

Table II -- Summary of calendar and carbon-14 ages from Newberry Volcano area. **

Dated Feature	Carbon- 14 age ¹ (14C yr B.P.)	Reference	Weighted mean age (14C yr B.P.)	Calibrated age ² (calendar yr B.P.)
<u>BIG OBSIDIAN ERUPTIVE PERIOD</u>				
Big Obsidian Flow	No 14C date ³			
Paulina Lake Ashflow	1,270±60 1,340±60 1,390±200 2,054±230	Pearson and others (1966) Robinson and Trimble (1983) Meyer Rubin, in Peterson and Groh (1969) Libby (1952)	1,310±40 ⁴	1,260±90
Newberry Pumice (pumice-fall deposits)	1,720±250 1,550±120	Spiker and others (1978) Robinson and Trimble (1983)	1,580±110	1,460±110
<u>EAST LAKE ERUPTIVE PERIOD</u>				
East Lake Obsidian Flows	No 14C date ⁵			
<u>TERRACE DEPOSITS AT LITTLE CRATER CAMPGROUND</u>				
Terrace Deposits	4,300±100	Robinson and Trimble (1983)	4,300±100	4,860±200
<u>NORTHWEST RIFT ERUPTIVE PERIOD</u>				
Lava Butte Flow	6,160±70	Chitwood and others (1977), Robinson and Trimble (1981)	6,160±70	7,020±140
Gas-Line Flows	5,800±150 6,150±65	Chitwood and others (1977); Robinson and Trimble (1981) Robinson (1977); Chitwood and others (1977)	6,100±60	6,940±80
North Sugarpine Flow	5,870±60	Robinson and Trimble (1981)	5,870±60	6,720±80
Forest Road Flow	5,960±100	Peterson and Groh (1969)	5,960±100	6,810±130
Lava Cast Forest Flow	6,150±210 6,380±130	Peterson and Groh (1969) Peterson and Groh (1969)	6,320±110	7,210±150
Lava Cascade Flow	5,800±100	Peterson and Groh (1969)	5,800±100	6,640±160
North Summit Flow	6,090±60	Peterson and Groh (1969)	6,090±60	6,910±100
Surveyor Flow	5,835±195 6,080±100	Swanberg and others (1988) Peterson and Groh (1969)	6,030±90	6,880±120
<u>INTERLAKE ERUPTIVE PERIOD</u>				
Central Pumice Cone	No 14C date ⁶			

Game Hut Obsidian Flow	No 14C date ⁷		
Interlake Obsidian Flow	No 14C date ⁸		
East Lake Tephra	6,220±200 6,500±300 6,550±300	Meyer Rubín and W.E. Scott, unpublished data, 1985. Meyer Rubín, in Linneman (1990) Meyer Rubín, in Linneman (1990)	6,400±130 7,270±120
<u>CLIMATIC ERUPTION OF MT. MAZAMA</u>			
Mazama Ash	6,845±50 ⁹	Bacon (1983)	7,630±50
<u>NEWBERRY CRATER ARCHAEOLOGY</u>			
Oldest domestic structure	8,460±110 8,540±90 8,670±110 9,920±470	Connolly (1999) Connolly (1999) Connolly (1999) Connolly (1999)	9,530±40 11,010±1300
Earliest dated human occupation			
<u>EAST RIM ERUPTIVE PERIOD</u>			
East Rim Fissure	10,000±500	Meyer Rubín, in Linneman (1990)	11,160±1200
<u>FORT ROCK CAVE ARCHAEOLOGY</u>			
Earliest dated human occupation	13,200±720	Bedwell (1973)	15,740±1100

** Modified from MacLeod and others (1995).

¹ Carbon-14 ages based on Libby half-life of 5,568 yrs. Years before present (yr B.P.) measured from 1950 A.D.

² Generalized from program in Stuiver and Reimer (1993) that computes intercepts and range (one confidence interval). Radiocarbon age curve not linear and may have multiple possible calendar ages (intercepts) for a given carbon-14 age. Calibrated age as reported here is midpoint between oldest and youngest intercepts rounded to nearest ten years; reported error is range (one confidence interval as calculated by the program).

³ Hydration-rind age of 1,400 calendar years in Friedman (1977) is too old based on stratigraphic position. Big Obsidian Flow overlies Paulina Lake Ashflow which has a calibrated age of 1,260 calendar years.

⁴ Weighted mean age does not include Libby's (1952) determination of 2,054 yr B.P.

⁵ Hydration-rind age of 3,500 calendar years in Friedman (1977).

⁶ Hydration-rind age of 4,500 calendar years in Friedman (1977) is too young based on stratigraphic position. Central Pumice Cone deposits lie between East Lake Tephra and North Summit Flow which have calibrated ages of 7,270 and 6,910 calendar years respectively.

⁷ Hydration-rind age of 6,700 calendar years in Friedman (1977) is too young based on stratigraphic position. Flow is younger than Central Pumice Cone. Central Pumice Cone deposits lie between East Lake Tephra and North Summit Flow which have calibrated ages of 7,270 and 6,910 calendar years respectively.

⁸ Hydration-rind age of 6,700 calendar years in Friedman (1977) is too young based on stratigraphic position. Flow is younger than Central Pumice Cone. Central Pumice Cone deposits lie between East Lake Tephra and North Summit Flow which have calibrated ages of 7,270 and 6,910 calendar years respectively.

⁹ Weighted mean age of four charcoal samples (Bacon, 1983): 6,780±100; 6,830±110; 6,880±70; 6,840±100.

¹⁰ Weighted mean age of three charcoal samples from burnt house posts (Connolly (1999)).

Table III—Summary of ages of volcanic rocks from Newberry Volcano area (as used in this book).

Calendar years before 1950	Feature	General Area	Comments	Radiometric Date	Reference
1,250	Big Obsidian Flow	Newberry	Newberry Caldera	Estimate	
1,250	Paulina Lake Ashflow	Newberry	Newberry Caldera	1,310±40 yrs	See Table II
1,250	Newberry Pumice	Newberry	Newberry Caldera	1,580±110 yrs	See Table II
3,500	East Lake Obsidian Flows	Newberry	Newberry Caldera	Hydration-rind	See Table II
4,900	Little Crater C.G. terrace sediments	Newberry	Newberry Caldera	4,300±100 yrs	See Table II
7,000	Lava Butte Vents and Flows	Newberry	NW Rift Zone	6,160±70 yrs	See Table II
7,000	Gas-Line Vents and Flows	Newberry	NW Rift Zone	6,100±60 yrs	See Table II
7,000	Mokst Butte Vents and Flows	Newberry	NW Rift Zone	Estimate	
7,000	South Kelsey Vents and Flows	Newberry	NW Rift Zone	Estimate	
7,000	North Sugarpine Vents and Flows	Newberry	NW Rift Zone	5,870±60 yrs	See Table II
7,000	South Sugarpine Vents and Flows	Newberry	NW Rift Zone	Estimate	
7,000	Forest Road Vents and Flows	Newberry	NW Rift Zone	5,960±100 yrs	See Table II
7,000	Lava Cast Forest Vents and Flows	Newberry	NW Rift Zone	6,320±110 yrs	See Table II
7,000	Lava Cascade Vents and Flows	Newberry	NW Rift Zone	5,800±100 yrs	See Table II
7,000	Hidden Vents and Flows	Newberry	NW Rift Zone	Estimate	
7,000	North Summit Vents and Flows	Newberry	NW Rift Zone	6,090±60 yrs	See Table II
7,000	Surveyor Vents and Flows	Newberry	NW Rift Zone	6,030±90 yrs	See Table II
7,100	Interlake Obsidian Flow	Newberry	South Flank	Estimate	
7,200	Central Pumice Cone & Game Hut Flow	Newberry	Newberry Caldera	Estimate	
7,200	Warm Springs Pumice Cone	Newberry	Newberry Caldera	Estimate	
7,300	East Lake Tephra	Newberry	Newberry Caldera	Estimate	
7,600	Eruption of Mt. Mazama	Newberry	Newberry Caldera	6,400±130 yrs	See Table II
10,000	- - -Holocene-Pleistocene Boundary	Crater Lake	Mazama Ash	6,845±50 yrs	See Table II
11,200	North Kawak Butte	Newberry	North Flank	Estimate	
11,200	Pipil Butte	Newberry	North Flank	Estimate	
11,200	East Rim Fissure	Newberry	East Rim	10,000±500 yrs	See Table II
11,200	The Dome	Newberry	Southeast Flank	Estimate	
11,200	Devils Horn	Newberry	South Flank	Estimate	
12,000	South Obsidian Flow	Newberry	In Newberry Caldera	Estimate	
13,500	Canyon Creek Glacial Advance	Cascades	11,000 to 12,500 14C yr B.P.	Estimate	
15,000	Lava Pass Flows	Newberry	East Flank	Estimate	
15,000	Eastside Flow	Newberry	East Flank	Estimate	
20,000	Devils Garden Flows	Fort Rock Basin	High Lava Plains	Estimate	
24,000	Suttle Lake Glacial Advance	Cascades	18,000 to 22,000 14C yr B.P.	Estimate	
39,000	Klawhop Butte and flow	Newberry	North Flank	Estimate	
50,000	Potholes Flow	Newberry	High Lava Plains	0.039±0.006 m.y.	Scott and Gardner, 1992
100,000	Eruption of Fort Rock Basin Maars	Fort Rock Basin	High Lava Plains	Estimate	
188,000	Pilot Butte and Flow	Bend	Bend	Estimate	
200,000	Paulina Lake domes	Newberry	West Flank	0.188±0.042 m.y. ¹	Donnelly-Nolan and others, 2000
225,000	Black Lapilli Tuff (caldera collapse)	Newberry	West Flank	Estimate ²	MacLeod and others, 1995
250,000	Paulina Peak domes	Newberry	West Flank	Estimate ³	MacLeod and others, 1995
250,000	Badlands Volcano	Newberry	West Flank	Estimate ⁴	MacLeod and others, 1995
260,000	Shevlin Park Tuff	Bend	High Lava Plains	Estimate	
			From High Cascades	0.26±0.015 m.y.	Lanphere and others, 1999

284,000	Kelsey Butte and flow	Newberry	North Flank	0.284±0.011 m.y. ⁵	Donnelly-Nolan and others, 2000
350,000	Lava Pass tephra	Newberry	Southeast Flank	0.350±0.015 m.y.	Kuehn, 2000 ⁶
380,000	Bend Pumice/Tumalo Tuff	Bend	From High Cascades	Stratigraphy	Hill and Taylor, 1990
400,000	West Flank Dome	Newberry	West Flank	0.40±0.15 m.y.	Fiebelkorn and others, 1983
410,000	Southwest Flank Dome	Newberry	Southwest Flank	0.41±0.08 m.y.	Fiebelkorn and others, 1983
500,000	Tepae Draw Tuff - (first caldera collapse)	Newberry	East Flank	0.50±0.25 m.y.	Fiebelkorn and others, 1983
600,000	McKay Butte domes	Newberry	West Flank	0.60±0.10 m.y.	McKee and others, 1976
650,000	Desert Springs Tuff	Bend	From High Cascades	Stratigraphy	Hill and Taylor, 1990
<780,000	Youngest Newberry Intracanyon Flow	Deschutes Basin	In Deschutes River Canyon	Paleomag	Smith, 1985
800,000	China Hat	E of Newberry	Dome in High Lava Plains	0.80±0.21 m.y.	McKee and others, 1976
870,000	East Butte	E of Newberry	Dome in High Lava Plains	0.87±0.05 m.y.	McKee and others, 1976
1,100,000	Quartz Mountain Dome	E of Newberry	Dome in High Lava Plains	1.13±0.05 m.y.	Fiebelkorn and others, 1983
1,200,000	Oldest Newberry Intracanyon Flow	Deschutes Basin	In Crooked River Canyon	1.2±0.1 m.y.	Smith, 1985
1,600,000	--- Pleistocene-Pliocene Boundary				
1,800,000	Benham Buttes Dome	NW of Newberry	Dome related to Cascades	1.8±0.8 m.y.	Fiebelkorn and others, 1983
2,400,000	Long Butte Dome	Fort Rock Basin	Dome in High Lava Plains	2.36±0.33 m.y.	Fiebelkorn and others, 1983
2,700,000	Wrights Point Basalt Membær	Harney Basin	Basalt in High Lava Plains	2.7 m.y. ⁷	Fiebelkorn and others, 1983
3,400,000	Upper Dry Creek ash-flow tuff	Fort Rock Basin	From caldera near Bald Mtn.	3.44±0.45 m.y.	Fiebelkorn and others, 1983
3,700,000	Squaw Ridge Dome	Fort Rock Basin	Dome in High Lava Plains	3.69±0.10 m.y.	Fiebelkorn and others, 1983
4,000,000	Frederick Butte Dome	Hampton	Dome in High Lava Plains	4.0±0.4 m.y.	Fiebelkorn and others, 1983
4,400,000	Cougar Mountain Dome	Fort Rock Basin	Dome in High Lava Plains	4.42±0.35 m.y.	Fiebelkorn and others, 1983
4,600,000	Peyari Ash-flow Tuff	Fort Rock Basin	From caldera near Bald Mtn.	4.65 m.y. ⁸	Fiebelkorn and others, 1983
4,800,000	Yamsey Mountain Area—dome	Yamsey Mtn.	In caldera near Yamsey Mtn.	4.79±0.17 m.y.	Fiebelkorn and others, 1983
4,800,000	Bald Mountain	Bald Mtn Area	In caldera near Bald Mtn.	4.8 m.y. ⁹	MacLeod and others, 1976
5,000,000	Glass Buttes	Glass Buttes	Dome in High Lava Plains	5.04±0.75 m.y.	Fiebelkorn and others, 1983
5,300,000	Squaw Butte Dome	Harney Basin	Dome in High Lava Plains	5.27±0.08 m.y.	Fiebelkorn and others, 1983
5,300,000	--- Pliocene-Miocene Boundary				
6,350,000	Conley Hills Dome	Fort Rock Basin	Dome in High Lava Plains	6.35±0.65 m.y.	Fiebelkorn and others, 1983
6,600,000	Rattlesnake Ash-Flow Tuff	Harney Basin	From caldera near Burns	6.6 m.y. ¹⁰	Fiebelkorn and others, 1983
6,700,000	Basalt—ridge N. of M.P. 32 Hwy. 20	Millican	Basalt in High Lava Plains	6.7±2.0 m.y.	Fiebelkorn and others, 1983
7,600,000	Horse Ridge Basalts	Horse Ridge	Basalt in High Lava Plains	7.61±0.08 m.y.	Fiebelkorn and others, 1983
8,800,000	Prater Creek Ash-Flow Tuff	Harney Basin	From caldera near Burns	8.75 m.y. ¹¹	Fiebelkorn and others, 1983
9,500,000	Devine Canyon Ash-Flow Tuff	Harney Basin	From caldera near Burns	9.5 m.y. ¹²	Fiebelkorn and others, 1983
22,000,000	Pine Mountain	E of Newberry	Kipuka of older rocks	22.0±4.0 m.y.	Fiebelkorn and others, 1983

¹ Two dates; ⁴⁰Ar/³⁹Ar age of 39±6 ka and K-Ar age of 24±14 ka

² Younger than last caldera collapse. Two dates by Fiebelkorn and others (1983): 0.56±0.40 m.y. and 0.58±0.40 m.y.

³ Younger than Southwest Flank dome, older than Paulina Lake domes.

⁴ Older than at least last caldera collapse. Two dates, unpublished data by E.H. McKee and N.S. MacLeod (1981): 0.58±0.40 m.y. and 0.24±0.07 m.y.

⁵ ⁴⁰Ar/³⁹Ar plateau age.

⁶ ⁴⁰Ar/³⁹Ar plateau age. Personal communication with M. Lanphere of U.S.G.S.

⁷ Average of three dates: ranging from 2.44±0.07 m.y. to 2.9±0.2 m.y.

⁸ Average of two dates: 4.7±2.0 m.y. and 4.65±0.1 m.y.

⁹ Average of three dates: ranging from 4.4±0.2 m.y. to 5.1±0.5 m.y.

¹⁰ Average of five dates: ranging from 5.54±0.21 m.y. to 7.2±1.0 m.y.

¹¹ Average of two dates: 8.4±0.12 m.y. and 9.1±0.2 m.y.

¹² Average of six dates: ranging from 8.9 m.y. to 10.3±0.3 m.y.