

EQ or Volcano 'Research Paper' Assignment (max- 100 points) 15% of your final grade**Event Proposal Due: July 11th, Paper due: August 2, 2010.**

The purpose of this 'research paper' exercise is to familiarize you with a *current (this semester)* earthquake (EQ) or volcanic eruption of your choice, so you understand it well enough to a) relate it to dynamic Earth processes, b) explain the event and the damage it caused, and c) summarize its importance and impact on society. First, decide on a topic, do a little research to make sure you can locate some information and post it as soon as possible on the Choice Topic Assignment by July 11th, to avoid duplication. Please try and select an event with some significance-you will undoubtedly find more information for the larger magnitude events. For example, you might select a state or country you would like to learn more about, and determine the most recent EQ or volcanic eruption there. You **are not** permitted to select any of the case study topics listed in the Lectures. Information for the paper should be obtained from a **variety** of sources, including books in the library, journal articles, and web sites, and should be properly cited. **At least 3 or 4 sources** should be used for the paper (blend of **reviewed** printed sources, such as newspaper and journal articles or books, and the internet-**but beware**-do not trust any one website-*confirm and verify*). The paper should address **three main aspects**: 1) how the particular EQ or eruption relates to plate tectonics or other earth processes, 2) a descriptive summary of the event, and 3) its impact on society (eg., injuries, deaths, damage). Quantitative information should be summarized, such as vital statistics, size, nature, timing, etc. The paper should be very short, **a maximum of 2 pages** in length (1 sheet-preferably printed or photocopied on 2 sides) and include a **very concise analysis** of the subject. Feel free to download and use either of the Microsoft word file EQPaperOutline.doc or VolcPaperOutline.doc preformatted, available on the eLearning class homepage. If you have problems understanding any papers, feel free to consult the instructor or TA and they will be happy to help. Please do not procrastinate event selection or your research, as we will be unable to assist you the last week prior to the due date. University regulations regarding Plagiarism will be strictly followed.

Include this signed statement at the top of your paper:

"I certify that this paper represents my own work and that I have properly cited all sources of information contained herein:"
_____ signed & dated

Grading is as follows: 25% clarity & quality (following outline, syntax, grammar, spelling), 75% content, including: a. plate tectonics, b. vital statistics, and c. impact on society.

Topics: choose one and write topic on class list by 11 July to make sure no duplication occurs.

Possible Sources of Information include: Internet search engines such as Google, Yahoo, etc.

****Citation search databases: GeoRef, Web of Science, WorldCat, etc.:** all available on the UTD library web page-list of electronic databases (<http://www.utdallas.edu/library/resources/databases/geology.htm>). These searches should provide you with some Journal articles, which you should **definitely** consult (that is, **do not limit yourself to the internet**).

****Journals:** such as: *Earthquakes and Volcanoes (formerly Earthquake Information Bulletin)*, *Seismological Society of America Bulletin*, *Seismological Research Letters*, *Journal of Geophysical Research*, *Geophysical Research Letters*, *Pure and Applied Geophysics*, *Journal of Volcanology & Geothermal Research*, *Bulletin of Volcanology*, etc. are in the Journal collection on second floor of the Library; some are electronically available on the UTD library web page-electronic journals where pdfs can be downloaded at: (<http://www.utdallas.edu/library/reference/journals.html>).

****Books:** such as: Bruce Bolt, *Earthquakes*, Ritchie & Gates, *Encyclopedia of Earthquakes & Volcanoes*. Decker & Decker, *Volcanoes*. Also many books with the call letters QE534-QE539 (4th floor of the library).

****WebSites:** (see eLearning class page for links and files).

Paper Outline

1. Location Information (City, State, Country, Latitude/Longitude if you wish)
2. Date & Time of event (local time); Duration of ground shaking or eruption
3. Depth to hypocenter or magma source (km below ground surface)
4. Magnitude (note EQ magnitude type used: M_l , M_s , M_w , m_b , m_f); Volcanic magnitude VEI or kg erupted.
5. Maximum Modified Mercalli Intensity (MMI) (I-XII) and felt area (km^2) for EQ or area covered by ash.
6. Fault Name, Fault type & orientation, total length of rupture zone, maximum amount of offset for EQ or Type of Volcano, volcanic chain name, size (diameter, height above base, area, volume)
7. Plate Tectonic Setting (discuss home plate, distance to nearest major plate boundary, type of boundary, and plot location as a star on the world plate map with relative motion arrows showing nearest plate boundary; include both a local sketch map showing the plate tectonics and a lithospheric-scale cross section sketch showing fault for EQ and magma source & vent for volcanoes).
8. Damage Details: Deaths, injuries, \$ value destruction, tsunamis, types of hazards, etc.
9. Impact on culture, economy, & society (verbal summary)
10. References cited (follow example on other side)

Example paper-purposely shortened to emphasize brevity...

“I certify that this paper represents my own work and that I have properly cited all sources of information contained herein.”
 date: _____

Student Name- Stone B. Rocky

ISNS3359 Summer 2010

EQ Paper: The Great Alaska Earthquake of 1964 (largest recorded in North America, second largest recorded in the world)

- 1. Epicenter Location:** Prince William Sound, AK, USA (latitude: 61.04°N, longitude: 147.73°W)
- 2. Date & Time:** (local time): 5:36 PM, 27 March 1964 (Good Friday); **Duration:** Gentle rolling motion for <1 min, followed by hard shaking for 3-4 min.
- 3. Depth to hypocenter:** 6-50 km
- 4. Magnitude:** $M_S = 8.4$; $M_W = 9.2$
- 5. Maximum Modified Mercalli Intensity:** $MMMI=X-XI$; **felt area:** >1,300,000 km² (nearly all of AK & parts of W Canada).
- 6. Fault Name:** Patton Bay Fault; **Fault type & orientation:** NE-striking NW-dipping Reverse fault; **total length of ruptured zone**~600-900 km (fault area>500 km x 300 km), maximum amount of **offset:** vertical 6-12 m; horizontal: ~20 m [average~7 m].
- 7. Plate Tectonic Setting:** home plate: North American, within ~100 km of the Subduction Zone Megathrust caused by subduction of the NW-dipping Pacific Plate moving at ~6 cm/year beneath the North American plate).
- 8. Damage Details:** Letouche Island moved 18 m to the southeast. Up to 2.3 m of coastal subsidence occurred over an area measuring 800 x 150 km (drowned forests); >124,000 km² of land and seafloor dropped and 155,000 km² rose. Pacific tsunami damaged coastal AK (<30 m high waves), W USA & Canada coast, reached Antarctica (1-2 m high waves), in ~1 day. Sound waves were heard in San Diego. Lower Atmosphere wave propagated at 0.3 km/sec and the ionosphere rippled 90 km above sea level, both due to the Tsunami. Long period (17 sec) surface waves with a 1 cm vertical ground displacement were recorded in Berkeley CA, but were not felt due to their long wavelengths (~50 km). Over ~131 people were killed (all but 9 by tsunami, most in Seward & Valdez), ~\$500 million damages; > 2000 Landslides & Avalanches, Rock Avalanches, Ground Fissures, Consolidation Subsidence, Cable Breaks, Railroad Tracks & Bridges, Tsunami. Over 70 homes were destroyed in the Turnagain Heights neighborhood of Anchorage due to landslides. The northern part of downtown Anchorage built on sedimentary fill and muds were severely damaged or destroyed. Over 12,000 aftershocks were detected (19 with $M>6$) during several subsequent months. Despite evacuations in Crescent City, CA due to the tsunami warning a total of 12 people drowned, including 5 killed by the third wave after they returned to the beach, thinking it was safe.
- 9. Impact** on culture, economy, & society: Damage was relatively minimal considering the immense size of the EQ due to the remote location and low population density of AK at the time (total AK population-<100,000). The EQ had significant effect on the natural landscape of the Prince William Sound by causing subsidence that flooded forests (dead trees remain in the PW Sound today) and uplift that created emergent land. The timing of the EQ also contributed to a reduced loss of life due to the holiday with students not in school, and workers not at work. The EQ stimulated the formation of the US EQ Hazards Program, and led to land-use changes in Anchorage with the preservation of “Earthquake Parks.”

10. References cited

Abbott, P. (2004) *Natural Disasters*, 4th Ed., McGraw Hill, NY, pp 99-100.
 Bolt, B. (2004) *Earthquakes*, 5th Ed., WH Freeman, NY, pp. 14-15, 175, 206-7.
 Christensen, D. (accessed 1/25/2004) http://www.aeic.alaska.edu/Seis/64quake/quake_description.html
 National Academy of Sciences (1972) The Great Alaska Earthquake of 1964. NRC, Washington.
 Pfafker, G. (1969) The Alaska Earthquake, Regional Effects; Tectonics. *U.S. Geological Survey Professional Paper 543-I*.
 Von Huene, R., Klauschen, D., & Fruehn, J. (1999) Relation between the subducting plate and seismicity associated with the Great 1964 Alaska Earthquake, *Pure & Applied Geophysics*, v. 154, p. 575-91.

Figure 1. AK Map showing epicenter and plate boundary

Source: http://neic.usgs.gov/neis/eq_depot/usa/1964_03_28.html

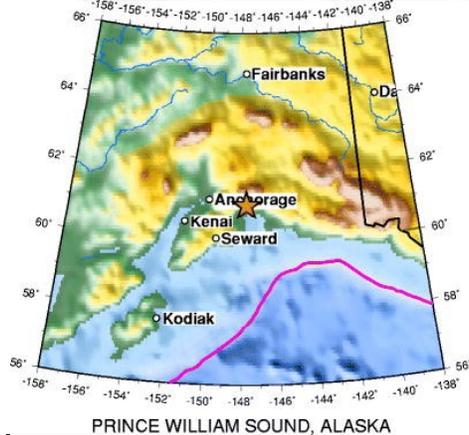


Figure 2. World Plate map showing epicenter

Source: Abbott (2004) Figure 2.6

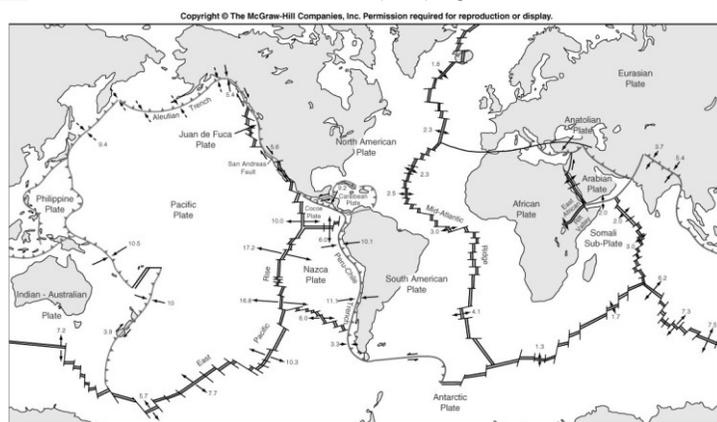
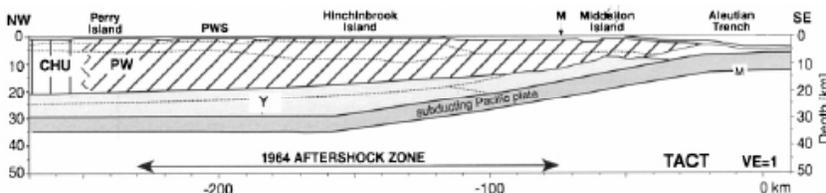


Figure 3. NW-SE Cross-section showing the NAM-PAC plate boundary and the EQ hypocenter (after Von Huene et al., 1999).



(cross section can be sketched)