Data Article

Radiolarian data from the submarine Vityaz Ridge, Northwest Pacific, for biostratigraphic and paleoceanographic reconstructions

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ABSTRACT

Radiolaria are marine siliceous microfossils used to reconstruct paleoceanographic and paleoclimatic events. This report presents a dataset obtained from radiolarian analysis for the biostratigraphic and paleoceanographic reconstructions of the submarine Vityaz Ridge and the Kuril-Kamchatka Trench paraxial zone. Data were obtained from dredge samples collected during the 4th cruise of the R/V Akademik A. Nesmeyanov in 1984 and during the 37th, 41st, and 52nd cruises of the R/V Akademik M. A. Lavrentyev in 2005, 2006, and 2010, respectively. Both new and previously published data on distribution of the Pleistocene radiolarian zones in the North Pacific are presented in this report.

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**Specifications Table**

| Subject                                      | Earth and Planetary Science |
|----------------------------------------------|-----------------------------|
| Specific subject area                        | Biostratigraphic and paleoceanographic reconstructions of the submarine Vityaz Ridge and the Kuril-Kamchatka Trench paraxial zone. |
| Type of data                                  | Tables, Figures, Plate images |
| How data were acquired                        | The samples were obtained by dredging during the 4th cruise of the R/V Akademik A. Nesmeyanov and during the 37th, 41st, and 52nd cruises of the R/V Akademik M. A. Lavrentyev. The data were acquired by examining 25 glass slides containing radiolarian skeletons. The radiolarians were examined under a light microscope (LOMO Mikmed 6) at 300 × magnification and photographed using a Touptek photonics camera (FMA050). The skeletal morphology of the Radiolaria was studied using a JEOL JSM9064LV scanning electron microscope at the Laboratory of Micro- and Nano-research of the Analytical center of the Far East Geological Institute, Far East Branch of the Russian Academy of Science in Vladivostok, Russia. |
| Data format                                  | Raw, Analyzed |
| Parameters for data collection                | The radiolarian diversity (number of species) and the species richness (composition, percentage of each species) were determined in the slides. The parameters of three morphologically different groups of radiolarians (Spumellaria, Nassellaria, and Collopllo) were calculated. |
| Description of data collection               | The taxonomic composition of the Radiolarians and total radiolarian abundance were determined in the slides. Pleistocene radiolarian zone assemblages Cycladophora sphaeris, Eucyrtidium matuyamai, Stylatractus universus, and Lychnocanoma sakai were determined [1]. The distribution of these zones in the North Pacific was determined based on published data from deep-water drilling sites and sediment cores, and our data were obtained from dredge samples. |
| Data source location                          | Institution: V. I. Il’ichev Pacific Oceanological Institute FEB RAS |
|                                              | City: Vladivostok |
|                                              | Country: Russian Federation |
|                                              | Latitude and longitude: 43°12’ N, 131°55’ E |
| Data accessibility                           | With the article |
|                                              | Repository name: Mendeley Data |
|                                              | Data identification number: DOI: 10.17632/6knkwcdxb6.3 |
|                                              | Direct link to the dataset: [https://data.mendeley.com/datasets/6knkwcdxb6/3](https://data.mendeley.com/datasets/6knkwcdxb6/3) |
| Related research article                     | L.N. Vasilenko, Yu.P. Vasilenko, Pleistocene radiolarian biostratigraphy of the submarine Vityaz Ridge, Northwest Pacific, Marine Micropaleontology. 2021. Vol. 169, 102,040. P. 1–27. [10.1016/j.marmicro.2021.102040](https://doi.org/10.1016/j.marmicro.2021.102040) |

**Value of the Data**

- This dataset provides quantitative data on high-rank Radiolaria taxa for studying changes in the paleoenvironment during the Pleistocene.
- The data can be helpful to paleontologists, geologists, and oceanologists studying the history of the development and evolution of the North Pacific.
- The presented data of the genera and species of radiolarians can be used to design a biostratigraphic radiolarian analysis and paleoceanographical reconstruction of the submarine Vityaz Ridge and the Kuril-Kamchatka Trench paraxial zone.

**1. Data Description**

Table 1 shows the dredge samples in which the assemblages of Pleistocene radiolarian zones were identified [1]. These dredge sample assemblages have been dated by comparing them to independently dated assemblages from other sources on the basis of similarity of them taxonomic
Table 1
Total radiolarian abundance (skeletons/g dry sediment) and quantitative analysis of the high-rank Pleistocene radiolarian taxa (%) in the studied dredge samples.

| Radiolarian zones | Dredge samples | Location | Total radiolarian abundance (skeletons/g dry sediment) | Spumellaria (%) | Nassellaria (%) | Collodaria (%) | Unidentified radiolaria (%) |
|-------------------|----------------|----------|-------------------------------------------------------|-----------------|-----------------|----------------|--------------------------|
| Lychnocanoma sakaii | LV52–5–2v-1 | s.p | 2950 | 24.0 | 69.5 | – | 6.5 |
|                     | LV52–5–2b-1 | s.p | 1732 | 24.6 | 70.1 | – | 5.1 |
| Stylatractus universus | LV52–1–7 | s.p | few | * | – | – | – |
|                     | LV52–1–7a | s.p | few | * | – | – | – |
|                     | LV52–1–8a | s.p | few | * | – | – | – |
|                     | LV57–13–5 | n.p | 736 | 34.0 | 62.0 | 2.0 | 2.0 |
| Eucyrtidium matuyamai | LV37–32–1 | B.G | 1827 | 31.5 | 55.5 | 1.4 | 12.2 |
|                     | LV37–32–2a | B.G | 2014 | 34.6 | 52.4 | – | 13.3 |
|                     | LV37–32–2b | B.G | 1972 | 32.8 | 55.5 | – | 11.5 |
|                     | LV37–32–2v | B.G | 1009 | 50.5 | 46.1 | 1.5 | 1.5 |
|                     | N4–21/2–3 | KKT p.z | 2745 | 54.7 | 41.9 | 1.1 | 2.3 |
|                     | LV52–9a | s.p | 1596 | 57.4 | 15.3 | 19.2 | 7.7 |
|                     | LV57–12–3 | n.p | 2966 | 61.1 | 29.8 | 1.7 | 6.7 |
|                     | LV57–12–2 | n.p | 2636 | 64.3 | 29.6 | 5.3 | 2.6 |
|                     | LV57–12–1 | n.p | 574 | 60.3 | 36.4 | – | 3.0 |
|                     | LV57–12–3 | n.p | few | * | * | * | * |
|                     | LV57–12–4 | n.p | few | * | * | * | – |
|                     | LV57–12–4a | n.p | few | * | – | – | – |
|                     | LV41–1 | s.p | few | * | – | – | – |
|                     | LV57–12–2 | n.p | few | * | – | – | * |
|                     | LV57–20–1a | n.p | few | * | * | – | – |
|                     | LV57–12–1c | n.p | 413 | * | * | – | – |
|                     | LV57–12–1a | n.p | few | * | * | – | * |
|                     | LV57–12–1 | n.p | 426 | * | – | – | * |

Note: * – presence of sporadic radiolarian taxa. Location of the dredge samples: s.p: southern plateau of the SVR, n.p: northern plateau of the SVR, B.G: Bussol Graben, and KKT p.z.: Kuril-Kamchatka Trench paraxial zone.
composition, presence of index specimens, and the quantitative characteristics of the radiolarians in the dredge samples. The total radiolarians abundance, quantitative analysis of high-rank radiolarian taxa (Spumellaria, Nassellaria, and Collodaria), and other unidentified radiolaria are also noted in this table.

Table 2 provides a taxonomic list of radiolaria identified in the dredge samples of the submarine Vityaz Ridge (SVR) and the Kuril-Kamchatka Trench paraxial zone. The genera and species richness of Spumellaria, Nassellaria, and Collodaria are also indicated.

Table 3 provides information on the distribution of the Cycladophora sphaeris Zone, Eucyrtidium matuyamai Zone, Stylatractus universus Zone, and Lychnocanoma sakaii Zone in the North Pacific. The table shows the deep-water drilling sites, sediment core, and dredge sites at which these zones were found.

Fig. 1 shows the content of radiolarian nine species (Echimomma leptodermum Jørgensen, Stylatractus universus Hays, Streblacantha circumtexta Jørgensen, Spongopyle osculosa Dreyer, Spongotrochus glacialis Popofsky, Lychnocanoma sakaii Morley et Nigrini, Cycladophora davisiana Ehrenberg, Eucyrtidium matuyamai Hays, and Ceratospyris borealis Bailey) in the Pleistocene sediments of the SVR and the Kuril-Kamchatka Trench paraxial zone. These species are of great stratigraphic and paleoceanographical significance.

Fig. 2 shows graphs based on data obtained from Table 1. It shows the change in total radiolarian abundance and the quantity of high-rank radiolarian taxa in the Pleistocene sediments of the southern and northern plateaus of the SVR, Bussol Graben, and the Kuril-Kamchatka Trench paraxial zone. Because the radiolarian microfauna sharply react to changes in salinity and water temperature, the presented data can be used for reconstructing paleoceanographic and paleoclimatic events.

Plate 1 modified from [1]. It shows the morphotypes and some taxa determined only up the genus.
| Genus No. | Taxa No. | Taxon Name |
|-----------|----------|------------|
| **Collodaria** | 1. | Acrosphaera arktios (Nigrini) F.1 |
| | 2. | Acrosphaera arktios (Nigrini) F.2 |
| | 3. | Collosphaera cf. polygona Haecckel |
| | 4. | Collosphaera elliptica Chen et Tan |
| | 5. | Collosphaera sp. F.1 |
| | 6. | Collosphaera sp. F.2 |
| **Spumellaria** | 1. | Actinomma boreale Cleve |
| | 2. | Amphylthonium sp. |
| | 3. | Cenosphaera cristata Haecckel |
| | 4. | Cenosphaera sp. |
| | 5. | Cromydrupocarpus cf. esterase Campbell et Clark |
| | 6. | Cromyechinus antarctica (Dreyer) |
| | 7. | Cromyomma villosum Haecckel |
| | 8. | Druppatractus ostracion Haecckel |
| | 9. | Druppatractus pyriformis (Bailey) |
| | 10. | Druppatractus bicostratus praecursor Gorbunov |
| | 11. | Echinomma lepodermus Jørgensen |
| | 12. | Echinomma delicatulum (Dogiel) |
| | 13. | Echinomma sp. |
| | 14. | Euchiton sp. |
| | 15. | Hallooma spp. |
| | 16. | Hexacontium pachydermus Jørgensen |
| | 17. | Hexacontium sp. |
| | 18. | Lithellus minor Jørgensen |
| | 19. | Lithellus sp. |
| | 20. | Ommatartus sp. |
| | 21. | Prunopyle spp. |
| | 22. | Rhizoplegma boreale Cleve |
| | 23. | Sphaeropyle langii Dreyer |
| | 24. | Spirema melonia Haecckel |
| | 25. | Spirema sp. |
| | 26. | Spirotunica spiralis (Haecckel) |
| | 27. | Spirotunica sp. |
| | 28. | Spongiscus biconcavus (?) Haecckel |
| | 29. | Spongiscus gigas Campbell et Clark |
| | 30. | Spongiscus resurgens Ehrenberg |
| | 31. | Spongiscus spp. |
| | 32. | Spongopyle osculosa Dreyer |
| | 33. | Spongopyle setosa Dreyer |
| | 34. | Spongotrechus glacialis Popofsky |
| | 35. | Spongurus pylomaticus Riedel |
| | 36. | Streblacantha circumtexta Jørgensen |
| | 37. | Stylostactorium acquilonium (Hays) |
| | 38. | Stylostactorium bispiculum Popofsky |
| | 39. | Stylostactorium pachydermus Chen, Zhang, Zhang, Liu |
| | 40. | Stylattractus neptunus Haecckel |
| | 41. | Stylattractus universus Hays |
| | 42. | Stylattractus sp. F.1 |
| | 43. | Stylattractus sp. F.2 |
| | 44. | Stylochlamidium bensoni Kamikuri |
| | 45. | Stylochlamidium venustum Bailey |
| | 46. | Stylodictya stellata Bailey |
| | 47. | Stylodictya validispina Jørgensen |
| | 48. | Stylosphaera sp. |
| | 49. | Stylotrochus sol Campbell et Clark |
| | 50. | Stylotrochus bipedius Vasilenko |
| | 51. | Stylotrochus tripedius Vasilenko |
| | 52. | Stylochlamidium bensoni Kamikuri |

(continued on next page)
Table 2 (continued)

| Genus No. | Taxa No. | Taxon Name |
|-----------|----------|------------|
| 30.       | 53.      | Tetrarype sp. |
| 31.       | 54.      | Thecosphaera dedoensis Nakaseko |
| 35.       | 55.      | Thecosphaera cf. japonica Nakaseko |
| 36.       | 56.      | Thecosphaera microsphaera Nakaseko |
| 37.       | 57.      | Thecosphaera pseudojaponica Nakaseko |
| 38.       | 58.      | Thecosphaera tochigiensis Nakaseko |
| 39.       | 59.      | Tholospyra sp. F.1 |
| 40.       | 60.      | Tholospyra sp. F.2 |

**Nassellaria**

1. 1. Androsyris cf. reticulidica Takahashi
2. 2. Arachnocorys aff. circumpetala Haeckel
3. 3. Archipilium tanorium Chen, Zhang, Zhang, Liu
4. 4. Artostrobium botryocyrtium (Haeckel)
5. 5. Artostrobium annulatus (Bailey)
6. 6. Bathropyramis ramosa Haeckel
7. 7. Botryocampe inflata (Bailey)
8. 8. Botryocampe spp.
9. 9. Botryostrobus aquilonaris (Bailey)
10. 10. Botryostrobus auritus (Ehrenberg)
11. 11. Botryostrobus sp.
12. 12. Ceratocyrtis sp.
13. 13. Ceratospyris borealis Bailey
14. 14. Ceratospyris sp.
15. 15. Cornutella hexagona Haeckel
16. 16. Cycladophora davisci Ennerberg
17. 17. Cycladophora cf. sphaeris (Popova)
18. 18. Cycladophora cornuta (Bailey)
19. 19. Cycladophora spp.
20. 20. Dictyophimus aff. longipes Haeckel
21. 21. Dictyophimus cf. hertwigii Haeckel
22. 22. Dictyophimus macrurus (Ehrenberg)
23. 23. Eucyrtis sp.
24. 24. Eucoronis nephrosyris Haeckel
25. 25. Eucyrtidium matuyamai Hays
26. 26. Eucyrtidium cf. teucheri Haeckel
27. 27. Lignocyclas sp.
28. 28. Lithomelissa cf. campanuliformis Campbell et Clark
29. 29. Lithomitra hyperboleum (Bailey)
30. 30. Lithomitra lineata Ehrenberg
31. 31. Lophophaena sp.
32. 32. Lychnocanoma grande brevis (Campbell et Clark)
33. 33. Lychnocanoma sakaii Morley et Nigrini
34. 34. Phormostichoartus cf. potamoporus Caulet
35. 35. Plectopyramis dodecomma Haeckel
36. 36. Plectopyramis polypleura Haeckel
37. 37. Pseudodictyophimus cf. crisae (Ehrenberg)
38. 38. Pseudodictyophimus gracilipes (Bailey)
39. 39. Pterocanium cf. bicornis Haeckel
40. 40. Pterocanium sp.
41. 41. Pterocodon cf. ornatus Haeckel
42. 42. Pterocorys columba Haeckel
43. 43. Pterocorys hirundo Haeckel
44. 44. Pterocorys sp. F.1
45. 45. Pterocorys sp. F.2
46. 46. Sethocorys sp.
47. 47. Stichopilium bicornis Haeckel
48. 48. Theoconus sp.
49. 49. Tripocyrtis sp.
50. 50. Zugocyrtis sp.
67 116 Total
| Radiolarian Zone | Sea of Japan and Japan Trench | Sea of Okhotsk | Kuril-Kamchatka Trench | Detroit Guyot | Meiji Guyot | Bering Sea | The Gulf of Alaska | Northwest Pacific | Shatsky Rise | Hess Rise | Northeast Pacific | Refs. |
|-----------------|-----------------------------|---------------|-------------------------|--------------|------------|-----------|-------------------|-----------------|-------------|-----------|------------------|-------|
| Lychnocanoma sakai | DSDP Site 302; IODP Sites U1422–U1427 and U1430 | Cores MD01–2415, LV28–42–4 | Dredge site LV52–5 | ODP Site 192 | ODP Sites 188, 190, and 191 | | | | | | | [1–4] |
| Stylatractus universus | DSDP Site 434–436 and 438; ODP Sites 1150 and 1151; IODP Sites 1422–1427 and 1430 | MD01–2415 | Dredge site LV52–1 and LV37–13 | ODP Site 884 | ODP Site 192 | ODP Sites 188, 190, and 191; IODP Site U1341 | IODP Site U1417 | DSDP Sites 193, 576, 579, 580, and 581; ODP Site 881A; dredge site B12–39 | DSDP Sites 47, 49, 50, 305, 577, and 578 | DSDP Site 310 | | [1–14] |
| Eucyrtidium matuyamai | DSDP Sites 302, 434–436, and 438; ODP Sites 1150 and 1151; IODP Sites 1423, 1424, 1425, and 1426 | Core MD01–2415; dredge site 2356 | Dredge sites N4–21/2–3, LV37–12, LV37–13, LV37–32, LV41–1, and LV52–9 | ODP Site 884 | ODP Site 192 | ODP Sites 188, 190, and 191; IODP Sites U1340 and U1341; Core V21–156 | IODP Site U1417 | DSDP Sites 579 and 580; ODP Site 881A; Core V20–119, V21–148, RC10–181, and RC10–182 | DSDP Sites 47, 51, 305, 577, and 578; Core V21–145 | DSDP Site 310 | | [1–15] |
| Cycladophora sphaeris (=Cycladophora sakai) | DSDP Sites 302 and 438; ODP Sites 1150 and 1151; IODP Sites 1422–1426 and 1430 | Dredge sites 2230 and 2302 | Dredge sites LV37–12 and LV37–20 | ODP Site 884 | ODP Site 192 | IODP Site U1341 | | | | | | [1,6,10–12] |

Note: DSDP – Deep Sea Drilling Project, ODP – Ocean Drilling Program, IODP – Integrated Ocean Drilling Program, LV – cruises of the R/V Akademik M. A. Lavrentyev, N – cruise of the R/V Akademik A. Nesmeyanov, MD – cruise of the R/V Marion Dufresne, V – cruises of the R/V Vema, RC – cruises of the R/V Robert D. Conrad.
Fig. 1. Temporal changes in the relative abundance of selected radiolarian species in the studied deposits. The vertical sequence of dredge samples is shown in Table 1.
Fig. 2. Changes in the total radiolarian abundance and quantitative ratios of high-rank radiolarian taxa (Spumellaria, Nassellaria, and Collodaria) in Pleistocene sediments: −1 southern plateau of the SVR and Bussol Graben, −2 northern plateau of the SVR, and −3 the Kuril-Kamchatka Trench paraxial zone.
Plate 1. Pleistocene radiolarians from the studied deposits modified from [1] with additions. Scale bars = 100 μm.
1. Acrosphaera arktios (Nigrini) F.1; Sample LV37–12–2. 2. Acrosphaera arktios (Nigrini) F.2; Sample LV37–12–2. 3. Collosphaera sp. F.1; Sample LV37–12–2. 4. Collosphaera sp. F.2; Sample N4–21/2–3. 5. Stylotractus sp. F.1; Sample N4–21/2–3. 6. Stylotractus sp. F.2; Sample N4–21/2–3. 7. Haliomma spp.; Sample LV37–32–2a. 8. Tetrapyle sp.; Sample N4–21/2–3. 9. Tholospyra sp. F.1; Sample LV52–5–2b-1. 10. Tholospyra sp. F.2; Sample LV52–5–2b-1. 11. Stylotrachus sp.; Sample LV37–12–3. 12. Prunopyle spp.; Sample LV37–32–2v. 13. Pterocorys sp. F.1; Sample LV37–12–2. 14. Pterocorys sp. F.2; Sample LV37–32–2v. 15. Lophophaena sp.; Sample N4–21/2–3. 16. Theoconus sp.; Sample LV37–32–2v. 17. Eucecryphalus sp.; Sample LV52–5–2v-1.
2. Experimental Design, Materials and Methods

2.1. Experimental design

The aim of this study was to design a Pleistocene biostratigraphic scheme based on radiolarians for the submarine Vityaz Ridge. The research plan included the following items:

1. Analysis of the radiolarian fauna in dredging samples;
2. Analysis of the previously developed radiolarians biostratigraphic schemes for adjacent areas of the northwestern Pacific to the studied region.
3. Comparison of radiolarian assemblages identified in samples with assemblages of radiolarian zones established in previous studies in the northwestern Pacific.
4. To design a radiolarians biostratigraphic scheme for the studied region.
5. Verification of the designed radiolarians scheme by correlation with schemes using other biostratigraphic methods (diatoms, silicoflagellates) for the region.
6. On the basis of the designed scheme and radiolarian assemblages, identify the features of the evolution of the Vityaz Ridge in the Pleistocene.

2.2. Materials

In this study, 25 dredge samples were analyzed from the SVR (24 samples) and the southern part of the Kuril-Kamchatka Trench paraxial zone opposite the Bussol Strait (1 sample) (Table 1). These samples were collected during the 4th cruise of the R/V Akademik A. Nesmeyanov in 1984 and during the 37th, 41st, and 52nd cruises of the R/V Akademik M.A. Lavrentyev in 2005, 2006, and 2010, respectively.

2.3. Preparation and counting

We prepared the slides according to the methods described by Tochilina [2]:

1. Each bulk sediment sample was weighed on high-precision scales (WAGA TORSYNA -WT).
2. It sediment sample was disaggregated by boiling in a 0.002 M solution of sodium pyrophosphate for 15–20 min.
3. After boiling, the samples were washed through a sieve a 40 μm mesh.
4. The fraction with >40 μm diameter was dried and weighed.
5. Of this fraction, an aliquot of approximately 20 mg was separated and weighed too.
6. This aliquot was placed on a glass slide (25 mm × 75 mm × 1.2 mm), added two drops of Canada balsam on top, and covered with a cover glass (24 mm × 24 mm × 0.17 mm).
7. The finished slide was placed under a fume hood for 24 h.

We examined the radiolaria on the slides using a light microscope (LOMO Mikmed 6) at 300 × magnification. We determined diversity of radiolaria (i.e., the number of species) and species richness of radiolaria (i.e., composition, as percentage of each species) in each slide. Then, we calculated the total radiolarian abundance (TRA) (i.e., the number of skeletons) as follows [1]:

\[
TRA = \frac{n_{\text{total}} \times w_{\text{fraction}}}{w_{\text{sample}} \times w_{\text{portion}}}
\]

where \(n_{\text{total}}\) is the total number of skeletons on the slide; \(w_{\text{fraction}}\) is the weight of the >40 μm fraction (g); \(w_{\text{sample}}\) is the weight of the dry sediment sample (g); and \(w_{\text{portion}}\) is the weighed portion of the >40 μm fraction (g). The unit of TRA is [skeleton/g dry sediment]

We ranked the radiolarian preservation as follows:

poor – > 50% of the skeletons were broken and/or exhibited signs of dissolution;
moderate – 25–50% of the skeletons were broken and/or exhibited signs of dissolution; good – < 25% of the skeletons were broken and/or exhibited signs of dissolution.

Poorly preserved radiolarians were classified as "Unidentified radiolaria" (Table 1). We photographed the radiolarian skeletons using the microscope (LOMO Mikmed 6) with a Touptek photonics camera (FMA050).

Also the skeletal morphologies of the radiolarians were studied using a JEOL JSM9064LV scanning electron microscope at the Laboratory of Micro- and Nano-research of the Analytical center of the Far East Geological Institute, Far East Branch of the Russian Academy of Science in Vladivostok, Russian Federation. For this, radiolarian skeletons were selected from dry sediment using a metal needle and attached on special posts (1 × 1 cm) to carbon tape, 10–15 skeletons in a row. The samples were sputtered with carbon. A total of about 100 radiolarian skeletons were selected and examined using a scanning electron microscope.

Collections of radiolarian skeletons are kept in Laboratory of Geological Formations, V. I. Il'ichev Pacific Oceanological Institute FEB RAS, Vladivostok, Russian Federation.

2.4. Radiolarian zonation and datum levels

The dredge sample radiolarian assemblages have been dated by comparing them to independently dated assemblages from other sources on the basis similarity of them taxonomic composition: presence of index specimens, and other species - stratigraphic markers and also the quantitative characteristics of the radiolarians in the dredge samples. These assemblages mainly agreed with radiolarian zones proposed by Hays [5], Motoyama [6], and Kamikuri et al. [4]: Cycladophora sphaeris, Eucyrtidium matuyamai, Stylatractus universus, and Lychnocanoma sakaii zones. Kamikuri et al. [11] and Matul [3] established the age boundaries of these zones.

Supplementary

https://data.mendeley.com/datasets/6knkwdcxb6/3

Ethics Statement

Not applicable.

Declaration of Competing Interest

The author declares that they have no known competing financial interests or personal relationships which have or perceived to have influenced the work reported in this article.

Data Availability

Radiolarian data from the submarine Vityaz Ridge, Northwest Pacific, for biostratigraphic and paleoceanographic reconstructions_Tables (Original data) (Mendeley Data).

CRediT Author Statement

Lidiya Nikolaevna Vasilenko: Visualization, Writing – original draft.
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