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Bartlett Springs fault system, Elk Creek section (Class A) No. 29c

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Synopsis	**General:** The Bartlett Springs fault system is a major northwest-trending zone comprised of discontinuous, steeply dipping dextral strike-slip faults associated with the San Andreas fault system. The Bartlett Springs fault system can be mapped for at least 120 km from the southern side of Round Valley southeast to near Clear Lake. North of Round Valley, Herd (1978) suggested that the Lake Mountain fault may by the northern continuation of the Bartlett Springs fault system, indicating a total length of about 165 km. Lienkaemper (2010) mapped Holocene active traces of the Bartlett Springs fault system that extend for approximately

175 km. Traces of the Bartlett Springs fault system locally are delineated by geomorphic evidence of latest Pleistocene and Holocene strike-slip displacement, especially in the vicinity of Lake Pillsbury (dePolo and Ohlin, 1984; Taylor and Swan, 1986; Swan and Taylor, 1991; Bryant, 1993). The Lake Pillsbury area also is characterized by a somewhat broad, linear zone of microseismicity with focal-plane solutions that are predominantly dextral strike-slip (Dehlinger and Bolt, 1984; Castillo and Ellsworth, 1993). Taylor and Swan (1986) excavated and logged trenches across traces of the Bartlett Springs fault zone in the Lake Pillsbury area. Here they documented evidence of Holocene displacement. Taylor and Swan (1986) reported that stratigraphic relations exposed in one of their trenches can be interpreted to represent at least 3 faulting events. Taylor and Swan (1986) reported that the most recent fault rupture event occurred from 300 to 1000 yrs ago, based on their observation that the fault affects the modern soil. Swan and Taylor (1991) reported a Holocene slip rate of 1 to 2 mm/yr for the fault zone near Lake Pillsbury. Lisowski and Prescott (1989) reported a creep rate of 8 mm/yr for the 1985–1989 period near Round Valley. This 8 mm/yr creep rate at Round Valley was neither well-constrained nor supported by additional measurements (Lienkaemper, 2010). GPS measurements near Covelo (in Round Valley, but not on the original Lisowski and Prescott array site) indicate a creep rate of 0.4±1.49 mm/yr near Covelo in the Round Valley region (McFarland and others 2016). Lienkaemper (2010) reported that fault creep occurs across six GPS or alinement arrays established in 2005 across traces of the Bartlett Springs fault system. Two array sites have recorded creep rates measured for the period 2005–2015 (Lake Pillsbury array 3.21±0.12 mm/yr) and 2007–2015 (Huntington Creek array 2.22±0.55 mm/yr) (Lienkaemper, 2010; McFarland and others, 2016) across the Bartlett Springs fault zone.

Sections: This fault has 4 sections. dePolo and Ohlin (1984) designated four segments for the fault system: from north to south, they are the Elk Creek fault (after CDWR, 1969), the Hot Springs shear zone (after Etter, 1979), the Chalk Mountain segment, and the Wilson fault [35] (after Lawton, 1956). Taylor and Swan (1986) divided the Bartlett Springs fault system into 6 segments from the area east of Clear Lake (north of the Wilson fault [35]) north to Round Valley, based on differences in geomorphic expression of the fault zone. These segments, from north to south include the Elk Creek, Coyote Rocks, McLeod

	Ridge, Twin Valley, Reister Rock, and Chalk Mountain. Lienkaemper (2010) identified two ≥ 2.5 km stepovers along the Bartlett Springs fault system: an extensional stepover near the southern end of the Bartlett Springs fault near Wilson Valley and a compressional stepover where Salmon Creek drains into the Middle Fork of the Eel River. An extensional step at Lake Pillsbury is about 2 km wide. The majority of mapping along the Bartlett Springs fault system is detailed reconnaissance in nature and very little data exists to characterize paleoseismic behavior and delineate paleoseismic segments. For this compilation, the Bartlett Springs fault system has been grouped into four principal sections and include, from north to south, the Lake Mountain section [29a] (after Herd, 1978), the Round Valley section [29b], the Elk Creek section [29c], and the Bartlett Springs section [29d].
Name comments	**General:** The Bartlett Springs fault system is comprised of discontinuous northwest-trending, steeply dipping faults that form a zone at least 1.5 km and possibly greater than 3 km wide. The Bartlett Springs fault system, as considered in this compilation, consists of the Lake Mountain fault zone, Round Valley fault zone, Etsel Ridge fault, Updegraff Ridge fault, and Bartlett Springs fault zone. The Bartlett Springs fault zone was first recognized by Clark (1930) as an essentially continuous zone of faulting, but was not named by him. Irwin (1960) first mapped a northwest-striking fault zone south of Lake Pillsbury, but did not name the fault. Maxwell (1974) and Etter (1979) mapped a zone of faults between Lake Pillsbury and Round Valley. Etter (1979) referred to this zone as the Hot Springs shear zone. Bolt and Oakeshott (1982) first used the name Bartlett Springs thrust fault for a structure that is associated with the unnamed fault of Irwin (1960) and the Hot Springs shear zone of Etter (1979). McLaughlin and Nilsen (1982) first used the name Bartlett Springs fault zone for the northwest-trending zone of discontinuous faults extending from the Wilson fault [35] of Lawton (1956) northwest to Herd's (1978) Lake Mountain fault zone. The Lake Mountain fault zone was first mapped and named by Herd (1978). Traces of the Round Valley fault zone were first mapped by CDWR (1966). Jayko and others (1989) mapped a northwest-trending zone of faults along the western side of Round Valley and was first to name the Round Valley fault zone. The Etsel Ridge fault was mapped and named by Jayko and others (1989). Bryant (1993) proposed the name Updegraff Ridge fault for the zone of northwest striking faults on the eastern side of Updegraff Ridge.

	Section: Elk Creek section incorporates the northern part of the Bartlett Springs fault zone and includes most of the Elk Creek and the very northern part of the Coyote Rocks segments delineated by Taylor and Swan (1986). Section extends from a right-releasing bend in the vicinity of the confluence of the Eel River and Elk Creek southeast to the Lake Pillsbury area, delineated by a right releasing step-over. **Fault ID:** Refers to numbers 78 (Lake Mountain fault zone), 90 (Round Valley fault zone), 91 (Etsel Ridge fault), and 92 (Bartlett Springs fault zone) of Jennings (1994) and Jennings and Bryant (2010), and numbers C6 (Bartlett Springs fault), C7 (Round Valley fault), and C8 (Lake Mountain fault) of WGNCEP (1996).
County(s) and State(s)	MENDOCINO COUNTY, CALIFORNIA LAKE COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Location of principal active traces of the Bartlett Springs fault zone are based on air photo interpretation of 1:12,000 scale aerial photographs by Lienkaemper (2010). Additional mapping by Bryant (1993) is at 1:24,000 scale; mapping by Taylor and Swan (1986) is at 1:62,500; and dePolo and Ohlin (1984) and Jayko and others (1989) is at 1:100,000 scale.
Geologic setting	The Bartlett Springs fault system is a major northwest-trending zone of steeply dipping, discontinuous Quaternary-active faults in the north-central Coast Ranges. This fault system has been reported to be from 1.5 km wide (McLaughlin and others, 1990; dePolo and Ohlin, 1984) to more than 3 km wide (Etter, 1979). Taylor and Swan (1986) interpreted the Bartlett Springs fault system to be an immature zone of dextral shear related to evolution of the San Andreas fault system. Herd (1978) inferred that a system of principally dextral strike-slip faults east of the San Andreas fault zone [1] defined an intracontinental plate boundary east of Cape Mendocino. The Bartlett Springs fault system considered for this compilation extends for about 175 km from the northern end of the Lake Mountain fault zone (Herd,

	1978; Kelsey and Carver, 1988) southeast to east of Clear Lake. The Bartlett Springs fault zone may complexly join with the Hunting Creek-Berryessa fault zone [35] along the Wilson fault [35] of Lawton (1956). The Bartlett Springs fault system has been variously described as a thrust fault related to the Coast Range thrust (Bolt and Oakeshott, 1982), a dextral-normal oblique fault (McLaughlin and others, 1990), and as a predominantly dextral strike-slip fault (dePolo and Ohlin, 1984; Dehlinger and Bolt, 1984; Clark, 1983; Taylor and Swan, 1986). The Bartlett Springs fault system occupies a topographic low nearly coincident with a narrow belt of Franciscan mélange and ultramafic rocks (dePolo and Ohlin, 1984). Cumulative dextral slip is not known, but the juxtaposition of different rock units of the Franciscan Complex suggests a significant strike-slip component. McLaughlin and others (1990) speculated that perhaps tens of kilometers of dextral strike-slip displacement has occurred on the fault system. Maximum vertical offset could be more than 1.5 km (southwest side down) east of Clear Lake, based on estimates of the total thickness of the Pliocene-Pleistocene Cache Formation (McLaughlin and others, 1990).
Length (km)	This section is 80 km of a total fault length of 160 km.
Average strike	N23°W (for section) versus N23°W (for whole fault)
Sense of movement	Right lateral, Normal *Comments:* Geomorphic evidence indicates dextral strike-slip displacement (Lienkaemper, 2010; Bryant, 1993). Dextral fault creep has been documented in the Gravelly Valley area since 2005. Dextral normal offset is indicated by the tectonic pull-apart basin now occupied by Lake Pillsbury (Taylor and Swan, 1986).
Dip Direction	V *Comments:* Focal mechanisms indicate steeply dipping to near vertical fault zone (Dehlinger and Bolt, 1984 #5230). Direction is variable but principally vertical to west dipping.
Paleoseismology studies	There is one detailed study along this section of the Bartlett Springs fault zone (site 29-1) by Taylor and Swan (1986). This study for the Scott Valley Dam involved the excavation of 5 trenches and the logging of 2 stream cut exposures in the northern Lake Pillsbury area. Faulted Holocene alluvium and colluvium

	were observed in these exposures.
Geomorphic expression	Geomorphology of this section of the Bartlett Springs fault zone is best expressed in the Lake Pillsbury area. Here the fault zone is delineated by geomorphic evidence of latest Pleistocene and Holocene strike-slip displacement (Bryant, 1993; Lienkaemper, 2010). Geomorphic features delineating the Bartlett Springs fault zone in the Gravelly Valley area just north of Lake Pillsbury include well-defined linear scarps and vegetation contrasts on Holocene alluvium, closed depressions, linear troughs and sidehill troughs, linear ridges and truncated ridges, and dextrally deflected drainages (dePolo and Ohlin, 1984; Taylor and Swan, 1986; Bryant, 1993). Lake Pillsbury is a pull apart basin, and a well-defined west-facing scarp on the east side of Gravelly Valley is indicative of normal-dextral slip (Sunset Point lineament of Taylor and Swan, 1986). Both north and south of the Lake Pillsbury area, traces of the Bartlett Springs fault zone are discontinuous and locally concealed by massive landslide deposits Bryant (1993).
Age of faulted surficial deposits	Taylor and Swan (1986) reported that the Bartlett Springs fault zone in the Lake Pillsbury area offsets latest Pleistocene stream terrace deposits, Holocene alluvium and colluvium, and modern soil.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Timing of most recent paleoevent is not known. Swan and Taylor (1991) reported that at least two surface faulting events have occurred along one trace in the past 3800 C14 yrs BP. Taylor and Swan (1986) reported that stratigraphic relations exposed in their trench T-3 (site 29-1) represent at least three faulting events. Taylor and Swan (1986) reported that the most recent fault rupture event occurred between 300 and 1000 yr ago, based on their observation that the fault extends into the modern soil. Strands of the Elk Creek section exhibit fault creep in the Gravelly Valley area (Lake Pillsbury array BSLP 3.21±0.12 mm/yr; McFarland and others, 2016).
Recurrence interval	

Slip-rate category	Between 1.0 and 5.0 mm/yr *Comments:* Taylor and Swan (1986) inferred a minimum Holocene slip rate of between 1 and 2 mm/yr for their Coyote Rocks segment of the Bartlett Springs fault zone. A subhorizontal depositional contact has been vertically displaced about 2–3 m. Using this apparent vertical separation and the 15° plunge of slickensides observed along the fault plane, they calculated 7–11 m of dextral component. Thus, a slip rate of between 1 and 2 mm/yr is indicated, based on the 3,800 yrs B.P. (maximum) radiocarbon age of the oldest exposed/faulted alluvium.
Date and Compiler(s)	2017 William A. Bryant, California Geological Survey
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