Supplementary Materials

Geochemical Results for Individual Analyses of Tephra Samples

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| **Supplementary Table 1.**  **DCA-DH-024-132.3 (from borehole B04)**  Sample DCA-DH-024-132.3 (bulk sample Munsell colors: yellowish gray (5Y 7/2) to light olive gray (5Y 5/2)) contains two geochemical populations of glass shards (see Supplementary Table 1). Compared to near basal sample DCA-DH-024-143.0, the residue from the DCA-DH-024-132.3 contains a lower percentage (~56%) of colorless to light brown shards. Furthermore, the glass separate in this sample is composed of lower density, lightly to heavily coated (iron oxide, carbonate, and clay), finely ribbed and webby/frothy pumiceous shards containing equant to irregular bubble-type vesicles. Bubble-wall/bubble wall junction shards, platy, and coarsely ribbed shards are less common. The remainder of the processed residue consists of ~34% devitrified grains, and ~10% euhedral to subhedral, occasionally glass-coated minerals, including hypersthene, biotite, plagioclase, quartz, hornblende, magnetite, and microphenocrystic apatite.  **Identification**:  **Pop 1: outliers;** minor mode with two dissimilar, unidentifiable grains.  **Pop 2: Rockland ash bed**; with alkalis, the major mode (12 shards) most closely correlates with DCA-DH-024-143.0, which is a tephra sample from lower in the core, now shown to be the base of same unit. With and without alkalis, there are multiple good correlations to key Rockland ash bed deposits from throughout the western U.S. and average Rockland compositions (see Table 3). | | | | | | | | | | |
| **No.** | **SiO2** | **Al2O3** | **FeO** | **MgO** | **MnO** | **CaO** | **TiO2** | **Na2O** | **K2O** | **Total** |
| **Pop. 1 - outliers** | | | | | | | | | | |
| 173 | 74.4458 | 12.2765 | 0.8986 | 0.3258 | 0.0965 | 0.3249 | 0.2515 | 2.8460 | 1.0167 | 92.4823 |
| 177 | 74.2007 | 12.1589 | 0.7273 | 0.1730 | 0.0146 | 0.4713 | 0.1507 | 2.7607 | 1.6373 | 92.2945 |
| **Mean** | **74.3233** | **12.2177** | **0.8130** | **0.2494** | **0.0556** | **0.3981** | **0.2011** | **2.8034** | **1.3270** | **92.3884** |
| **Pop. 2** | | | | | | | | | | |
| 181 | 74.5546 | 12.4662 | 0.8467 | 0.1569 | 0.0419 | 0.7801 | 0.1593 | 2.7477 | 3.3681 | 95.1216 |
| 185 | 74.1343 | 12.2526 | 0.6829 | 0.1437 | 0.0600 | 0.7999 | 0.1839 | 2.7889 | 3.2860 | 94.3323 |
| 183 | 74.0292 | 12.1428 | 0.8510 | 0.1730 | 0.0460 | 0.8080 | 0.2065 | 2.7223 | 3.2650 | 94.2438 |
| 186 | 74.1998 | 12.3062 | 0.7107 | 0.1545 | 0.0516 | 0.8105 | 0.1853 | 2.9732 | 3.2685 | 94.6604 |
| 187 | 74.1281 | 12.3042 | 0.8849 | 0.1390 | 0.0437 | 0.8198 | 0.1528 | 2.8885 | 3.2344 | 94.5955 |
| 182 | 73.9676 | 12.3112 | 0.8451 | 0.1490 | 0.0673 | 0.8292 | 0.1336 | 2.7258 | 3.1350 | 94.1639 |
| 188 | 74.5213 | 12.1890 | 0.7432 | 0.1421 | 0.0269 | 0.8328 | 0.1610 | 2.8787 | 3.2479 | 94.743 |
| 189 | 74.2514 | 12.1896 | 0.7580 | 0.1446 | 0.0494 | 0.8480 | 0.1205 | 2.7623 | 3.1342 | 94.2581 |
| 184 | 74.4262 | 12.3183 | 0.8051 | 0.1773 | 0.0045 | 0.8644 | 0.1798 | 2.8809 | 3.3193 | 94.9759 |
| 190 | 75.2527 | 12.4969 | 0.7941 | 0.1657 | 0.0606 | 0.8741 | 0.1125 | 2.9613 | 3.6458 | 96.3638 |
| 179 | 75.0915 | 12.2931 | 0.6206 | 0.1804 | 0.0314 | 0.8809 | 0.1388 | 2.7394 | 3.7495 | 95.7256 |
| 180 | 74.0180 | 12.3258 | 0.6945 | 0.1801 | 0.0438 | 0.9919 | 0.1631 | 2.8584 | 3.3724 | 94.648 |
| **Mean** | **74.3812** | **12.2997** | **0.7697** | **0.1589** | **0.0439** | **0.8450** | **0.1581** | **2.8273** | **3.3355** | **94.8193** |

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| **Supplementary Table 2.**  **DCA-DH-024-143.0 (from borehole B04)**  Sample DCA-DH-024-143.0 (bulk sample Munsell color: yellowish gray (5Y 8/1)) contains ~82% moderately coated, (clay and iron oxide) predominantly colorless (rarely light brown), platy or blocky glass shards occasionally with bubble wall/bubble wall junctions or fine, straight ribs, and equant to irregular bubble-type or elongate tubular vesicles. Some microlitic shards were also observed along with a small subpopulation of highly frothy pumiceous shards. Remaining sample constituents include comagmatic plagioclase feldspar, quartz, devitrified grains, hypersthene, hornblende, magnetite, biotite, and microphenocrysts of apatite.  **Identification**:  **Rockland ash bed**; with alkalis, the best correlation is to DCA-DH-024-132.3, from the uppermost interval of the same, thick tephra deposit. With and without alkalis, there are multiple good correlations to key Rockland ash bed deposits from throughout the western U.S. and average Rockland compositions (see Table 3). | | | | | | | | | | |
| **No.** | **SiO2** | **Al2O3** | **FeO** | **MgO** | **MnO** | **CaO** | **TiO2** | **Na2O** | **K2O** | **Total** |
| 191 | 74.0155 | 12.2600 | 0.8881 | 0.1816 | 0.0343 | 0.8273 | 0.0974 | 2.9928 | 3.3497 | 94.6468 |
| 192 | 74.4434 | 12.3781 | 0.7676 | 0.1716 | 0.0456 | 0.8565 | 0.0873 | 2.8697 | 3.3401 | 94.9600 |
| 193 | 73.8324 | 12.2243 | 0.6699 | 0.1895 | 0.0000 | 0.8500 | 0.0833 | 2.7390 | 3.4353 | 94.0238 |
| 195 | 74.0541 | 12.4733 | 0.7684 | 0.1601 | 0.0298 | 0.8829 | 0.1748 | 2.8567 | 3.3539 | 94.7541 |
| 196 | 73.6256 | 12.2796 | 0.7254 | 0.1855 | 0.0434 | 0.8329 | 0.1769 | 2.7634 | 3.3561 | 93.9889 |
| 197 | 74.4528 | 12.3928 | 0.7758 | 0.1772 | 0.0208 | 0.8311 | 0.1769 | 2.9390 | 3.4101 | 95.1766 |
| 198 | 71.6961 | 11.8729 | 0.7195 | 0.2121 | 0.0175 | 0.8083 | 0.1586 | 2.6650 | 3.4152 | 91.5653 |
| 199 | 73.5454 | 12.1353 | 0.7166 | 0.1620 | 0.0253 | 0.8439 | 0.1749 | 2.7386 | 3.2219 | 93.5640 |
| 200 | 73.7826 | 12.1227 | 0.7137 | 0.1593 | 0.0253 | 0.9198 | 0.1769 | 2.6856 | 3.0107 | 93.5967 |
| 201 | 73.7665 | 12.2152 | 0.6869 | 0.1581 | 0.0513 | 0.8076 | 0.1576 | 2.6711 | 3.1879 | 93.7022 |
| 202 | 73.8227 | 12.2423 | 0.7173 | 0.1896 | 0.0400 | 0.9282 | 0.1659 | 2.7232 | 3.1728 | 94.0021 |
| 203 | 73.7703 | 12.2321 | 0.6305 | 0.1686 | 0.0377 | 0.7991 | 0.1515 | 2.8218 | 3.2864 | 93.8981 |
| 204 | 73.8981 | 12.1965 | 0.6632 | 0.1787 | 0.0636 | 0.8642 | 0.1413 | 2.5276 | 3.2187 | 93.7520 |
| 205 | 73.5657 | 12.1954 | 0.7677 | 0.1962 | 0.0434 | 0.8391 | 0.1842 | 2.7058 | 3.2452 | 93.7428 |
| 206 | 74.2795 | 12.2008 | 0.7292 | 0.1533 | 0.0141 | 0.7887 | 0.1699 | 2.8144 | 3.2212 | 94.3711 |
| 207 | 73.8627 | 12.2195 | 0.7647 | 0.1683 | 0.0355 | 0.8369 | 0.1130 | 2.8070 | 3.3838 | 94.1914 |
| 208 | 74.8654 | 12.2096 | 0.8295 | 0.1779 | 0.0074 | 0.8330 | 0.1634 | 2.7447 | 3.2480 | 95.0790 |
| 209 | 74.1274 | 12.3628 | 0.8184 | 0.1893 | 0.0276 | 0.8248 | 0.1089 | 2.8509 | 3.1442 | 94.4544 |
| 210 | 74.2506 | 12.1443 | 0.8005 | 0.1459 | 0.0175 | 0.8010 | 0.1496 | 3.0675 | 3.3974 | 94.7744 |
| **Mean** | **73.8767** | **12.2293** | **0.7448** | **0.1750** | **0.0305** | **0.8408** | **0.1480** | **2.7886** | **3.2841** | **94.118** |

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| **Supplementary Table 3.**  **DCA-DH-037-174.1 (from borehole B05)**  DCA-DH-037-174.1 (bulk sample Munsell color: olive gray (5Y 3/2) contains ~72% platy or finely ribbed glass shards. Some of the shards display moderately to well-hydrated, tubular, and (or) equant to irregular bubble-type vesicles, and some also have randomly oriented microlites. The sample additionally contains ~21% highly altered and devitrified grains, ~5% feldspars and quartz, ~1% hypersthene, hornblende, and biotite.  **Identification**:  **Loleta ash bed;** with and without alkalis, correlates well with multiple Loleta ash samples from the Pacific margin and NE Pacific Ocean (see Table 3). | | | | | | | | | | |
| **No.** | **SiO2** | **Al2O3** | **FeO** | **MgO** | **MnO** | **CaO** | **TiO2** | **Na2O** | **CaO** | **Total** |
| 211 | 72.2737 | 13.8199 | 1.5218 | 0.1092 | 0.0648 | 0.7362 | 0.1762 | 3.7609 | 0.7362 | 95.4815 |
| 212 | 70.8432 | 13.3401 | 1.6391 | 0.0824 | 0.0721 | 0.7290 | 0.1564 | 3.3289 | 0.7290 | 93.1416 |
| 213 | 71.6293 | 13.5318 | 1.4939 | 0.0968 | 0.0833 | 0.7666 | 0.1361 | 3.4735 | 0.7666 | 94.0864 |
| 214 | 71.0073 | 13.3407 | 1.6598 | 0.0978 | 0.0901 | 0.7673 | 0.1726 | 3.6127 | 0.7673 | 93.6210 |
| 215 | 71.6519 | 13.4771 | 1.6134 | 0.1290 | 0.0444 | 0.8214 | 0.1969 | 3.3248 | 0.8214 | 94.0120 |
| 216 | 71.6284 | 13.6022 | 1.5530 | 0.1111 | 0.0670 | 0.7651 | 0.1706 | 3.5595 | 0.7651 | 94.3901 |
| 217 | 71.2191 | 13.4762 | 1.7038 | 0.1531 | 0.0659 | 0.7528 | 0.1867 | 3.2810 | 0.7528 | 93.6335 |
| 218 | 71.3085 | 13.4934 | 1.6222 | 0.0978 | 0.0545 | 0.7375 | 0.1703 | 3.5643 | 0.7375 | 93.7786 |
| 219 | 71.0662 | 13.3672 | 1.7003 | 0.1373 | 0.0399 | 0.7961 | 0.0932 | 3.5030 | 0.7961 | 93.8274 |
| 220 | 71.0599 | 13.6537 | 1.6944 | 0.1031 | 0.0343 | 0.7486 | 0.1559 | 3.6322 | 0.7486 | 93.8300 |
| 221 | 71.3551 | 13.5898 | 1.5482 | 0.1118 | 0.0792 | 0.7234 | 0.1084 | 3.3571 | 0.7234 | 93.7107 |
| 222 | 70.8494 | 13.3356 | 1.6325 | 0.1430 | 0.0522 | 0.7174 | 0.1204 | 3.0994 | 0.7174 | 92.5722 |
| 223 | 71.6865 | 13.6242 | 1.6469 | 0.1324 | 0.0701 | 0.7524 | 0.1548 | 3.5315 | 0.7524 | 94.5265 |
| 224 | 71.3146 | 13.6041 | 1.5435 | 0.1409 | 0.0926 | 0.7773 | 0.1427 | 3.6243 | 0.7773 | 94.2663 |
| 225 | 71.8096 | 13.5487 | 1.6770 | 0.1303 | 0.0810 | 0.7421 | 0.1011 | 2.9648 | 0.7421 | 93.8405 |
| 226 | 71.6368 | 13.6764 | 1.6511 | 0.1242 | 0.1127 | 0.7499 | 0.1476 | 3.5511 | 0.7499 | 94.6044 |
| 227 | 71.0515 | 13.4132 | 1.3770 | 0.1164 | 0.0667 | 0.7767 | 0.1355 | 3.2032 | 0.7767 | 92.9907 |
| 228 | 71.4130 | 13.5362 | 1.7220 | 0.1065 | 0.0802 | 0.7729 | 0.1011 | 3.4448 | 0.7729 | 94.0484 |
| 229 | 71.4061 | 13.4500 | 1.5509 | 0.1274 | 0.0891 | 0.7475 | 0.1233 | 3.5386 | 0.7475 | 93.9178 |
| 230 | 71.1260 | 13.3404 | 1.4449 | 0.1213 | 0.0679 | 0.7798 | 0.1315 | 3.4209 | 0.7798 | 93.1706 |
| **Mean** | **71.3668** | **13.5110** | **1.5998** | **0.1186** | **0.0704** | **0.7580** | **0.1441** | **3.4388** | **0.7580** | **93.8725** |

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| **Supplementary Table 4.**  **DCE-DH-005-197.3 (from borehole B06)**  The bulk sample had a dry Munsell color of light olive gray (5Y 6/1). Glass shard morphology indicates the presence of ~90% well-hydrated, platy, finely to coarsely ribbed, or bubble wall/bubble wall junction shards that are solid to well-vesiculated with elongate cylindrical or equant to irregular bubble-type vesicles. Approximately 4% of constituents are highly devitrified grains. The remainder of the sample is composed of minor percentages of feldspars, quartz, orthopyroxenes, amphiboles, and biotite.  **Identification:**  **Informally named ash of Wildcat Grade**; the best geochemical correlative is CARL-1(1), an ash from near the base of the Carlotta Formation from the Wildcat Ridge along Mattole Road, about a mile south of Ferndale, California. This sample also correlates well with sample HW692-8, a tuff from the Montezuma Fm. Exposed in the Montezuma Hills west of the Sacramento-San Joaquin Delta (see Table 3). | | | | | | | | | | | |
| **No.** | | **SiO2** | **Al2O3** | **FeO** | **MgO** | **MnO** | **CaO** | **TiO2** | **Na2O** | **K2O** | **Total** |
| 246 | 70.8468 | | 14.4155 | 1.3356 | 0.2810 | 0.1143 | 1.0593 | 0.1828 | 3.5989 | 2.507 | 94.3413 |
| 247 | 70.8892 | | 14.2000 | 1.2928 | 0.2775 | 0.0673 | 1.0734 | 0.2174 | 3.4168 | 2.5405 | 93.9745 |
| 248 | 71.0300 | | 14.1751 | 1.3105 | 0.2137 | 0.0973 | 1.0703 | 0.2276 | 3.1945 | 2.5809 | 93.900 |
| 249 | 70.4769 | | 14.1586 | 1.2750 | 0.2140 | 0.0527 | 1.0602 | 0.2114 | 3.3669 | 2.7538 | 93.570 |
| 250 | 72.1300 | | 14.1605 | 1.3552 | 0.2584 | 0.1044 | 1.1201 | 0.2240 | 2.5242 | 2.5756 | 94.4526 |
| 251 | 70.0566 | | 14.0454 | 1.3548 | 0.2459 | 0.0079 | 1.0433 | 0.2329 | 3.1895 | 2.4638 | 92.640 |
| 252 | 69.3690 | | 14.0218 | 1.3738 | 0.2739 | 0.0326 | 1.0840 | 0.1480 | 2.9857 | 2.6356 | 91.9245 |
| 253 | 70.2293 | | 13.9794 | 1.3621 | 0.2404 | 0.0360 | 1.0262 | 0.1763 | 3.2880 | 2.3000 | 92.6378 |
| 254 | 70.7508 | | 13.9462 | 1.2450 | 0.2487 | 0.0630 | 1.0670 | 0.2090 | 3.1648 | 2.5112 | 93.2058 |
| 255 | 69.4855 | | 14.0012 | 1.3071 | 0.2619 | 0.0461 | 1.0670 | 0.1867 | 3.0994 | 2.5430 | 91.9979 |
| 256 | 70.7045 | | 14.3564 | 1.2951 | 0.2393 | 0.0692 | 0.9764 | 0.2363 | 3.5264 | 2.4282 | 93.8319 |
| 257 | 71.2589 | | 14.1153 | 1.2258 | 0.2019 | 0.0688 | 0.9998 | 0.1693 | 3.4083 | 2.5659 | 94.0141 |
| 258 | 70.5539 | | 14.0542 | 1.4001 | 0.2810 | 0.0805 | 0.9879 | 0.1797 | 3.3633 | 2.6049 | 93.5055 |
| 259 | 70.9752 | | 14.3456 | 1.2786 | 0.2731 | 0.0760 | 1.0320 | 0.2508 | 3.5592 | 2.4852 | 94.2757 |
| 260 | 69.9936 | | 13.9278 | 1.2817 | 0.2492 | 0.1019 | 1.0733 | 0.2000 | 3.2954 | 2.4732 | 92.5962 |
| 261 | 70.1600 | | 14.2006 | 1.3261 | 0.2679 | 0.0833 | 1.0346 | 0.1604 | 3.2998 | 2.4706 | 93.0032 |
| 262 | 70.3175 | | 13.9686 | 1.2968 | 0.2434 | 0.0710 | 1.0341 | 0.2072 | 3.5022 | 2.5102 | 93.151 |
| 263 | 70.6226 | | 14.0505 | 1.3918 | 0.2159 | 0.0845 | 1.0992 | 0.2072 | 3.4437 | 2.6204 | 93.7358 |
| 264 | 70.5211 | | 13.9949 | 1.2968 | 0.2320 | 0.0935 | 0.9411 | 0.2011 | 3.4233 | 2.5859 | 93.290 |
| 265 | 70.2467 | | 13.8850 | 1.3183 | 0.2481 | 0.0766 | 1.0329 | 0.1667 | 3.1346 | 2.4614 | 92.570 |
| **Mean** | **70.5309** | | **14.1001** | **1.3161** | **0.2484** | **0.0713** | **1.0441** | **0.1997** | **3.2892** | **2.5309** | **93.3308** |

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| **Supplementary Table 5.**  **DCRA-DH-005-187.5 (from borehole B24)**  Sample DCRA-005-187.5 (bulk sample Munsell color: light olive gray (5Y 6/1) is predominantly comprised of ~79% angular, colorless, platy, tightly ribbed, or bubble wall/bubble-wall junction, and sparsely vesiculated shards. Microlites are noted in some of the shards. Webby shards, and unhydrated to poorly hydrated, nearly to perfectly spherical single bubble shards are much less common. Observed mineral assemblage includes feldspars, quartz, hornblende, biotite, and possibly chlorite. This is consistent with the percent abundance and shard morphology observed in sample DCA-DH-037-174.1.  **Identification**:  **Loleta ash bed;** with and without alkalis, correlates well with multiple Loleta ash samples from the Pacific margin and NE Pacific Ocean (see Table 3). | | | | | | | | | | |
| **No.** | **SiO2** | **Al2O3** | **FeO** | **MgO** | **MnO** | **CaO** | **TiO2** | **Na2O** | **K2O** | **Total** |
| 107 | 69.2612 | 13.3504 | 1.6243 | 0.1177 | 0.0345 | 0.7313 | 0.1131 | 5.0712 | 3.0394 | 93.3432 |
| 108 | 70.1634 | 13.3951 | 1.6683 | 0.1065 | 0.0197 | 0.6690 | 0.1487 | 4.5087 | 3.1626 | 93.8420 |
| 109 | 67.9439 | 13.1701 | 1.6800 | 0.1071 | 0.0554 | 0.6838 | 0.1551 | 4.9209 | 3.0676 | 91.7839 |
| 112 | 67.8592 | 12.7893 | 1.5911 | 0.0890 | 0.0631 | 0.7249 | 0.1485 | 4.7181 | 3.1210 | 91.1043 |
| 113 | 69.0524 | 13.1174 | 1.6737 | 0.1221 | 0.0827 | 0.6808 | 0.1244 | 5.1969 | 2.9831 | 93.0336 |
| 114 | 69.4077 | 12.9264 | 1.4755 | 0.1359 | 0.0738 | 0.7459 | 0.1235 | 4.9434 | 2.9871 | 92.8193 |
| 117 | 69.2812 | 13.0172 | 1.6439 | 0.0778 | 0.0874 | 0.6929 | 0.1642 | 4.6691 | 3.0618 | 92.6955 |
| 118 | 69.2673 | 13.0912 | 1.5957 | 0.0578 | 0.0720 | 0.7432 | 0.1412 | 4.8100 | 3.0800 | 92.8585 |
| 119 | 69.5878 | 13.2422 | 1.6406 | 0.0880 | 0.0476 | 0.6653 | 0.1108 | 5.4560 | 3.0671 | 93.9055 |
| 121 | 68.0425 | 12.6813 | 1.5701 | 0.0700 | 0.0506 | 0.6915 | 0.1663 | 4.7885 | 3.1148 | 91.1756 |
| 122 | 69.3867 | 13.2241 | 1.4409 | 0.0792 | 0.0381 | 0.7019 | 0.1350 | 5.1178 | 2.8579 | 92.9817 |
| 123 | 69.3955 | 13.1684 | 1.6424 | 0.1298 | 0.0416 | 0.7175 | 0.1266 | 4.9168 | 2.9661 | 93.1048 |
| 125 | 69.2751 | 13.0287 | 1.5897 | 0.0658 | 0.0452 | 0.6501 | 0.1213 | 5.1105 | 2.9998 | 92.8863 |
| 126 | 69.3901 | 13.1952 | 1.6469 | 0.1130 | 0.0470 | 0.6588 | 0.1778 | 4.7309 | 3.0247 | 92.9844 |
| 127 | 68.5811 | 12.7926 | 1.5177 | 0.1493 | 0.0238 | 0.6984 | 0.1172 | 4.8658 | 2.9362 | 91.6822 |
| 128 | 69.5020 | 13.4487 | 1.6632 | 0.0997 | 0.0856 | 0.7317 | 0.1255 | 5.1263 | 2.9489 | 93.7317 |
| 129 | 69.2832 | 13.3286 | 1.5132 | 0.0978 | 0.0268 | 0.7187 | 0.1328 | 4.9761 | 2.7225 | 92.7998 |
| 130 | 69.6620 | 13.3739 | 1.6016 | 0.0552 | 0.0559 | 0.7338 | 0.1412 | 5.3147 | 2.8849 | 93.8233 |
| 134 | 68.7276 | 13.3052 | 1.5865 | 0.0703 | 0.0273 | 0.809 | 0.1808 | 4.9900 | 3.0805 | 92.7772 |
| 135 | 69.6232 | 13.0712 | 1.5882 | 0.0775 | 0.0481 | 0.7283 | 0.1536 | 4.7703 | 3.1241 | 93.1846 |
| **Mean** | **69.1347** | **13.1358** | **1.5977** | **0.0955** | **0.0513** | **0.7088** | **0.1404** | **4.9501** | **3.0115** | **92.8259** |

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| **Supplementary Table 6.**  **DCN4-DH-028-140.0 (from borehole B11)**  **Identification**:  **Rockland ash bed**; best correlates with DCR3-DH-013-133.75 and average Rockland ash bed compositions (see Table 3). | | | | | | | | | | |
| **No.** | **SiO2** | **Al2O3** | **FeO** | **MgO** | **MnO** | **CaO** | **TiO2** | **Na2O** | **K2O** | **Total** |
| 72 | 73.7727 | 12.0453 | 0.7381 | 0.1250 | 0.0024 | 0.8587 | 0.1368 | 3.4136 | 3.5441 | 94.6368 |
| 73 | 71.6251 | 11.7946 | 0.7117 | 0.1871 | 0.0161 | 0.8651 | 0.1587 | 3.5620 | 3.0436 | 91.9641 |
| 74 | 72.4333 | 11.7986 | 0.7675 | 0.0980 | 0.0370 | 0.9604 | 0.2270 | 3.5730 | 3.2796 | 93.1745 |
| 75 | 73.8417 | 11.8732 | 0.7313 | 0.1415 | 0.0113 | 0.7931 | 0.1419 | 3.6195 | 3.6351 | 94.7887 |
| 76 | 72.5307 | 11.8217 | 0.6588 | 0.1397 | 0.0287 | 0.8329 | 0.1735 | 3.4693 | 3.2644 | 92.9198 |
| 77 | 73.8286 | 11.9984 | 0.6830 | 0.1563 | 0.0030 | 0.7759 | 0.1272 | 3.3340 | 3.5851 | 94.4915 |
| 78 | 73.5406 | 11.9494 | 0.6920 | 0.1775 | 0.0084 | 0.7809 | 0.1346 | 3.5630 | 3.5271 | 94.3736 |
| 79 | 72.9840 | 11.9508 | 0.6732 | 0.1437 | 0.0477 | 0.8173 | 0.1355 | 3.6350 | 3.4597 | 93.8470 |
| 81 | 72.2171 | 11.9530 | 0.7984 | 0.1729 | 0.0531 | 0.7904 | 0.1596 | 3.4100 | 3.3492 | 92.9038 |
| 83 | 70.4725 | 11.8874 | 0.7274 | 0.1357 | 0.0143 | 0.7509 | 0.1386 | 3.5397 | 3.4052 | 91.0717 |
| 84 | 70.2444 | 12.1648 | 0.7591 | 0.1431 | 0.0155 | 0.8378 | 0.1155 | 3.3948 | 3.1873 | 90.8624 |
| 86 | 70.7319 | 11.2383 | 0.7230 | 0.1356 | 0.0376 | 0.7387 | 0.1555 | 3.0547 | 3.5229 | 90.3383 |
| 87 | 72.9343 | 11.8130 | 0.6921 | 0.1896 | 0.0626 | 0.8316 | 0.1374 | 3.6803 | 3.3999 | 93.7409 |
| 88 | 71.7843 | 11.8930 | 0.7208 | 0.1555 | 0.0149 | 0.8772 | 0.0797 | 3.4198 | 3.2988 | 92.2440 |
| 89 | 74.3970 | 12.0786 | 0.6741 | 0.1473 | 0.0369 | 0.8392 | 0.1060 | 3.7963 | 3.4871 | 95.5626 |
| 91 | 72.4843 | 11.7600 | 0.6288 | 0.1797 | 0.0107 | 0.8014 | 0.1333 | 3.7827 | 3.5340 | 93.3149 |
| 93 | 74.4024 | 12.1205 | 0.7660 | 0.1503 | 0.0644 | 0.8707 | 0.1920 | 3.3376 | 3.5873 | 95.4912 |
| 94 | 73.7205 | 11.8708 | 0.6892 | 0.1048 | 0.0482 | 0.7591 | 0.1162 | 3.6055 | 3.6165 | 94.5309 |
| 95 | 74.6526 | 12.3322 | 0.6313 | 0.1568 | 0.0208 | 0.8357 | 0.1237 | 3.5364 | 3.5042 | 95.7938 |
| **Mean** | **72.7683** | **11.9128** | **0.7087** | **0.1495** | **0.0281** | **0.8219** | **0.1417** | **3.5120** | **3.4332** | **93.4763** |

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| **Supplementary Table 7.**  **DCR3-DH-013-133.75 (from borehole B16)**  **Identification**:  **Rockland ash bed**; best correlates with DCR5-DH-013-136.0, DCN4-DH-028-140.0, average Rockland ash bed composition (see Table 3). | | | | | | | | | | |
| **No.** | **SiO2** | **Al2O3** | **FeO** | **MgO** | **MnO** | **CaO** | **TiO2** | **Na2O** | **K2O** | **Total** |
| 41 | 72.7239 | 12.1295 | 0.7870 | 0.1598 | 0.0411 | 0.7863 | 0.1699 | 3.7117 | 3.1627 | 94.6720 |
| 42 | 73.8259 | 12.3172 | 0.7200 | 0.1536 | 0.0507 | 0.7945 | 0.1239 | 3.4036 | 3.4950 | 95.8845 |
| 43 | 73.8766 | 12.2825 | 0.6054 | 0.1749 | 0.0101 | 0.8770 | 0.0820 | 3.3006 | 3.5382 | 95.7474 |
| 44 | 75.1642 | 12.1473 | 0.7276 | 0.1774 | 0.0268 | 0.8067 | 0.1386 | 3.6364 | 3.4237 | 97.2488 |
| 45 | 73.8535 | 12.1767 | 0.8785 | 0.1349 | 0.0268 | 0.8139 | 0.1271 | 3.1129 | 3.4061 | 95.5304 |
| 46 | 72.2894 | 12.0709 | 0.6899 | 0.1962 | 0.0245 | 0.7949 | 0.1239 | 3.2069 | 3.1990 | 93.5956 |
| 47 | 73.7682 | 12.1258 | 0.7094 | 0.1550 | 0.0495 | 0.7753 | 0.1607 | 3.2370 | 3.6196 | 95.6005 |
| 48 | 72.9777 | 12.0806 | 0.7004 | 0.1404 | 0.0078 | 0.7695 | 0.1533 | 3.4941 | 3.3140 | 94.6379 |
| 50 | 74.1268 | 12.0469 | 0.7374 | 0.1291 | 0.0245 | 0.8623 | 0.1987 | 3.0909 | 3.4626 | 95.6792 |
| 52 | 72.7586 | 12.0377 | 0.6957 | 0.1996 | 0.0412 | 0.8341 | 0.1809 | 3.5757 | 3.1766 | 94.5001 |
| 53 | 74.2724 | 12.1054 | 0.7396 | 0.1504 | 0.0209 | 0.8805 | 0.1579 | 3.2600 | 3.5561 | 96.1432 |
| 54 | 72.8431 | 11.8871 | 0.7531 | 0.1824 | 0.0191 | 0.8019 | 0.1410 | 3.6152 | 3.4237 | 94.6667 |
| 55 | 73.9715 | 11.9371 | 0.5512 | 0.0627 | 0.0419 | 0.8605 | 0.1949 | 3.3603 | 3.5601 | 95.5402 |
| 56 | 72.2772 | 11.7249 | 0.6950 | 0.0758 | 0.0168 | 0.8999 | 0.1022 | 3.0802 | 3.5499 | 93.4220 |
| 57 | 73.1839 | 11.9314 | 0.7804 | 0.0873 | 0.0293 | 0.8017 | 0.1539 | 3.5411 | 3.5241 | 95.0331 |
| 58 | 72.4070 | 11.8372 | 0.7380 | 0.1669 | 0.0000 | 0.8243 | 0.1149 | 3.7083 | 3.2701 | 94.0668 |
| 59 | 74.0316 | 12.3360 | 0.7638 | 0.1823 | 0.0156 | 0.8573 | 0.1434 | 3.3530 | 3.4939 | 96.1769 |
| 60 | 72.6304 | 12.1695 | 0.7335 | 0.1616 | 0.0204 | 0.8819 | 0.1623 | 3.7890 | 3.0138 | 94.5625 |
| 61 | 73.1485 | 12.2016 | 0.7123 | 0.1398 | 0.0090 | 0.8357 | 0.1550 | 3.2611 | 3.4832 | 94.9463 |
| **Mean** | **73.4949** | **12.0634** | **0.7280** | **0.1478** | **0.0266** | **0.8361** | **0.1475** | **3.4000** | **3.4171** | **95.2612** |

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| **Supplementary Table 8.**  **DCR5-DH-013-136.0 (from borehole B22)**  **Identification**:  **Rockland ash bed**; best correlates with DCR3-DH-013-133.75, DCN4-DH-028-140.0, and with average Rockland ash bed composition (see Table 3). | | | | | | | | | | |
| **No.** | **SiO2** | **Al2O3** | **FeO** | **MgO** | **MnO** | **CaO** | **TiO2** | **Na2O** | **K2O** | **Total** |
| 146 | 74.5460 | 11.8503 | 0.7563 | 0.1250 | 0.0131 | 0.8109 | 0.1163 | 3.3074 | 3.3344 | 94.8597 |
| 148 | 72.7435 | 12.1619 | 0.6532 | 0.1390 | 0.0107 | 0.7683 | 0.1204 | 3.4883 | 3.2427 | 93.3280 |
| 150 | 72.7323 | 12.0333 | 0.8081 | 0.1659 | 0.0190 | 0.8386 | 0.1591 | 3.4231 | 3.3332 | 93.5126 |
| 151 | 71.8614 | 12.0368 | 0.7524 | 0.1125 | 0.0059 | 0.8562 | 0.1633 | 3.6455 | 3.2355 | 92.6695 |
| 153 | 72.2236 | 11.9386 | 0.7825 | 0.1454 | 0.0119 | 0.8763 | 0.1560 | 3.6056 | 3.1224 | 92.8624 |
| 155 | 73.8843 | 12.0793 | 0.7149 | 0.1207 | 0.0137 | 0.8973 | 0.1655 | 3.3629 | 3.4933 | 94.7319 |
| 156 | 73.9983 | 12.1282 | 0.8848 | 0.1950 | 0.0149 | 0.8376 | 0.1811 | 3.1745 | 3.5370 | 94.9515 |
| 157 | 73.9998 | 11.6911 | 0.7277 | 0.1372 | 0.0405 | 0.8050 | 0.1489 | 3.2138 | 3.6502 | 94.4143 |
| 159 | 72.0396 | 11.9334 | 0.6643 | 0.1907 | 0.0697 | 0.7993 | 0.1415 | 3.3305 | 3.3715 | 92.5406 |
| 160 | 74.3444 | 12.1046 | 0.7750 | 0.1503 | 0.0440 | 0.8826 | 0.1235 | 3.5780 | 3.5081 | 95.5106 |
| 161 | 71.2180 | 11.6496 | 0.7607 | 0.1254 | 0.0518 | 0.8066 | 0.1279 | 3.3796 | 3.4320 | 91.5517 |
| 166 | 72.2086 | 11.8290 | 0.7246 | 0.1712 | 0.0274 | 0.8268 | 0.1897 | 3.3843 | 3.2771 | 92.6388 |
| 167 | 72.8716 | 11.7153 | 0.6569 | 0.1052 | 0.0000 | 0.7695 | 0.1730 | 3.5712 | 3.4454 | 93.3082 |
| 169 | 73.6886 | 11.8396 | 0.6816 | 0.1300 | 0.0352 | 0.8138 | 0.1437 | 3.5260 | 3.4612 | 94.3197 |
| 170 | 71.7719 | 11.8658 | 0.7924 | 0.1383 | 0.0238 | 0.8327 | 0.1677 | 3.2580 | 3.2511 | 92.1017 |
| 172 | 73.0388 | 11.8287 | 0.7043 | 0.1499 | 0.0511 | 0.7733 | 0.1246 | 3.7093 | 3.2817 | 93.6618 |
| 173 | 73.8231 | 11.9878 | 0.8758 | 0.1535 | 0.0256 | 0.7758 | 0.1308 | 3.4115 | 3.3528 | 94.5368 |
| **Mean** | **72.9996** | **11.9220** | **0.7480** | **0.1444** | **0.0270** | **0.8218** | **0.1490** | **3.4335** | **3.3723** | **93.6176** |

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| **Supplementary Table 9.**  **DCR5-DH-013-151.55 (from borehole B22)**  **Identification**:  **Rockland ash bed**; best correlates with DCR5-DH-013-136.0, DCN4-DH-028-140.0, and average Rockland ash bed. With and without alkalis, there are multiple correlations to key Rockland ash bed deposits from throughout the western U.S. (see Table 3). | | | | | | | | | | | |
| **No.** | **SiO2** | **Al2O3** | **FeO** | **MgO** | **MnO** | **CaO** | **TiO2** | **Na2O** | **K2O** | **Total** | |
| 186 | 71.3997 | 11.6778 | 0.8313 | 0.1670 | 0.0208 | 0.7694 | 0.1631 | 3.3895 | 3.3122 | 91.7309 |
| 188 | 72.4876 | 11.5950 | 0.7277 | 0.1390 | 0.0463 | 0.8969 | 0.1359 | 3.8090 | 3.0166 | 92.8541 |
| 189 | 72.4214 | 11.9548 | 0.7666 | 0.1131 | 0.0505 | 0.7845 | 0.1182 | 3.6858 | 3.4476 | 93.3426 |
| 190 | 71.6586 | 11.4827 | 0.7915 | 0.1267 | 0.0249 | 0.7895 | 0.1483 | 3.5052 | 3.1854 | 91.7129 |
| 191 | 72.8210 | 11.7499 | 0.7089 | 0.1479 | 0.0540 | 0.7862 | 0.1233 | 3.3787 | 3.4302 | 93.2002 |
| 199 | 71.0170 | 11.5939 | 0.7891 | 0.1126 | 0.0624 | 0.8115 | 0.1778 | 3.5566 | 3.6004 | 91.7214 |
| 200 | 71.9225 | 11.6990 | 0.7097 | 0.1001 | 0.0297 | 0.8077 | 0.1318 | 3.0224 | 3.4965 | 91.9194 |
| 202 | 70.3768 | 11.5375 | 0.6706 | 0.0918 | 0.0238 | 0.8005 | 0.0983 | 3.4193 | 3.2841 | 90.3028 |
| 203 | 70.4672 | 11.4639 | 0.7230 | 0.1319 | 0.0392 | 0.7955 | 0.1307 | 3.8721 | 3.4580 | 91.0816 |
| 205 | 73.0752 | 12.0655 | 0.7863 | 0.1551 | 0.0351 | 0.8520 | 0.1506 | 3.3182 | 3.3386 | 93.7767 |
| 207 | 73.4901 | 11.8631 | 0.6856 | 0.1121 | 0.0208 | 0.8334 | 0.1245 | 3.7589 | 3.3343 | 94.2228 |
| 208 | 73.3417 | 11.9338 | 0.8433 | 0.1515 | 0.0469 | 0.8451 | 0.1423 | 3.0953 | 3.7319 | 94.1319 |
| 209 | 72.1571 | 11.7149 | 0.8913 | 0.1486 | 0.0416 | 0.7469 | 0.1223 | 3.4370 | 3.5209 | 92.7806 |
| 211 | 70.6874 | 11.4753 | 0.8521 | 0.1579 | 0.0416 | 0.8187 | 0.1715 | 3.7088 | 3.5577 | 91.4711 |
| 214 | 70.1448 | 11.4048 | 0.7103 | 0.1241 | 0.0665 | 0.8140 | 0.1578 | 3.3846 | 3.4893 | 90.2962 |
| 215 | 71.2107 | 11.4914 | 0.5828 | 0.1665 | 0.0439 | 0.8382 | 0.1453 | 3.4317 | 3.4345 | 91.3451 |
| **Mean** | **71.7924** | **11.6690** | **0.7544** | **0.1341** | **0.0405** | **0.8119** | **0.1401** | **3.4858** | **3.4149** | **92.2431** |

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| **Supplementary Table 10.**  **DCA-DH-005-127.5 (from borehole B02)**  Tephra sample DCA-DH-005-127.5 in borehole B02 is from a thin (<0.1 m-thick) layer of well-sorted, very fine-grained, pinkish to pale olive-gray silt in core. The sample (bulk sample Munsell color: yellowish gray (5Y 7/2) contains ~75% colorless to medium brown colored, microlitic or microphenocrystic glass shards that are commonly platy, or exhibit bubble wall/bubble-wall junctions, ribs, and vesicles. The microlites and microphenocrysts are oriented randomly, parallel following ribbing, or rarely in a radiating pattern.  **Identification**:  **Pop. 1: informally named dacitic ash of Hood**; best correlates with sample 61284-10 from Tulelake, near Deadhorse Gulch (see Table 3).  **Pop. 2: outliers;** minor mode with two dissimilar, unidentifiable grains. | | | | | | | | | | |
| **No.** | **SiO2** | **Al2O3** | **FeO** | **MgO** | **MnO** | **CaO** | **TiO2** | **Na2O** | **K2O** | **Total** |
| **Pop. 1** | | | | | | | | | | |
| 231 | 64.4811 | 14.9329 | 3.8573 | 0.5717 | 0.1684 | 2.0762 | 0.6802 | 5.1625 | 2.0830 | 94.0134 |
| 233 | 63.3530 | 14.6798 | 3.7897 | 0.5743 | 0.1737 | 1.8360 | 0.6169 | 4.6327 | 2.0665 | 91.7227 |
| 234 | 64.2611 | 15.2860 | 3.6866 | 0.5696 | 0.1219 | 1.9181 | 0.6323 | 5.1641 | 2.1646 | 93.8044 |
| 237 | 64.0237 | 15.2521 | 3.8625 | 0.6589 | 0.1566 | 2.2698 | 0.5302 | 4.8317 | 2.1941 | 93.7796 |
| 239 | 65.0517 | 14.9396 | 3.9470 | 0.5588 | 0.0949 | 1.9101 | 0.6182 | 5.3477 | 2.2556 | 94.7237 |
| 242 | 62.0812 | 14.8510 | 4.3012 | 0.7088 | 0.1397 | 2.1322 | 0.5364 | 4.9509 | 2.0958 | 91.7973 |
| 245 | 64.1330 | 14.6619 | 3.5219 | 0.6214 | 0.0983 | 1.8125 | 0.5757 | 5.3216 | 2.2146 | 92.9609 |
| 250 | 64.9850 | 15.2773 | 3.8018 | 0.7063 | 0.1619 | 1.8968 | 0.5103 | 5.0487 | 2.1800 | 94.5682 |
| 251 | 63.6136 | 14.9427 | 3.3264 | 0.6080 | 0.1256 | 2.0351 | 0.6518 | 4.9492 | 2.1910 | 92.4435 |
| 253 | 62.0925 | 15.0319 | 3.8252 | 0.6133 | 0.1607 | 2.1513 | 0.5756 | 5.1216 | 2.1641 | 91.7362 |
| 254 | 63.2157 | 15.1731 | 4.2947 | 0.8093 | 0.1255 | 2.1081 | 0.7461 | 4.6406 | 2.1549 | 93.2681 |
| 255 | 64.2094 | 14.9113 | 3.8060 | 0.5434 | 0.1465 | 1.8477 | 0.5878 | 5.2730 | 2.1833 | 93.5085 |
| 256 | 63.3997 | 14.7487 | 3.9390 | 0.5509 | 0.0665 | 1.8730 | 0.7126 | 4.8950 | 2.2157 | 92.4012 |
| 257 | 63.0769 | 15.1476 | 3.9133 | 0.6383 | 0.1469 | 2.0480 | 0.4868 | 5.2407 | 2.1588 | 92.8573 |
| 258 | 64.2924 | 14.6411 | 3.6491 | 0.5249 | 0.0538 | 1.8592 | 0.4719 | 5.2067 | 2.2685 | 92.9677 |
| 259 | 65.3637 | 15.2625 | 3.8356 | 0.5994 | 0.1459 | 1.9342 | 0.6041 | 4.9813 | 2.3191 | 95.0459 |
| 263 | 64.3782 | 14.8284 | 4.0651 | 0.6079 | 0.0693 | 1.9908 | 0.5546 | 5.2133 | 2.1603 | 93.8680 |
| 264 | 64.2968 | 15.0108 | 3.8462 | 0.6327 | 0.0567 | 1.9768 | 0.6260 | 4.9314 | 2.1682 | 93.5456 |
| 265 | 64.5762 | 15.1488 | 3.9662 | 0.6554 | 0.1362 | 2.0791 | 0.5822 | 5.4210 | 2.1711 | 94.7363 |
| 266 | 63.4771 | 14.6765 | 3.9476 | 0.6347 | 0.1105 | 1.9613 | 0.5914 | 4.9738 | 2.1994 | 92.5723 |
| 268 | 63.3127 | 15.3011 | 4.1332 | 0.8247 | 0.1185 | 2.3476 | 0.7417 | 4.8849 | 2.1055 | 93.7700 |
| 270 | 63.3202 | 14.7460 | 3.9663 | 0.6938 | 0.1883 | 1.9969 | 0.8121 | 4.5473 | 2.1169 | 92.3879 |
| **Mean** | **63.8634** | **14.9751** | **3.8765** | **0.6321** | **0.1257** | **2.0028** | **0.6111** | **5.0336** | **2.1741** | **93.2945** |
| **Pop. 2 - outliers** | | | | | | | | | | |
| 261 | 62.7631 | 15.5079 | 4.2405 | 0.9414 | 0.1217 | 2.6097 | 0.7390 | 5.4306 | 1.9564 | 94.3104 |
| 262 | 64.2284 | 15.7689 | 4.3866 | 1.0909 | 0.1007 | 2.7084 | 0.9492 | 5.4635 | 2.2006 | 96.8972 |
| **Mean** | **63.4958** | **15.6384** | **4.3136** | **1.0162** | **0.1112** | **2.6591** | **0.8441** | **5.4471** | **2.0785** | **95.6038** |