*Supplementary Material for:*

**End-Permian terrestrial ecosystem collapse in North China: evidence from palynology and geochemistry**

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**1. Methods**

Palynological isolation and identification was undertaken according to the China national standard (SY/T5915–2018) at the Chinese Academy of Geological Sciences (Beijing). Each sample was first crushed into particles less than 1 mm in diameter before acid digestion in 30% hydrochloric acid (HCl) and 38% hydrofluoric acid (HF) to remove carbonate and silicates, respectively. After this, samples were rinsed with distilled water until a neutral pH was achieved, prior to sieving of residues with a 10 μm nylon mesh.

Various chemical weathering indices were determined to quantify the intensity of subaerial chemical weathering. Of the widely used chemical weathering indices, the chemical index of alteration (CIA, Nesbitt and Young, 1982) is defined as Al2O3/(Al2O3+Na2O +CaO\*+K2O)×100%, the weathering index of Parker (WIP, Parker, 1970) is expressed as CaO\*/0.7+2Na2O/0.35+2K2O/0.25 +MgO/0.9, and the variation trend of the chemical index of weathering (CIW, Harnois, 1988) is defined as Al2O3/(Al2O3+CaO +Na2O) × 100%. The above chemical weathering indices are calculated using molecular proportions, and CaO\* refers to the CaO in silicate minerals. Silicate CaO is corrected by first subtracting phosphate CaO based on P2O5 content (Fedo et al., 1995) and then making CaO\* = NaO if the molar content of remaining CaO is higher than that of Na2O, otherwise using the remaining CaO as the CaO\* (e.g., Xu and Shao, 2018; Zhang et al., 2019). A third chemical weathering index, τNa, denotes the chemical depletion of sodium in weathering materials relative to the fresh parent rocks using Zr or Ti as immobile elements (Rasmussen et al., 2011). It is calculated in this study as Nam/Tim/(NaS/TiS)−1, where Nam and Tim represent the concentrations of Na and Ti in the analyzed mudstones in the study area, and NaS and TiS mean the concentrations of Na and Ti in the average source rock from the southern NCP (Gao et al., 1998).

**2. Paleofloral reconstruction and paleoclimatological inferences of palynological records**

We carried out a detailed experimental analysis on 26 pollen samples from the Sunjiagou Formation in the Dayulin section of the Yiyang Coalfield in the southern North China Plate (NCP). In the middle part of the Sunjiagou Formation (samples YY-1 to YY-10), abundant palynological fossils were isolated from greyish-green mudstone and/or argillaceous sandstone, while in the upper part of the Sunjiagou Formation (samples YY-11 to YY-27), almost no palynological fossils were isolated from purplish-red mudstone, and only a very small amount of palynological fossils were isolated from sample YY-11. A previous study shows the extinction of terrestrial floras was marked by the loss of ~54% (14/26) of genera and ~88% (28/32) of species of plant genera in the gymnosperm-dominated assemblage of the Sunjiagou Formation in the NCP (Chu et al., 2019). Therefore, we conducted repeated (3 times) extraction experiments for palynological fossil samples from the purplish-red mudstone in the upper part of the Sunjiagou Formation, and the sample weight of each experiment was 3 times that of the national standard (SY/T5915 2018) sample (*ca.* 300g). Despite this, we still did not extract enough palynological fossils for systematic analysis, which is a function of the low palynological content in the purplish-red mudstone.

The low abundance of parent plants or the influence of other factors during burial (e.g., temperature) may be responsible for the poor preservation of palynological fossils (e.g., Zhao, 1989; Traverse, 2007; Looy and Hotton, 2014). In our study, the diversity and abundance of spore-pollen fossils decreased rapidly in the middle part of the Sunjiagou Formation (at the base of bed 20), accompanied by the disappearance of *Ullmannia*-*Yuania* assemblage (Chu et al., 2015, 2017), a rapid decline in TOC content (from 0.3 wt. % to 0.01 wt. %) (Wu et al., 2020), the onset of the negative δ13Corg excursion (Wu et al., 2020), a shift of lithology (from greyish-green sandstone and mudstone to purplish-red mudstone), the appearance of calcareous nodules (Fig. 2d), frequent wildfires (Fig. 3), and a subsequent fall in CIA\* values (Figs. 3, 8). These anomalies predate the spikes of CIA\* and Ni values associated with PTME, so we consider that the rapid decline of spore-pollen content is mainly related to the onset of end-Permian Terrestrial Collapse (EPTC) in the study area (see Discussion 5.1). The EPTC in the study area leads to a decline in the abundance of parent plants, which leads to a decline in spore-pollen productivity (e.g., Looy and Hotton, 2014; Zhang et al., 2022). In addition, the palynological fossils in the study area were dark in color, and some palynological fossils were severely deformed (such as *conifers spp.* pollen that could not be identified), which may have been affected by the dry climate. Therefore, we consider that the lack of palynological fossils in the purplish-red mudstone in the study area is a true reflection of the decline in abundance of parent plants linked to the EPTC.

The characteristic elements and assemblages of palynological fossils are effective for biostratigraphic assignment of the studied strata (Ouyang et al., 2017; Lu et al., 2021; Zhang et al., 2022). In this study, samples YY-1 to YY-10 were dominated by gymnosperm pollen, followed by fern spores. This is different from the palynological assemblages dominated by fern spores in the Xiashihezi and Shangshihezi formations (Zhu, 1993). Similar phenomena have been recorded in other regions of the NCP, such as the Liulin area in Shanxi Province (Hou and Ouyang, 2000) and the Ruzhou area in Henan Province (Wang, 1997). In addition, there are also palynological genera (e.g., *Lueckisporites*, *Alisporites*, and *Protohaploxypinus*) with solid chronological significance in the study area. Among these, *Lueckisporites* is only known from the Late Permian and was found in the Tarim (Hou, 1990; Ouyang et al., 2004), Junggar (Ouyang et al., 1993), and Turpan-Hami (Liu, 2000) basins and in Pakistan (Balme, 1995). A high content of *Alisporites* also occurs in the Tarim basin of northwestern China during the Late Permian (Hou, 1990; Ouyang et al., 2004). *Protohaploxypinus* is also one of the most common genera during the Permian-Triassic transition (Gao et al., 2018). The Permian genus *Gulisporites* was also found in the study area (Xing et al., 2021), and this is regarded as one of the characteristic elements of the Late Paleozoic (Ouyang and Hou, 1999). In conclusion, the palynological assemblages in the study area are be similar to those of the Late Permian Changxingian Stage (*Lueckisporites Virkkiae*-*Jugasporites Schaubergeroides*) in the NCP (Ouyang and Hou, 1999) and strongly suggest a Late Permian age for the relevant beds.

Paleovegetation information in geological history can be reconstructed based on the genetic relationship between palynological taxa and parent plants (Ouyang et al., 2017; Lu et al., 2021; Zhang et al., 2022). Diverse plant groups in the study area are recognized from the Late Permian, including horsetails, “filicalean” ferns, cycads, conifers, lycopsids, and pteridosperms (seed ferns) (Tables. S2). These taxa mainly grow in tropical and temperate regions (Liu et al., 2000; Zheng et al., 2013). In this study, analysis of the palynological distributions using stratigraphically constrained cluster analyss (CONISS) identified two empirically distinct assemblage zones (AZ-I and AZ-II; Supplementary Fig. 1). The compositions of AZ-I and AZ-II are generally similar and dominated by conifers (38.9–47.2% and 33.7–48.4, x̄= 44.3 and 44.1%, respectively; including Taxodiaceae and Pinaceae) and “filicalean” ferns (14.7–24.1% and 12.5–27.9%, x̄= 18.8 and 18.9%, respectively; including Dipteridaceae and Osmundaceae), with subordinate pteridosperms (10.4–17.4% and 16.5–22.7%, x̄= 14.3 and 18.7%, respectively). Lycopsids (0.0–3.7% and 0.0–2.7%, x̄= 2.2 and 1.6%, respectively), cycads (0.0–2.9% and 0.0–2.9%, x̄= 1.3 and 0.7%, respectively), and horsetails (0.0–1.0% and 0.0–1.8%, x̄= 0.4 and 0.9%, respectively) are less abundant and appear sporadically (Tables. S1, S2). Compared with AZ-I, the abundance of Taxodiaceae (conifers), lycopsids and cycads declined in AZ-II, while the abundance of Dipteridaceae (ferns), horsetails, and pteridosperms incereased in AZ-II (Tables. S1, S2).

Previous studies have shown that the wetland Cathaysian flora was rapidly succeeded by a Zechstein-type drier flora at the end of the Wuchiapingian (Yang and Wang, 2012). In this study, the paleovegetation types are mainly xerophytic conifer and meso-xerophytic seed ferns (e.g., Balme, 1995; Looy and Hotton, 2014), and no Cathaysian flora was found, indicating that the study area in this period was similar to the Zechstein-type drier flora of Euramerica and was experiencing the declining stage of the Cathaysian flora. However, the content of fern spores in the study area still accounts for approximately 1/4 (x̄ = 22.5% and 21.7%), indicating that a semi-arid climate prevailed during this time (samples YY-1 to YY-10; AZ-1 and AZ-II). Furthermore, the presence of purplish-red mudstone and sandstone and calcareous nodules in the upper part of the Sunjiagou Formation indicates that a hot and arid climate prevailed in the study area during this time (samples YY-11 to YY-26; AZ-III) (e.g., Tu et al., 2016; Wu et al., 2020; Zheng et al., 2020). In conclusion, we consider that the study area experienced a transition from hot semi-arid to arid climatic conditions during the Changxingian to early Induan stages (Sunjiagou Formation).

**3. Supplementary Figures**

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**Figure S1.** Cumulative sporopollen summary diagram of the Dayulin section in the Yiyang Coalfield, with palynomorph percentages of the total spore-pollen sum plotted on the x-axis, and zones based on stratigraphically constrained cluster analysis (CONISS) ordinations. Abbreviations: 1 = *Limatulasporites*; 2 = *Leiotriletes*; 3 = *Osmundacidites*; 4 = *Reticulatasporites* *clathratus*; 5 = *Laevigatosporites*; 6 = *Striotatospora multifasciatus*; 7 = *Crassispora*; 8 = *Densosporites*; 9 = *Spinozontriletes*; 10 = *Planisporites*; 11 = *Raistrickia*; 12 = *Cyclogranisporites*; 13 = *Lophotrilotes*; 14 = *Verrucosisporites*; 15 = *Anapiculatisporites*; 16 = *A. incundus*; 17 = *Calamospora*; 18 = *Punctatisporites*; 19 = *Inaperturopollenites*; 20 = *Cycadopites*; 21 = *Ephedripites*; 22 = *Perinopollenites*; 23 = *Potonieisporites*; 24 = *Crucisaccites*; 25 = *Pityosporites*; 26 = *Alisporites*; 27 = *Platysaccus*; 28 = *Klausipollenites*; 29 = *Vesiccaspora*; 30 = *Vesiccaspora* *giganteus*; 31 = *Vesiccaspora minor*; 32 = *Florinites*; 33 = *Cordaitina*; 34 = *Chordasporites*; 35 = *Lueckisporites*; 36 = *Gardenasporites*; 37 = *Vestigisporites*; 38 = *Limitisporites*; 39 = *Taeniaesporites*; 40 = *Lunatisporites*; 41 = *Protohaploxypinus*; 42 = *Costapollenites globosus*; 43 = *Conifers Spp*; TSS = Total sum of squares.

**4. Supplementary Tables**

**Table S1.** Results of the quantitative spore-pollen analysis (number) from the Dayulin section in the Yiyang Coalfield.

| **Spore-pollen** | **Sunjiagou Formation** |
| --- | --- |
| YY-1 | YY-2 | YY-3 | YY-4 | YY-5 | YY-6 | YY-7 | YY-8 | YY-9 | YY-10 | YY-11 |
| *Limatulasporites* | 1 |  | 1 |  | 1 |  | 2 |  | 1 | 1 |  |
| *Leiotriletes* | 1 | 1 | 1 |  | 2 | 1 | 1 |  | 2 | 1 |  |
| *Osmundacidites* | 2 |  | 2 |  | 1 |  | 1 |  | 2 |  |  |
| *Reticulatasporites clathratus* | 3 |  | 1 | 1 |  |  | 1 | 2 |  |  |  |
| *Laevigatosporites* | 1 | 1 | 1 |  | 2 |  |  |  | 1 |  |  |
| *Striotatospora multifasciatus* | 1 |  | 3 |  |  | 1 |  | 1 |  |  |  |
| *Crassispora* |  | 3 |  |  | 3 |  |  | 2 |  | 1 |  |
| *Densosporites* |  | 1 |  | 2 |  |  | 1 |  | 1 |  |  |
| *Spinozontriletes* |  | 1 |  | 2 |  | 3 |  | 2 |  | 2 |  |
| *Planisporites* | 5 |  | 1 |  | 4 | 4 | 3 |  | 1 | 2 |  |
| *Raistrickia* | 1 |  |  | 1 | 1 |  | 2 | 1 |  | 1 |  |
| *Cyclogranisporites* |  | 6 |  | 5 |  | 4 |  | 1 | 2 | 1 |  |
| *Lophotrilotes* | 6 | 10 | 7 | 5 | 2 | 6 | 7 | 5 | 4 | 3 |  |
| *Verrucosisporites* |  | 2 |  | 3 |  | 6 | 5 | 2 | 3 | 4 |  |
| *Anapiculatisporites* | 2 |  | 1 |  | 2 |  |  | 1 | 1 |  |  |
| *A.incundus* | 1 |  | 2 |  | 2 | 1 |  |  |  | 1 |  |
| *Calamospora* |  |  | 1 |  | 1 |  | 1 | 1 | 2 | 1 |  |
| *Punctatisporites* |  | 5 |  | 6 |  | 4 |  | 3 | 4 | 4 |  |
| *Inaperturopollenites* | 2 |  | 1 | 1 | 1 |  | 2 | 1 |  |  |  |
| *Cycadopites* | 2 |  | 3 |  | 2 | 3 |  | 1 |  |  | 2 |
| *Ephedripites* | 3 |  | 2 |  | 2 |  | 3 | 1 |  |  |  |
| *Perinopollenites* | 1 |  | 1 |  |  |  |  | 1 |  |  |  |
| *Potonieisporites* | 3 |  | 4 | 3 | 2 |  | 1 | 1 |  |  |  |
| *Crucisaccites* | 2 |  | 2 |  | 1 |  |  | 1 |  | 3 |  |
| *Pityosporites* | 2 | 2 | 3 | 3 | 4 | 3 | 4 | 6 | 5 | 4 |  |
| *Alisporites* | 4 | 5 | 6 | 9 | 6 | 9 | 5 | 7 | 5 | 6 |  |
| *Platysaccus* | 4 | 2 | 4 | 3 | 1 |  | 3 | 2 | 3 | 1 |  |
| *Klausipollenites* | 3 | 4 | 3 | 5 | 6 | 3 | 1 | 3 | 2 | 2 |  |
| *Vesiccaspora* | 6 | 7 | 3 | 4 | 7 | 5 | 4 | 7 | 8 | 6 |  |
| *V. giganteus* |  |  | 1 |  | 1 |  |  | 2 | 3 | 4 |  |
| *V. minor* | 3 | 2 | 2 | 1 | 1 |  | 1 |  | 3 | 2 |  |
| *Florinites* | 9 | 11 | 10 | 12 | 11 | 9 | 6 | 7 | 4 | 6 |  |
| *Cordaitina* | 3 | 2 | 2 | 3 | 4 | 5 | 3 | 2 | 2 | 1 |  |
| *Chordasporites* | 5 | 6 | 6 | 7 | 6 | 6 | 5 | 4 | 3 | 5 |  |
| *Lueckisporites* |  | 1 |  | 2 |  | 2 | 3 | 5 | 2 | 3 |  |
| *Gardenasporites* | 4 | 6 | 7 | 5 | 5 | 4 | 3 | 4 | 6 | 8 |  |
| *Vestigisporites* | 2 | 4 | 1 | 1 | 3 | 2 | 2 | 3 | 3 | 2 |  |
| *Limitisporites* | 1 | 2 | 1 |  |  | 1 | 4 | 6 | 7 | 5 |  |
| *Taeniaesporites* |  |  |  |  |  |  |  | 3 | 2 | 2 |  |
| *Lunatisporites* | 6 | 10 | 7 | 9 | 7 | 8 | 9 | 14 | 9 | 6 |  |
| *Protohaploxypinus* | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |  | 1 |  |
| *Costapollenites globosus* |  |  |  |  |  |  |  |  |  | 1 |  |
| *Conifers spp.* | 17 | 13 | 14 | 15 | 17 | 13 | 26 | 24 | 21 | 19 |  |

**Table S2.** Botanical affinity for dispersed Sunjiagou Formation sporomorph genera from the Dayulin section in the Yiyang Coalfield.

| **Botanical affinity** | **Sporomorph genera** | **Botanical affinity** | **Sporomorph genera** |
| --- | --- | --- | --- |
| Lycopsids | *Densosporites* | Conifers (Podocarpaceae) | *Taeniaesporites* |
| *Crassispora* | *Platysaccus* |
| *Raistrickia* | Conifers | *Lueckisporites* |
| Horsetails | *Calamospora* | *Klausipollenites* |
| Ferns (Dipteridaceae) | *Verrucosisporites* | *Vesiccaspora* |
| Ferns (Osmundaceae) | *Osmundacidites* | *Pityosporites* |
| ‘filicalean’ Ferns | *Laevigatosporites* | *Florinites* |
| *Punctatisporites* | *Potonieisporites* |
| *Cyclogranisporites* | *Conifers Spp.* |
| *Leiotriletes* | Gymnosperm | *Chordasporites* |
| *Anapiculatisporites* | *Cordaitina* |
| *Limatulasporites* | *Ephedripites* |
| *Reticulatasporites* | *Gardenasporites* |
| *Spinozontriletes* | *Vestigisporites* |
| *Planisporites* | *Costapollenites* |
| *Lophotrilotes* | Seed ferns | *Alisporites* |
| Cycadophytes | *Cycadopites* | *Limitisporites* |
| Conifers (Taxodiaceae) | *Inaperturopollenites* | *Protohaploxypinus* |
| *Perinopollenites* | *Lunatisporites* |

**Table S3.** Results of Hg concentrations (ppb), Ni concentrations (μg/g) and Ni/Al ratios (10-4), CIA and CIA\* values, WIP and WIP\* values, Al/Si ratios, τNa values, and Th/U ratios from the Dayulin section in the Yiyang Coalfield.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Formation** | **Sample** | **Hg** | **Ni** | **Ni/Al** | **CIA** | **CIA\*** | **WIP** | **WIP\*** | **Al/Si** | **τNa** | **Th/U** |
| SunjiagouFormation | 26 | 14.30 | 39.53 | 2.20 | 77.59 | 79.67 | 42.57 | 37.83 | 0.20 | -0.83 | 4.62 |
| 25 | 21.50 | 36.57 | 1.99 | 78.57 | 80.93 | 42.44 | 37.11 | 0.18 | -0.89 | 4.20 |
| 24 | 10.80 | 32.99 | 2.31 | 78.10 | 80.20 | 41.59 | 37.82 | 0.20 | -0.89 | 3.69 |
| 23 | 15.40 | 41.66 | 2.38 | 78.01 | 80.27 | 43.33 | 38.36 | 0.18 | -0.87 | 4.52 |
| 22 | 17.70 | 35.23 | 3.08 | 78.98 | 81.45 | 31.25 | 27.81 | 0.12 | -0.94 | 4.06 |
| 21 | 12.20 | 29.29 | 3.39 | 79.06 | 81.30 | 36.86 | 34.49 | 0.09 | -0.92 | 2.39 |
| 20 | 47.70 | 49.56 | 3.58 | 81.98 | 83.77 | 27.94 | 25.11 | 0.15 | -0.95 | 4.16 |
| 19 | 10.40 | 36.07 | 3.06 | 77.00 | 79.33 | 35.97 | 32.43 | 0.14 | -0.90 | 4.22 |
| 18 | 11.50 | 41.64 | 3.60 | 77.26 | 79.21 | 30.37 | 27.49 | 0.11 | -0.87 | 2.94 |
| 17 | 21.20 | 37.95 | 3.04 | 78.28 | 80.63 | 30.79 | 27.14 | 0.15 | -0.92 | 3.07 |
| 16 | 8.20 | 39.65 | 3.18 | 78.82 | 81.22 | 30.42 | 26.74 | 0.18 | -0.94 | 3.00 |
| 15 | 10.50 | 39.81 | 2.81 | 78.82 | 81.35 | 33.70 | 29.32 | 0.20 | -0.92 | 1.97 |
| 14 | 36.30 | 34.28 | 2.78 | 74.68 | 77.86 | 37.38 | 32.09 | 0.16 | -0.88 | 3.53 |
| 13 | 16.20 | 20.59 | 1.96 | 68.24 | 69.64 | 31.24 | 28.81 | 0.13 | -0.81 | 5.19 |
| 12 | 11.00 | 20.81 | 1.86 | 72.48 | 73.94 | 28.34 | 25.95 | 0.12 | -0.94 | 5.18 |
| 11 | 16.20 | 31.30 | 1.71 | 75.12 | 78.53 | 49.37 | 41.06 | 0.19 | -0.90 | 4.15 |
| 10 | 8.70 | 30.19 | 1.85 | 73.05 | 75.98 | 46.50 | 39.73 | 0.19 | -0.88 | 4.83 |
| 9 | 11.70 | 29.53 | 1.72 | 73.04 | 75.70 | 48.42 | 41.95 | 0.17 | -0.92 | 3.70 |
| 8 | 9.60 | 28.07 | 1.65 | 73.22 | 75.89 | 46.67 | 40.25 | 0.23 | -0.90 | 4.11 |
| 7 | 15.20 | 36.13 | 2.39 | 72.03 | 74.22 | 43.50 | 38.66 | 0.16 | -0.87 | 2.60 |
| 6 | 16.00 | 28.93 | 1.43 | 76.20 | 79.53 | 51.96 | 43.20 | 0.21 | -0.94 | 2.70 |
| 5 | 8.10 | 31.75 | 1.81 | 74.23 | 76.91 | 46.51 | 40.05 | 0.17 | -0.86 | 2.48 |
| 4 | 11.50 | 28.40 | 1.37 | 75.61 | 78.95 | 54.22 | 45.12 | 0.21 | -0.93 | 4.04 |
| 3 | 16.50 | 27.11 | 1.77 | 72.57 | 74.77 | 43.05 | 38.16 | 0.13 | -0.87 | 3.68 |
| 2 | 12.90 | 34.33 | 1.87 | 74.89 | 77.93 | 48.71 | 41.19 | 0.18 | -0.91 | 3.63 |
| 1 | 14.90 | 28.51 | 1.79 | 71.96 | 75.05 | 46.88 | 39.74 | 0.14 | -0.87 | 1.78 |

**Table S4.** Results of clay mineral compositions (%), Illite crystallinity (∆°/2θ), and Charcoal (number) from the Dayulin section in the Yiyang Coalfield.

| **Formation** | **Sample** | **Clay mineral compositions** | **Illite crystallinity (KI)** | **Charcoal** |
| --- | --- | --- | --- | --- |
| **I/S** | **Illite** | **Kaolinite** | **Smectite** |
| Sunjiagou Formation | 26 | 45 | 39 | 6 | 10 | 0.28 | 17 |
| 25 | 36 | 44 | 8 | 12 | 0.31 | 16 |
| 24 | 40 | 43 | 6 | 11 | 0.35 | 21 |
| 23 | 44 | 39 | 6 | 11 | 0.29 | 40 |
| 22 | 54 | 34 | 4 | 8 | 0.41 | 48 |
| 21 | 35 | 48 | 9 | 8 | 0.46 | 31 |
| 20 | 45 | 31 | 15 | 9 | 0.32 | 75 |
| 19 | 42 | 41 | 1 | 16 | 0.28 | 35 |
| 18 | 50 | 32 | 1 | 17 | 0.31 | 61 |
| 17 | 52 | 34 | 1 | 13 | 0.39 | 11 |
| 16 | 56 | 28 | 1 | 15 | 0.46 | 23 |
| 15 | 55 | 33 | 1 | 11 | 0.42 | 22 |
| 14 | 42 | 52 | 3 | 3 | 0.39 | 67 |
| 13 | 66 | 29 | 3 | 2 | 0.33 | 73 |
| 12 | 66 | 28 | 4 | 2 | 0.35 | 783 |
| 11 | 64 | 34 | 1 | 1 | 0.27 | 1023 |
| 10 | 56 | 38 | 3 | 3 | 0.32 | 542 |
| 9 | 56 | 37 | 3 | 4 | 0.41 | 210 |
| 8 | 59 | 35 | 3 | 3 | 0.48 | 301 |
| 7 | 49 | 35 | 5 | 11 | 0.36 | 281 |
| 6 | 58 | 39 | 2 | 1 | 0.49 | 245 |
| 5 | 62 | 33 | 3 | 2 | 0.33 | 295 |
| 4 | 52 | 44 | 2 | 2 | 0.31 | 213 |
| 3 | 48 | 37 | 10 | 5 | 0.35 | 371 |
| 2 | 53 | 35 | 9 | 3 | 0.37 | 201 |
| 1 | 55 | 43 | 1 | 1 | 0.31 | 278 |

Abbreviations: I/S = illite-smectite mixed layer.

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