report (Borcherdt and Wentworth, 1995).

How To Obtain the Digital Image and Reports

A 12 MB postscript file of the poster-sized map image (kobepga.ps, 30 by 21 inch), a 10 MB page-sized version (kobepgapg.ps), and ASCII versions of this report (kobeA.txt) and its companion report (Open-File Report 95-259B: kobeB.txt) can be obtained over Internet by anonymous ftp or World Wide Web or by sending the database coordinator a tape on which the files will be copied and returned.

To obtain the files over Internet by ftp, connect via anonymous ftp to quake.usgs.gov. The files are located in the subdirectory pub/www/QUAKES/shake/kobe.

To obtain the files via World Wide Web (WWW), connect to the Web site:

http://quake.wr.usgs.gov/QUAKES/shake/kobe/kobeshake.html.

To obtain the files on magnetic tape in UNIX tar format: send an 8 mm Exabyte tape or 150-MB 1/4-inch cartridge tape and request to Database Coordinator c/o BWRG, U.S. Geological Survey, 345 Middlefield Road MS-975, Menlo Park, CA 94025.

Description of the Map

The map displays the peak horizontal accelerations (in gals) recorded in the epicentral region over a generalized geologic background. Acceleration values are shown near the stations at which they were recorded and contours of those values are superimposed on the maps. Fore- and aftershocks over a two-day period indicate the approximate location of the source and circles at a distance interval of 25 km around the mainshock epicenter indicate both map scale and position of features relative to the mainshock. A 1-degree grid of latitude and longitude is superimposed on the geology.

The prominent dumbbell-shaped high in the acceleration contours is centered over the Bay-margin fringe of Holocene sediment in the Kobe City area adjacent to the northeastern end of the source fault.

It's relatively narrow shape and rapid falloff northeastward along strike are real, based on the distribution of control around it's northeastern end. The dumbbell peaks rise to 600-700 gals, but two stations in the intervening gap reach above 800 gals (other nearby stations with lower values force the saddle in the contours).

The geologic units are those of the generalized Geologic Map of Japan, which distinguishes rock and sediment formed during different intervals of geologic time (time stratigraphic units). Although the materials can be inferred to increase in stiffness or hardness with increasing age, as a first approximation, the textures in the Holocene and Pleistocene sediments that are important for evaluating local amplification are not well distinguished. For this presentation, the full distinctions in the upper Cenozoic time-stratigraphic units on the source map are retained, but the older bedrock units are combined. Note that the recent land fill that has been placed along the margins of Osaka Bay and at Kansai International Airport (location of the 160 gal station in Osaka Bay) is not included.

Data and Sources

A brief description of the data and sources is provided here. See the companion report (Borcherdt and Wentworth, 1995) for more detail.

Strong Motion Data

The strong motion data were derived from preliminary information provided to R.D. Borcherdt by the various agencies and principal investigators and colleagues in Japan, together with the "Prompt Report on Strong Motion Accelerograms No. 46" (Science and Technology Agency of Japan, 1995). The mainshock location is from the above noted Prompt Report. Seismicity for the two-day period including the main shock is that reported via ftp by the Earthquake Research Institute, University of Tokyo, Observation Networks of Disaster Prevention Research Institute, Kyoto University, and Faculty of Science, Kochi University.

Acceleration Contours

The acceleration contours were prepared by gridding the station values at a spacing of 0.5 km using a minimum curvature gridding routine (Webring, 1981) and then contouring the grid at a contour interval of 50 gals. The contours provide a guide to the general variation of acceleration throughout the region. The data are sparse, however, the contours represent a generalized surface that does not pass through all the station values, and the contours continue into or across areas of little or no control, including Osaka Bay.

Geology

The geologic background was prepared from a digital version of the Geologic Map of Japan (Geological Survey of Japan, 1992). This is a very generalized map of the country at a scale of 1:1,000,000. In its representation in the poster-sized image, the Kobe region of the geologic map is enlarged about twofold (to a scale of 1:425,000), a process that adds no detail but simply makes room for the other data that are included.

Map Projection

The digital geology on the CD-ROM is stored in a coordinate system of decimal degrees of longitude and latitude. This was converted for graphical presentation into an Oblique Mercator projection with the following parameters, chosen to center the map on the Kobe region:

.9999	- scale factor at projection's center
34 48 07	- latitude of projection's center
129 30 04	- longitude of 1st pt on central line
29 40 16	- latitude of 1st pt on central line
147 45 11	- longitude of 2nd pt on central line
45 06 43	- latitude of 2nd pt on central line

References Cited

Borcherdt,R.D., and Wentworth, C.M., 1995, Preliminary map of peak horizontal ground acceleration for the Hanshin-Awaji earthquake of January 17, 1995, Japan (part B of 2, description of mapped data sets): U.S. Geological Survey Open-File Report 95-259B)

Geological Survey of Japan, 1992, Geological Map of Japan, Third Edition, CD-ROM Version: Geological Survey of Japan, CD-ROM series of Earth Science Databases, CDGSJ92010.

Science and Technology Agency of Japan, 1995, Prompt report on strong-motion accelerograms No. 46: The National Research Institute for Earth Science and Disaster Prevention, Science and Technology Agency of Japan, 42 p.

Webring, Michael, 1981, A gridding program based on Minimum curvature: U.S. Geological Survey Open-file Report 81-1224, 41 and cd to p.

Wentworth, C.M., Borcherdt, R.D, Mark, R.K., and Boore, D.M., 1994, Maps of peak horizontal and vertical accelerations recorded for the Northridge, California earthquake of January 17, 1994, and general geology of the epicentral region: U.S. Geological Survey Open-File Report 94-197, 3 p.

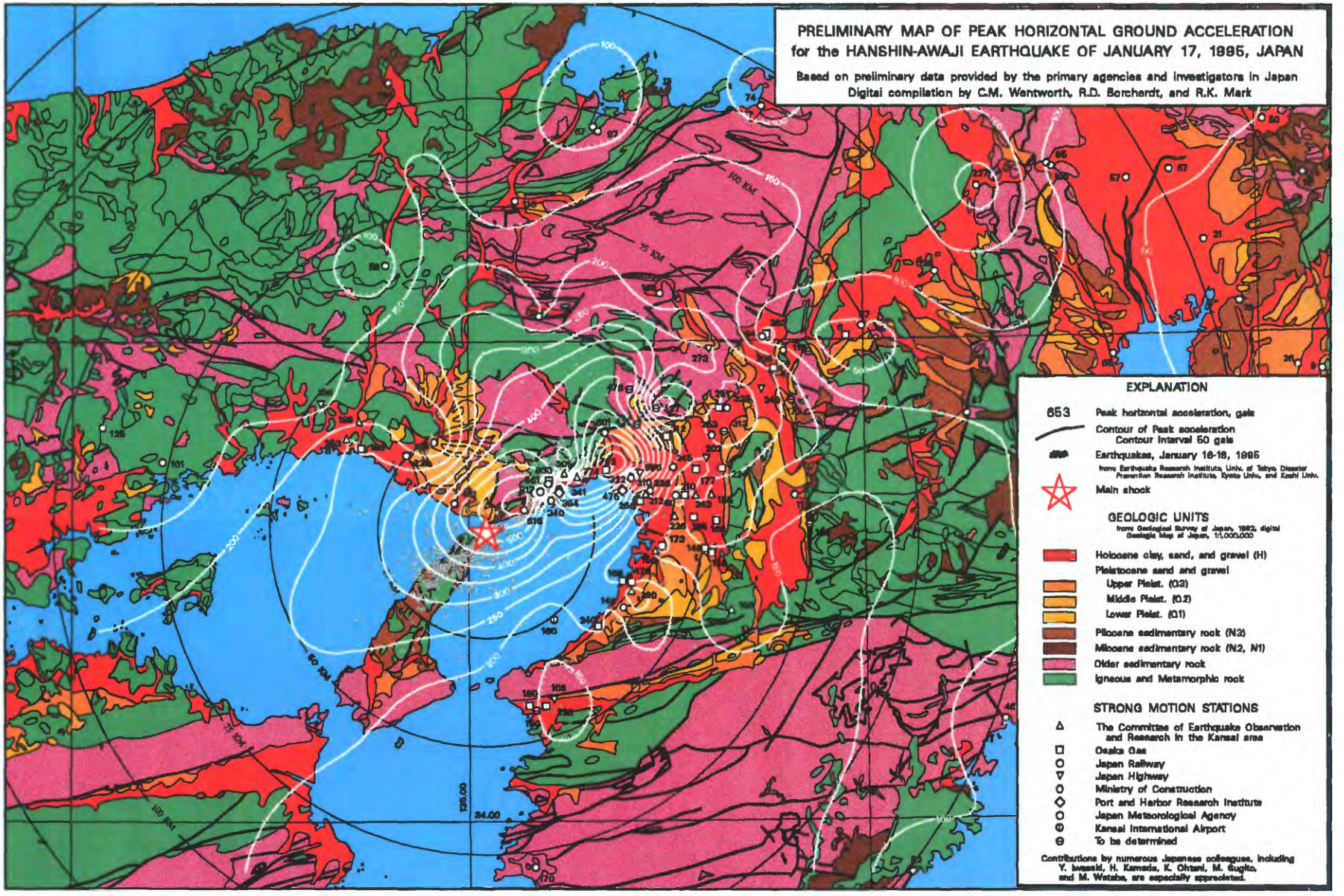
PRELIMINARY MAP OF PEAK HORIZONTAL GROUND ACCELERATION
for the HANSHIN-AWAJI EARTHQUAKE OF JANUARY 17, 1995, JAPAN
Based on preliminary data provided by the primary agencies and investigators in Japan
Digital compilation by C.M. Wentworth, R.D. Borcherdt, and R.K. Mark
EXPLANATION
653 Peak horizontal acceleration, gals
Contour of Peak acceleration
Contour Interval 50 gals
Earthquakes, January 16-18, 1995
from Earthquake Research Institute, Univ. of Tokyo, Disaster Prevention Research Institute, Kyoto Univ., and Kochi Univ.
Main shock
GEOLOGIC UNITS
from Geological Survey of Japan, 1982, digital Geologic Map of Japan, 1:1,000,000
Holocene clay, sand, and gravel (H)
Pleistocene sand and gravel
Upper Pleist. (Q3)
Middle Pleist. (Q2)
Lower Pleist. (Q1)
Pliocene sedimentary rock (N3)
Miocene sedimentary rock (N2, N1)
Older sedimentary rock
Igneous and Metamorphic rock
STRONG MOTION STATIONS
The Committee of Earthquake Observation and Research in the Kansai area
Osaka Gas
Japan Railway
Japan Highway
Ministry of Construction
Port and Harbor Research Institute
Japan Meteorological Agency
Kansai International Airport
To be determined
Contributions by numerous Japanese colleagues, including Y. Iwasaki, H. Kameda, K. Ohtani, M. Sugito, and M. Watabe, are especially appreciated.
100 KM
150 KM
200 KM
75 KM
50 KM
135.00
34.00

Figure 1.

OPEN FILE NOTICE

OF-95-259A. Preliminary map of peak horizontal ground acceleration for the Hanshin-Awaji earthquake of January 17, 1995, Japan (Part I of 2 - The map) By C. M. Wentworth, R.D. Borcherdt, and R.K. Mark. 1995. 5 p.

This report describes a digital image in ARC/INFO postscript format of a map available in page size (10 MB) and poster size (30 by 21 inch, 12 MB).

Requirements: Access to Internet or a supported tape drive is required to download the files.

To obtain the digital files:

Over Internet via anonymous ftp to: quake.usgs.gov. Files are located in the subdirectory pub/www/QUAKES/shake/kobe.

Via World Wide Web: http://quake.wr.usgs.gov/QUAKES/shake/kobe/kobeshake.html

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