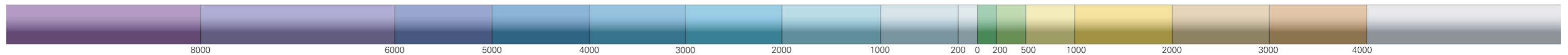
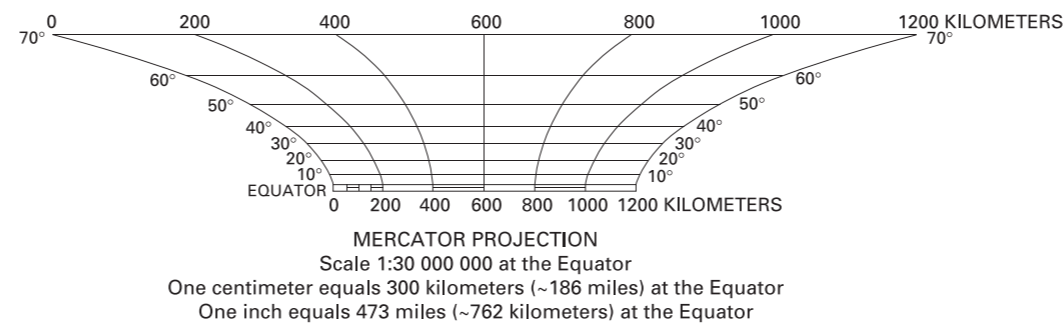


TOPOGRAPHY: DEPTH AND ELEVATION IN METERS



Sea-floor data from Scripps Institution of Oceanography Web site "Satellite Geodesy" (http://topex.ucsd.edu/marine_topo/mar_topo.html), accessed June 11, 1997; land-elevation data from U.S. Geological Survey (1997). Most lakes are shown in pale blue, with depth not implied. For the world's largest inland sea (Caspian) and deepest lake (Baikal), however, actual lake floor topography is shown using the same color scale as for the rest of the map.



Suggested citation: Simkin, Tom, Tilling, R.I., Vogt, P.R., Kirby, S.H., Kimberly, Paul, and Stewart, D.B., 2006, This dynamic planet: World map of volcanoes, earthquakes, impact craters, and plate tectonics: U.S. Geological Survey Geologic Investigations Series Map I-2800, 1 two-sided sheet, scale 1:30,000,000.

Volcanoes—Data from Global Volcanism Program, Smithsonian Institution, Washington, D.C.; accessed at <http://www.volcano.si.edu/world/summary.cfm>, March 16, 2005

- ▲ Erupted A.D. 1900 through 2004
- △ Erupted A.D. 1 through 1899
- △ Erupted in Holocene time (past 10,000 years), but no known eruptions since A.D. 1
- △ Uncertain Holocene activity and fumarolic activity

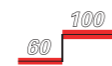
Impact Craters—Data from University of New Brunswick, Planetary and Space Science Centre, Earth Impact Database; accessed at <http://www.unb.ca/passc/ImpactDatabase/>, October 23, 2003 (also see Grieve, 1998). Geologic age span: 50 years to 2,400 million years. Crater diameter indicated below

- * <10 km
- * 10 to 70 km
- ⊙ >70 km (shown at actual map scale)

Notable Events—Numbers next to a few symbols—of many thousands shown—denote especially noteworthy events, keyed to correspondingly numbered entries in tables found on the back of the map. These numbered events have produced devastating natural disasters, advanced scientific understanding, or piqued popular interest. They remind us that the map's small symbols may represent large and geologically significant events

- 19 Volcanoes
- 9 Earthquakes
- 23 Impact craters

Plate Tectonics



Divergent (sea-floor spreading) and transform fault boundaries—Red lines mark spreading centers where most of the world's volcanism takes place; thickness of lines indicates divergence rate, in four velocity ranges. White number is speed in millimeters per year (mm/yr) from DeMets and others (1994). The four spreading-rate ranges are <30 mm/yr; 30–59 mm/yr; 60–90 mm/yr; and >90 mm/yr. Thin black line marks the plate boundary, whether sea-floor spreading center or transform fault. On land, divergent boundaries are commonly diffuse zones (see interpretive map to the left); therefore, most are not shown. The only transform faults shown on land are those separating named plates

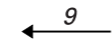


Plate motion—Data from Rice University Global Tectonics Group. Length of arrow is proportional to plate velocity, shown in millimeters per year. These approximate rates and directions are calculated from angular velocities with respect to hotspots, assumed to be relatively fixed in the mantle (see plate motion calculator at <http://tectonics.rice.edu/hs3.html>)



Plate convergence—More accurately known than "absolute" plate motion (above), convergence data are shown by arrows of uniform length showing direction and speed, in millimeters per year, relative to the plate across the boundary. Data from Charles DeMets (University of Wisconsin at Madison, written commun., 2003) and Bird (2003)

Earthquakes—Data from Engdahl and Villaseñor (2002). From 1900 through 1963, the data are complete for all earthquakes ≥6.5 magnitude; from 1964 through 1999, the data are complete for all earthquakes ≥5.0 magnitude. Most location uncertainties <35 km. Eleven more recent major or great earthquakes (magnitude ≥7.7) have been added for completeness through 2004; data from USGS National Earthquake Information Center at <http://neic.usgs.gov/>, accessed January 4, 2005. An epicenter is the surface location of the first rupture on an earthquake fault. Symbols shown represent epicenters. For earthquakes larger than about magnitude 7.0, the size of the rupture zone, which can extend hundreds of kilometers from the epicenter, is larger than the symbols used on this map

Depth to earthquake, in km	Magnitude of earthquake			
	5.0–5.9	6.0–6.9	7.0–7.9	≥8.0
<60	•	•	○	○
60–300	•	•	○	○
>300	•	•	○	○
Global average occurrence ¹	1,319/yr	134/yr	17/yr	1/yr

¹Earthquakes of magnitude <5 (not shown on map) are much more frequent, with ~13,000/yr in the 4.0–4.9 range alone. Data from USGS National Earthquake Information Center.

- Earthquakes that occurred from 1750 to 1963 within stable plate interiors on continents—Data from A.C. Johnston (Center for Earthquake Research and Information, University of Memphis, written commun., 2002). Even though these epicenters do not meet the precise location criteria of Engdahl and Villaseñor (2002), they are plotted here to remind readers of the potentially hazardous earthquakes that are distant from known plate boundaries. Size of symbol proportional to magnitude of earthquake
- ⊙ Notable pre-1900 earthquakes—Nos. 1, 2, 3, 6, and 7 (see table 3, on back)

THIS DYNAMIC PLANET

WORLD MAP OF VOLCANOES, EARTHQUAKES, IMPACT CRATERS, AND PLATE TECTONICS

By

Tom Simkin,¹ Robert I. Tilling,² Peter R. Vogt,^{3,1} Stephen H. Kirby,² Paul Kimberly,¹ and David B. Stewart²

Cartography and graphic design by Will R. Stettner,² with contributions by Antonio Villaseñor,⁴ and edited by Katharine S. Schindler²

¹Smithsonian Institution, ²U.S. Geological Survey, ³U.S. Naval Research Laboratory, ⁴Institute of Earth Sciences Jaume Almera, Spanish National Research Council

2006

