

Ge 177a THE GEOLOGY OF EARTHQUAKES

Version of 8 January 2008

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Text: The Geology of Earthquakes (Yeats, Sieh and Allen)

Grading: Final exam 30%

Project 25%

Labs 25%

Field trips 20%

Lectures: Tu (11am-12pm) We (9-10am) Th (11am-12pm); 300 North Mudd

Labs: Tues (1-4pm); 300 NM (#1-4); 309 NM (#5 and Lab Projects)

	Date	Topic	Lectures, Labs, ¹ and Field trips	Reading assignments
Tu	8-Jan	Introduction	1 Earthquakes, global tectonics and man	Intro. and Chapter 1, p. 3-16, ² 369-370
We	9-Jan	Neotectonics	2 Strike-slip faults 1 (Tectonic environments) [Aron]	Chapter 8, p.167-186, 247-248; 165
Th	10-Jan	"	3 Strike-slip faults 2 (Coseismic features) [Aron]	Chapter 8, p. 186-209, 221-229; 114-115
Th	10-Jan		<i>Lab 1: Strike-slip faults (Carrizo Plain)</i>	
Tu	15-Jan	"	4 Strike-slip faults 3 (Regional features, rates) [Aron]	Chapter 8, p. 209-221, 243-244
We	16-Jan	"	5 Normal faults 1 (Tectonic environments)	Chapter 9, p. 249-261; 59
Th	17-Jan	"	6 Normal faults 2 (Coseismic, regional features and rates)	Chapter 9, 261-293; 245-246
Tu	15-Jan		<i>Lab 2: Normal faults (Eastern Sierra Nevada and Idaho)</i>	
Tu	22-Jan	"	7 Reverse faults and folds 1 (Tectonic environments)	Chapter 10, p. 301-328
We	23-Jan	"	8 Reverse faults and folds 2 (Coseismic features, etc)	Chapter 10, p. 328-352
Th	24-Jan	"	9 Neotectonics of the Los Angeles area	Dolan et al. (1995) ³
Tu	22-Jan		<i>Lab 3: Reverse faults and folds (San Fernando, East L.A.)</i>	
Tu	29-Jan	"	10 Active faults and tandem suturing of Taiwan 1	Shyu et al. (2005)
We	30-Jan	"	11 Active faults and tandem suturing of Taiwan 2	Shyu et al. (2006)
Th	31-Jan	"	12 Active faults and tandem suturing of Taiwan 3	
		<i>Field trip⁵</i>	<i>3-day weekend field trip, San Andreas fault (Fri-Sun, 1-3 Feb)</i>	To be assigned
Tu	5-Feb	"	13 Subduction zones 1	Chapter 11, p. 371-424
We	6-Feb	"	14 Subduction zones 2	Sieh and Natawidjaja (2000)
Th	7-Feb	"	15 Sumatran megathrust earthquakes of 2004, 2005 and 2007	Subarya et al. (2006); Briggs et al. (2006)
Tu	5-Feb		<i>Lab Project 1: Regional neotectonic mapping of Myanmar</i>	
Tu	12-Feb	Secondary effects	16 Seismically induced mass-wasting and liquefaction	Chapter 12, p. 427-444
We	13-Feb	" "	17 Tsunamis	
Th	14-Feb	Paleoseismology	18 Introduction	Chapter 8, p. 229-242
Tu	12-Feb		<i>Lab Project 2: Regional neotectonic mapping of Myanmar</i>	
Tu	19-Feb	"	19 Normal faults and reverse faults	Chapter 9, p. 293-298; Chapter 10, 352-361
We	20-Feb	"	20 San Andreas fault 1	
Th	21-Feb	"	21 San Andreas fault 2	
Tu	19-Feb		<i>Lab 4: Clastic paleoseismology</i>	
Tu	26-Feb	"	22 San Andreas fault 3	Weldon et al. (2004) ⁴
We	27-Feb	"	23 Subduction zones of Alaska, Japan and Chile	Plafker (1978 or 1992)
Th	28-Feb	"	24 Sumatran megathrust 1	Natawidjaja et al. (2004)
Tu	26-Feb		<i>Lab 5: Paleoseismology and neotectonics of subduction zones</i>	

Tu	4-Mar	"	25	Sumatran megathrust 2	Natawidjaja et al. (2006)
We	5-Mar	"	26	Sumatran megathrust 3	Sieh et al. (in review)
Th	6-Mar	"	27	Flexi lecture	
Tu	11-Mar	"	28	Earthquake science and human welfare	Sieh (2006); Borrero et al. (2006)
We	12-Mar			Review of lectures, labs, and field trip in prep. for final exam	Come with your questions, hand in projects
Mo	17-Mar	Final exam		Final Exam emailed out by 9 am	
We	19-Mar	" "		Final exam due, 5 pm, KS mailbox or office	

¹ Labs will be supervised by Aron but Kerry will be available throughout the week to help. (Also see note 6, below.)

² For those students who would like a review of other background material, peruse these other chapters in Yeats, Sieh and Allen:
Structural geology and fault-zone geology (Ch 2 and 3) Earthquake seismology (Ch 4) Earthquake geodesy (Ch5) Geochronology (Ch 6)

³ PDF files of these assigned papers and manuscripts are downloadable from Kerry's website [<http://www.gps.caltech.edu/~sieh/publications.htm>].
Borrero, J., Sieh, K., Chlieh, M., and Synolakis, C., 2006, Tsunami forecasts for Western Sumatra: *Proc. Natl. Acad. Sci.*, v. 103, p. 19673-19677.
Briggs, R., Sieh, K., Meltzner, A.J., Natawidjaja, D., Galetzka, J., Suwargadi, B., Hsu, Y.J., Simons, M., Hananto, N., Suprihanto, I., Prayudi, D., Avouac, J.-P., 2006, The giant Sumatran megathrust rupture of March 2005: *Science*, v. 311, p. 1897-1901.
Dolan, J., Sieh, K., Rockwell, T., Yeats, R., Shaw, J., Suppe, J., Huftile, G., and Gath, E., 1995, Prospects for larger or more frequent earthquakes in the Los Angeles metropolitan region: *Science*, v. 267, p. 199-205.
Natawidjaja, D., Sieh, K., Ward, S., Cheng, H., Edwards, R.L., Galetzka, J., and Suwargadi, B., 2004, Paleogeodetic records of seismic and aseismic subduction from central Sumatran microatolls, Indonesia: *Journal of Geophysical Research*, v. 109, B04306.
Natawidjaja, D., Sieh, K., Chlieh, M., Galetzka, J., Suwargadi, B., Cheng, H., Edwards, R.L., Avouac, J.P., Ward, S., 2006, Source parameters of the great Sumatran megathrust earthquakes of 1797 and 1833 inferred from coral microatolls: *Journal of Geophysical Research*, v. 111, B06403.
Shyu, B., Sieh, K., and Chen, Y.G., 2005, Tandem suturing and disarticulation of the Taiwan orogen revealed by its neotectonic elements: *Earth and Planetary Science Letters*, v. 233, p. 167-177.
Shyu, B., Sieh, K., Avouac, J.P., Chen, W.S., and Chen, Y.G., 2006, Millennial slip rate of the Longitudinal Valley fault from river terraces: Implications for convergence across the active suture of eastern Taiwan: *Journal of Geophysical Research*, v. 111, B08403.
Sieh, K., 1996, The repetition of large-earthquake ruptures: *Proc. Natl. Acad. Sci.*, v. 93, p. 3764-3771.
Sieh, K., and Natawidjaja, D., 2000, Neotectonics of the Sumatran fault, Indonesia: *Journal of Geophysical Research*, v. 105, p. 28,295-28,326.
Sieh, K., 2006, Sumatran Megathrust Earthquakes - From Science to Saving Lives: *Philos. Trans. Royal Society*, Vol. 364, No. 1845, p. 1947-1963.
Subarya, C., Chlieh, M., Prawirodirdjo, L., Avouac, J.-P., Bock, Y., Sieh, K., Meltzner, A.J., Natawidjaja, D., and McCaffrey, R., 2006, Plate-boundary deformation of the great Aceh-Andaman earthquake: *Nature*, v. 440, p. 46-51.

⁴ PDF files of these papers will be provided by Aron
Plafker, G., 1992, Determining Recurrence Intervals of Great Subduction Zone Earthquakes in Southern Alaska by Radiocarbon Dating, in Taylor, R.E., Long, Austin and Kra, R.S., ed., Radiocarbon After Four Decades: An Interdisciplinary Perspective: New York, Springer-Verlag, p. 436-453.
Plafker, G., and Rubin, M., 1978, Uplift history and earthquake recurrence as deduced from marine terraces on Middleton Island, Alaska, Proceedings of Conference VI: Methodology for identifying seismic gaps and soon-to-break gaps, U.S. Geological Survey Open File Report 78-943, p. 857-868.
Sieh, K., et al., in review.
Weldon, R., Fumal, T., and Biasi, G., 2004, Wrightwood and the earthquake cycle: What a long recurrence record tells us about how faults works: *GSA Today*, v. 14, p. 4-10.

⁵ Contingency dates for field trip are Fri-Sun, 8-10 February

⁶ Aron will be out of town (in Indonesia) 18 Jan thru 11 Feb. He will be reachable by e-mail during this time.
Belle Philipposian (belle@gps.caltech.edu) will run the labs and field trip during Aron's absence.