Jump to Navigation

Quaternary Fault and Fold Database of the United States

As of January 12, 2017, the USGS maintains a limited number of metadata fields that characterize the Quaternary faults and folds of the United States. For the most up-to-date information, please refer to the interactive fault map.

Denali fault, Dalton section (Class A) No. 5000j

Last Review Date: 2012-07-01

Compiled in cooperation with the Alaska Department of Natural Resources

citation for this record: **(Craw) Burns, P.A., and Koehler, R.D., compilers, 2012, Fault number 5000j, Denali fault, Dalton section, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2020 03:08 PM.**

Synopsis	**General:** The Denali fault is a major structural element in south-central Alaska, and accommodates a significant amount of the on-land deformation caused by the convergence between the northwestward-moving Pacific plate and the overriding North American plate. Underthrusting and subduction along the Aleutian Trench accommodates most of the plate convergence, but part of the motion is transferred inland to the North American plate and produces dextral transpressive faulting in southern and south-central Alaska. The Denali fault system extends more than 2,000 km across Alaska and the Yukon Territory of Canada in a large, northward convex arc. The sense of motion on the Denali fault is predominately right-lateral, but some parts of the fault are

	predominately thrust faults. Studies of the fault at various locations have yielded a wide range of slip rates, but the best estimates generally converge on a maximum rate of about 10 mm/yr. Surface rupture associated with the 1912 M_w 7.2–7.4 Delta River earthquake (Carver and others., 2004 #7724) and the 2002 M_w7.9 Denali earthquake occurred on the central part of the fault. The 2002 Denali earthquake produced 341 km of surface rupture on three faults, the central Denali, the Totschunda [5230], and the Susitna Glacier [5501] faults.The earthquake began with rupture on the previously unknown Susitna Glacier fault. Rupture then propagated eastward onto the main Denali fault, and diverted southeastward onto the Totschunda fault. The 2002 earthquake showed that surface ruptures from large events are not restricted to a single fault within the system and demonstrated the complex interaction between faults. **Sections:** This fault has 11 sections. Various authors have subdivided the fault system into sections or segments that have differing names and lengths. We use the subdivisions of Plafker and others (1994 #AK327) for the purposes of this compilation. Following this precedent, we divide the main Denali fault into ten sections and discuss the characteristics of each section.
Name comments	**General:** In some publications, the Denali fault is treated as a single tectonic structure, but it actually consists on several interconnected and inter-related faults. St. Amand (1957 #AK807) first applied the name “Denali fault” to this system of faults that extends from southeastern Alaska, across the southern Yukon Territory of Canada, through the Alaska Range, and extending to Goodnews Bay on the Bering Sea in southwestern Alaska.
County(s) and State(s)	YUKON TERRITORY, CANADA
Physiographic province(s)	WESTERN CORDILLERA
Reliability of location	Compiled at 1:250,000 scale. *Comments:* Location of fault based on Koehler and others (2012 #7468) attributed to Reed (1961 #AK856), Csejtey and others (1992 #AK339), and Nokleberg and others (1992 #AK504). Digital data of Koehler and others (2012 #7468) from http://www.dggs.alaska.gov/pubs/id/23944 downloaded on June 4, 2016.

Geologic setting	
Length (km)	This section is 294 km of a total fault length of 4254 km.
Average strike	S. 56° E. (for section) versus S. 84° E. (for whole fault)
Sense of movement	Right lateral
Dip	near vertical to 70-75° S
Paleoseismology studies	
Geomorphic expression	
Age of faulted surficial deposits	Plafker and others (1977 #AK53) report Holocene offset features on this segment, but lacked reliable dates.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Wahrhaftig and others (1975 #AK301)
Recurrence interval	
Slip-rate category	Between 1.0 and 5.0 mm/yr *Comments:* No published information is available to determine a Quaternary slip rate for this fault segment. However, GPS velocities and geodetic surveys suggest deformation at a rate of 3.8 mm/yr (Fletcher and Freymueller, 2003 #7736). Anbd long term deformation results in 370 km of dextral slip since Early Cretaceous (Lowey, 1998 #7738).
Date and Compiler(s)	2012 Patricia A. (Craw) Burns, Alaska Division of Geological and Geophysical Surveys Richard D. Koehler, Alaska Division of Geological and Geophysical Surveys
References	#AK120 Boucher, G., and Fitch, T.J., 1969, Microearthquake seismicity of the Denali fault: Journal of Geophysical Research, v. 74, p. 6638-6648.

#AK5 Cady, W.M., Wallace, R.E., Hoare, J.M., and Webber, E.J., 1955, The central Kuskokwim region, Alaska: U.S. Geological Survey Professional Paper 268, 132 p.

#AK489 Campbell, R.B., and Dodds, C.J., 1975, Operation Saint Elias, Yukon Territory, *in* Geological Survey of Canada; Paper 75-1: p. 51-53.

#AK559 Campbell, R.B., and Eisbacher, G.H., 1974, Operation Saint Elias, *in* Department of Energy, Mines and Resources, ed., Report of Activities Part A. April to October 1973: Ottawa, Geological Survey of Canada Paper 74-1 Part A, p. 11-12.

#7724 Carver, G.A., Plafker, G., Metz, M.C., Cluff, L., Slemmons, B., Johnson, E., Roddick, J., and Sorensen, S., 2004, Surface rupture on the Denali fault interpreted from tree damage during the 1912 Delta River Mw 7.2–7.4 earthquake—Implications for the 2004 Denali fault earthquake slip distribution: Bulletin of the Seismological Society of America, v. 94, no. 6B, p. S58–S71, doi: 10.1785/0120040625.

#AK490 Clague, J.J., 1979, The Denali fault system in southwest Yukon Territory - A geologic hazard?, *in* Geological Survey of Canada, Paper 79-1A: p. 169-178.

#AK339 Csejtey, B., Jr., Mullen, M.W., Cox, D.P., and Stricker, G.D., 1992, Geology and geochronology of the Healy Quadrangle, south-central Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map I-1961, 1 sheet, 1:250,000 scale.

#AK717 Decker, J., Reifenstuhl, R.R., Robinson, M.S., Waythomas, C.F., and Clough, J.G., 1995, Geology of the Sleetmute A-5, A-6, B-5, and B-6 quadrangles, southwestern Alaska: Alaska Division of Geological & Geophysical Surveys, 16 p., 2 sheets, 1:63,360 scale.

#AK912 Eberhart-Phillips, D., Haeussler, P.J., Freymueller, J.T., Frankel, A.D., Rubin, C.M., Craw, P.A., Ratchkovski, N.A., Anderson, G., Carver, G.A., Crone, A.J., Dawson, T.E., Fletcher, H., Hansen, R., Harp, E.L., Harris, R.A., Hill, D.P., Hreinsdottir, S., Jibson, R.W., Jones, L.M., Kayen, R., Keefer, D.K., Larsen, C.F., Moran, S.C., Personius, S.F., Plafker, G., Sherrod, B., Sieh, K., Sitar, N., and Wallace, W.K., 2003, The 2002 Denali Fault

earthquake, Alaska—A large magnitude, slip-partitioned event: Science, v. 300, no. 5622, May 16, p. 1113–1118, doi:10.1126/science.1082703.

#AK590 Eisbacher, G.H., 1976, Sedimentology of the Dezadeash flysch and its implications for strike-slip faulting along the Denali fault, Yukon Territory and Alaska: Canadian Journal of Earth Science, v. 13, no. 11, p. 1495-1513.

#AK20 Fernald, A.T., 1960, Geomorphology of the upper Kuskokwim region, Alaska: U.S. Geological Survey Bulletin 1071-G, 88 p., 2 sheets, 1:250,000 scale.

#7736 Fletcher, H.J., and Freymueller, J.T., 2003, New constraints on the motion of the Fairweather fault, Alaska, from GPS observations: Geophysical Research Letters, v. 30, paper number 1139, doi:10.1029/2002GL016476.

#AK562 Gemuts, I., Puchner, C.C., and Steffel, C.I., 1983, Regional geology and tectonic history of western Alaska, *in* Alaska Geological Society, ed., Journal of the Alaska Geological Society: Anchorage, Alaska Geological Society, v. 3, p. 67-85.

#AK30 Gilbert, W.G., Solie, D.N., Kline, J.T., and Dickey, D.B., 1990, Geologic map of the McGrath B-3 Quadrangle: Alaska Division of Geological & Geophysical Surveys Professional Report 102, 2 sheets, 1:63,360 scale.

#AK31 Grantz, A., 1966, Strike-slip faults in Alaska: U.S. Geological Survey Open-File Report 66-53, 82 p., https://pubs.er.usgs.gov/publication/ofr6653.

#AK819 Hoare, J.M., and Coonrad, W.L., 1961, Geologic map of the Goodnews Quadrangle, Alaska: U.S. Geological Survey Map I-339, 1 sheet, 1:250,000 scale.

#7468 Koehler, R.D., Farrell, R-E., Burns, P.A.C., and Combellick, R.A., 2012, Quaternary faults and tolds in Alaska—A digital database: Alaska Division of Geophysical and Geophysical Surveys Miscellaneous Publication 141, 31 p, 1 sheet, scale 1:3,700,000. doi:10.14509/23944.

#AK154 Lanphere, M.A., 1978, Displacement history of the Denali fault system, Alaska and Canada: Canadian Journal of

Earth Science, v. 15, p. 817–822.

#7738 Lowey, 1998, Lowey, G. W., A new estimate of the amount of displacement on the Denali fault system based on the occurrence of carbonate megaboulders in the Dezadeash Formation (Jura-Cretaceous), Yukon, and the Nutzotin Mountains sequence (Jura-Cretaceous), Alaska, Bull. Can. Petroleum Geol., 46, 379–386, 1998.

#AK504 Nokleberg, W.J., Aleinikoff, J.N., Lange, I.M., Silva, S.R., Miyaoka, R.T., Schwab, C.E., and Zehner, R.E., 1992, Preliminary geologic map of the Mount Hayes Quadrangle, eastern Alaska Range, Alaska: U.S. Geological Survey Open File Report 92-594, 1 sheet, 1:250,000 scale.

#AK327 Plafker, G., Gilpin, L.M., and Lahr, J.C., 1994, Neotectonic map of Alaska, *in* Plafker, G., and Berg, H.C., eds., Geology of Alaska, Geology of North America, *in* Decade of North American Geology: Boulder, Geological Society of America, v. G-1, plate 12, 1 sheet, 1:2,500,000 scale.

#AK53 Plafker, G., Hudson, T., and Richter, D.H., 1977, Preliminary observations on late Cenozoic displacements along the Totschunda and Denali fault system, *in* Blean, K.M., ed., The United States Geological Survey in Alaska: Accomplishments during 1976: Geological Survey Circular 751-B, p. B67-B69.

#AK182 Reed, B.L., and Lanphere, M.A., 1974, Offset plutons and history of movement along the McKinley segment of the Denali fault system, Alaska: Geological Society of America Bulletin, v. 85, p. 1883-1892.

#AK108 Reed, B.L., and Nelson, S.W., 1977, Geologic map of the Talkeetna Quadrangle, Alaska: U.S. Geologic Survey Miscellaneous Field Studies Map MF-870-A, 1 sheet, 1:250,000 scale.

#AK109 Reed, B.L., and Nelson, S.W., 1980, Geologic map of the Talkeetna Quadrangle, Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map I-1174, 15 p., 1 sheet, 1:250,000 scale.

#AK856 Reed, J.C., Jr., 1961, Geology of the Mount McKinley Quadrangle, Alaska: U.S. Geological Survey Bulletin 1108-A, 36

p., 1 sheet, 1:250,000 scale.

#AK501 Richter, D.H., and Jones, D.L., 1973, Reconnaissance geologic map of the Nabesna A-2 Quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations I-749, 1 sheet, 1:63,360 scale.

#AK807 St. Amand, P., 1957, Geological and geophysical synthesis of the tectonics of portions of British Columbia, the Yukon Territory, and Alaska: Geological Society of America Bulletin, v. 68, no. 10, p. 1343-1370.

#7746 Wahrhaftig, C., 1994, Maps of physiographic divisions of Alaska, *in* Plafker, G., and Berg, H.C., eds., The geology of Alaska: Boulder, Colorado, Geological Society of America, The Geology of North America, v. G-1, plate 2, scale 1: 2 500 000.

#AK301 Wahrhaftig, C., Turner, D.L., Weber, F.R., and Smith, T.E., 1975, Nature and timing of movement on Hines Creek strand of Denali fault system, Alaska: Geology, v. 3, no. 8, p. 463-466.