

Dissolved iron data set in the North Pacific

Dissolved iron data in the North Pacific collected by PICES Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* (WG 22) are compiled in an Excel file (available at http://www.pices.int/members/working_groups/Disbanded_working_groups/products/Fe_data_set_Aug2012.xlsx) from 45 original papers listed below. A map of the stations and vertical profiles of the compiled data are shown in Figs. 1 and 2. The data set includes dates, cruise #, position (station, depth), dissolved iron concentrations (filter sizes ranging from 0.2 - 0.45 μm) and references. The database is an expansion of that compiled by Moore and Braucher (2008). **All users of this data set are requested to include the original papers into the reference section of their articles.**

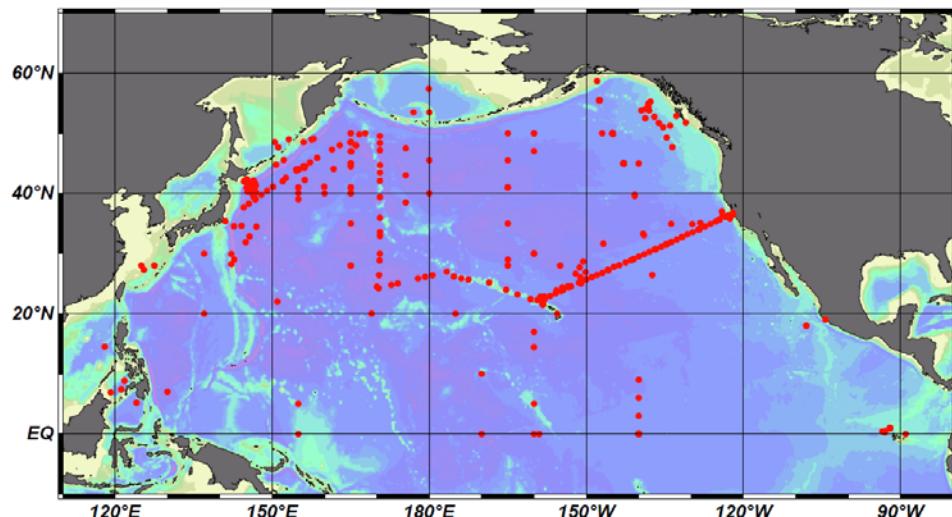


Fig. 1 Location of the sampling stations compiled in the PICES WG 22 dissolved iron data set of the North Pacific Ocean.

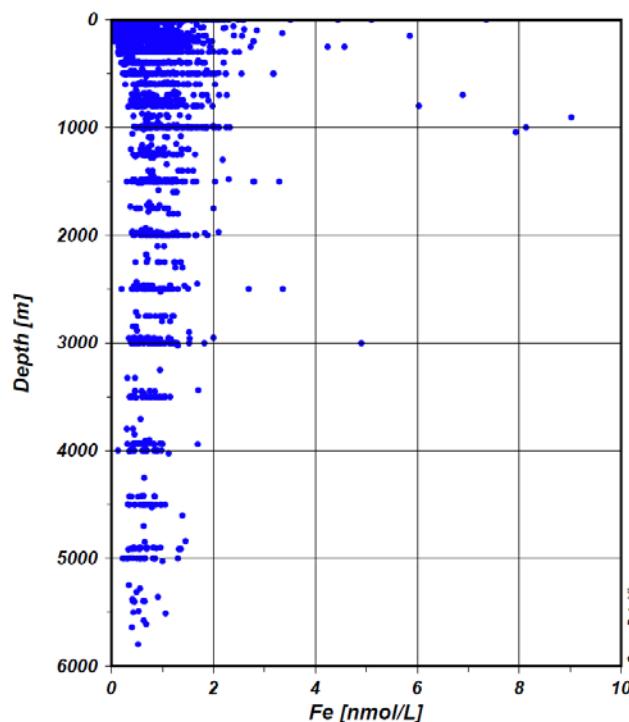


Fig. 2 Vertical profiles of the dissolved iron concentrations in the North Pacific Ocean.

List of the original papers

1. Boyle, E.A., Bergquist, B.A., Kayser, R.A. and Mahowald, N. 2005. Iron, manganese and lead at Hawaii Ocean Time-Series station ALOHA: Temporal variability and an intermediate water hydrothermal plume. *Geochim. Cosmochim. Acta* 69: 933–952.
2. Brown, M.T., Landing, W.M. and Measures, C.I. 2005. Dissolved and particulate Fe in the western and central North Pacific: Results from the 2002 IOC cruise. *Geochem. Geophys. Geosyst.* 6: Q10001, doi: 10.1029/2004GC000893.
3. Bruland, K., Orians, K. and Cowen, P. 1994. Reactive trace metals in the stratified central North Pacific. *Geochim. Cosmochim. Acta* 58: 3171–3182.
4. Coale, K.H., Fitzwater, S.E., Gordon, R.M., Johnson, K.S. and Barber, R.T. 1996a. Control of community growth and export production by upwelled iron the equatorial Pacific Ocean. *Nature* 379: 621–624.
5. Ezoe, M., Ishita, T., Kinugasa, M., Lai, X., Norisuye, K. and Sohrin, Y. 2004. Distributions of dissolved and acid-dissolvable bioactive trace metals in the North Pacific Ocean. *Geochem. J.* 38(6): 535–550.
6. Fitzwater, S.E., Coale, K.H., Gordon, R.M., Johnson, K.S. and Ondrusek, M.E. 1996. Iron deficiency and phytoplankton growth in the equatorial Pacific. *Deep-Sea Res. II* 43: 995–1015.
7. Fujishima, Y., Ueda, K., Maruo, M., Nakayama, E., Tokutome, C., Hasegawa, H., Matsui, M. and Sohrin, Y. 2001. Distribution of trace bioelements in the subarctic North Pacific Ocean and the Bering Sea (the R/V Hakuhou Maru Cruise KH-97-2). *J. Oceanogr.* 57: 261–273.
8. Gordon, R.M., Johnson, K.S. and Coale, K.H. 1998. The behavior of iron and other trace elements during the IronEx I and PlumEx experiments in the equatorial Pacific. *Deep-Sea Res. II* 45: 995–1041.
9. Gordon, R.M., Martin, J.H. and Knauer, G.A. 1982. Iron in north-east Pacific waters. *Nature* 299: 611–612.
10. Johnson, K.S., Gordon, R.M. and Coale, K.H. 1997. What controls dissolved iron concentrations in the world ocean? *Mar. Chem.* 57: 137–161. (for global iron dataset, see <http://www.mbari.org/chemsensor/fe/APPENDA.XLS>)
11. Johnson, K.S., Elrod, V., Fitzwater, S., Plant, J.N., Chavez, F.P., Tanner, S.J., Gordon, M., Westphal, D.L., Perry, K.D., Wu, J. and Karl, D.M. 2003. Surface ocean-lower atmosphere interactions in the Northeast Pacific Ocean Gyre: Aerosols, iron, and the ecosystem response. *Global Biogeochem. Cycles* 17: 1063, doi:10.1029/2002GB002004.
12. Johnson, K.S., Chavez, F.P., Elrod, V.A., Fitzwater, S.E., Pennington, J.T., Buck, K.R. and Walz, P.M. 2001. The annual cycle of iron and the biological response in central California coastal waters. *Geophys. Res. Lett.* 28: 1247–1250.
13. Johnson, W.K., Miller, L.A., Sutherland, N.D. and Wong, C.S. 2005. Iron transport by mesoscale Haida eddies in the Gulf of Alaska. *Deep-Sea Res. II* 52: 933–953.
14. Kinugasa, M., Ishita, T., Sohrin, Y., Okamura, K., Takeda, S., Nishioka, J. and Tsuda, A. 2005. Dynamics of trace metals during the subarctic Pacific iron experiment for ecosystem dynamics study (SEEDS2001). *Prog. Oceanogr.* 64: 129–147.
15. Kitayama, S., Kuma, K., Manabe, E., Sugie, K., Takata, H., Isoda, Y., Toda, K., Saitoh, S., Takagi, S., Kamei, Y. and Sakaoka, K. 2009. Controls on iron distributions in the deep water column of the North Pacific Ocean: Iron(III) hydroxide solubility and humictype fluorescent dissolved organic matter. *J. Geophys. Res.* 114: C08019, doi:10.1029/2008JC004754.
16. Kondo, Y. 2007. Dynamics of the organic Fe complexing ligands and phytoplankton in the Pacific Ocean. The University of Tokyo. Ph.D. Thesis, 256 pp.
17. Kondo, Y., Takeda, S. and Furuya, K. 2007. Distribution and speciation of dissolved iron in the Sulu Sea and its adjacent waters. *Deep-Sea Res. II* 54: 60–100.
18. Kondo, Y., Takeda, S. and Furuya, K. 2012. Distinct trends in dissolved Fe speciation between shallow and deep waters in the Pacific Ocean. *Mar. Chem.* 134–135: 18–28.
19. Kondo, Y., Takeda, S., Nishioka, J., Obata, H., Furuya, K., Johnson, W.K. and Wong, C.S. 2008. Organic iron (III) complexing ligands during an iron enrichment experiment in the western subarctic North Pacific. *Geophys. Res. Lett.* 35: L12601, doi:10.1029/2008GL033354.
20. Kuma, K., Nishioka, J. and Matsunaga, K. 1996. Controls on iron (III) hydroxide solubility in seawater: The influence of pH and natural organic chelators. *Limnol. Oceanogr.* 41: 396–407.

21. Kuma, K., Katsumoto, A., Kawakami, H., Takatori, F. and Matsunaga, K. 1998. Spatial variability of Fe(III) hydroxide solubility in the water column of the northern North Pacific Ocean. *Deep-Sea Res. I* 45: 91–113.
22. Kuma, K., Isoda, Y. and Nakabayashi, S. 2003. Control on dissolved iron concentrations in deep waters in the western North Pacific: Iron(III) hydroxide solubility. *J. Geophys. Res.* 108(C9): 3289, doi:10.1029/2002JC001481.
23. Landing, W.M. and Bruland, K.W. 1987. The contrasting biogeochemistry of iron and manganese in the Pacific Ocean. *Geochim. Cosmochim. Acta* 51: 29–43.
24. Mackey, D.J., O'Sullivan, J.E. and Watson, R.J. 2002. Iron in the western Pacific: A riverine or hydrothermal source for iron in the Equatorial Undercurrent? *Deep-Sea Res. I* 49: 877–893.
25. Martin, J.H. and Gordon, R.M. 1988. Northeast Pacific iron distributions in relation to phytoplankton productivity. *Deep-Sea Res. Part A* 35: 177–196.
26. Martin, J.H., Gordon, R.M., Fitzwater, S. and Broenkow, W.W. 1989. VERTEX: phytoplankton/iron studies in the Gulf of Alaska. *Deep-Sea Res. Part A* 36: 649–680.
27. Nakabayashi, S., Kuma, K., Sasaoka, K., Saitoh, S., Mochizuki, M., Shiga, N. and Kusakabe, M. 2002. Variation in iron(III) solubility and iron concentration in the northwestern North Pacific Ocean. *Limnol. Oceanogr.* 47: 885–892.
28. Nakabayashi, S., Kusakabe, M., Kuma, K. and Kudo, I. 2001. Vertical distributions of Iron(III) hydroxide solubility and dissolved iron in the northwestern North Pacific Ocean. *Geophys. Res. Lett.* 28: 4611–4614.
29. Nishioka, J., Takeda, S., Kudo, I., Tsumune, D., Yoshimura, T., Kuma, K. and Tsuda, A. 2003. Size-fractionated iron distributions and iron-limitation processes in the subarctic NW Pacific. *Geophys. Res. Lett.* 30 (14): 1730, doi:10.1029/2002GL016853.
30. Nishioka, J., Takeda, S., Kondo, Y., Obata, H., Doi, T., Tsumune, D., Wong, C.S., Johnson, W.K. and Tsuda, A. 2009. Changes in iron concentrations and bio-availability during an open ocean mesoscale iron enrichment experiment in the western subarctic pacific, SEEDS II. *Deep-Sea Res. II* 56: 2796–2809.
31. Nishioka, J., Ono, T., Saito, H., Nakatsuka, T., Takeda, S., Yoshimura, T., Suzuki, K., Kuma, K., Nakabayashi, S., Tsumune, D., Mitsudera, H., Johnson, W.K. and Tsuda, A. 2007. Iron input into the western subarctic Pacific, importance of iron export from the Sea of Okhotsk. *J. Geophys. Res.* 112: C10012, doi:10.1029/2006JC004055.
32. Nishioka, J., Ono, T., Saito, H., Sakaoka, K. and Yoshimura, T. 2011. Oceanic iron supply mechanisms which support the spring diatom bloom in the Oyashio region, western subarctic Pacific. *J. Geophys. Res.* 116: C02021, doi:10.1029/2010JC006321.
33. Nishioka, J., Takeda, S., Wong, C.S. and Johnson, W.K. 2001. Size-fractionated iron concentrations in the northeast Pacific Ocean: Distribution of soluble and small colloidal iron. *Mar. Chem.* 74, 157–179.
34. Obata, H. 1997. Development of an automated analytical method of iron in seawater and studies on the behavior of iron in the ocean. Kyoto University. Ph.D. Thesis, 109 pp.
35. Obata, H., Karatani, H. and Nakayama, E. 1993. Automated determination of iron in seawater by chelating resin concentration and chemiluminescence detection. *Anal. Chem.* 65: 1524–1528.
36. Obata, H., Karatani, H., Matsui, M. and Nakayama, E. 1997. Fundamental studies for chemical speciation of iron in seawater with an improved analytical method. *Mar. Chem.* 56: 97–106.
37. Rue, E.L. and Bruland, K.W. 1995. Complexation of iron(III) by natural organic ligands in the central North Pacific as determined by a new competitive ligand equilibration/adsorptive cathodic stripping voltammetric method. *Mar. Chem.* 50: 117–138.
38. Takata, H., Kuma, K., Saitoh, Y., Chikira, M., Saitoh, S., Isoda, Y., Takagi, S. and Sakaoka, K. 2006. Comparing the vertical distribution of iron in the eastern and western North Pacific Ocean. *Geophys. Res. Lett.* 33: L02613, doi:10.1029/2005GL024538.
39. Takata, H., Kuma, K., Iwade, S., Yamajyo, Y., Yamaguchi, A., Takagi, S., Sakaoka, K., Yamashita, Y., Tanoue, E., Midorikawa, T., Kimura, K. and Nishioka, J. 2004. Spatial variability of iron in the surface water of the northwestern North Pacific Ocean. *Mar. Chem.* 86: 139–157.
40. Takeda, S. 2011. Iron and phytoplankton growth in the subarctic North Pacific. *Aqua-BioSci. Monogr.* 4(2): 41–93.
41. Takeda, S. and Obata, H. 1995. Response of equatorial Pacific phytoplankton to subnanomolar Fe enrichment. *Mar. Chem.* 50: 219–227.

42. Tsuda, A., Takeda, S., Saito, H., Nishioka, J., Nojiri, Y., Kudo, I., Kiyosawa, H., Shiomoto, A., Imai, I., Ono, T., Shimamoto, A., Tsumune, D., Yoshimura, T., Aono, T., Hinuma, A., Kinugasa, M., Suzuki, K., Sohrin, Y., Noiri, Y., Tani, H., Deguchi, Y., Tsurushima, N., Ogawa, H., Fukami, K., Kuma, K. and Saino, T. 2003. A mesoscale iron enrichment in the western subarctic Pacific induces large centric diatom bloom. *Science* 300: 958–961.
43. Tsumune, D., Nishioka, J., Shimamoto, A., Takeda, S. and Tsuda, A. 2005. Physical behavior of the SEEDS iron-fertilized patch by sulphur hexafluoride tracer release. *Prog. Oceanogr.* 64: 111-127.
44. Wong, C.S., Johnson, W.K., Sutherland, N., Nishioka, J., Timothy, D.A., Robert, M. and Takeda, S. 2006. Iron speciation and dynamics during SERIES, a mesoscale iron enrichment experiment in the NE Pacific. *Deep-Sea Res. II* 53: 2075–2094.
45. Wu, J., Boyle, E., Sunda, W. and Wen, L.-S. 2001. Soluble and colloidal iron in the oligotrophic North Atlantic and North Pacific. *Science* 293: 847–849.

Original Iron Database

Moore, J.K. and Braucher, O. 2008. Sedimentary and mineral dust sources of dissolved iron to the world ocean. *Biogeosciences* 5: 631–656.

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