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Foreword*

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Introduction

Humanity has always been fascinated by organisms which survive in the most extreme and hostile environments and one such environment, is the hadal depths of the ocean trenches. Life can exist here in a food deprived habitat at enormous pressure and as far from the sun as possible, and yet it thrives. Which kinds of organisms can are found there and where did they come from? Is it a refuge for old phylogenetic lines elsewhere gone extinct or is it a habitat for highly specialized species? Considering that the trenches constitute only a minor part of the deep sea, the trenches have received the lion's share of scientific attention. The first 'Trench' exploration consisted of depth soundings made during the Challenger expedition in 1872-1876, but biological deep sea sampling started in earnest with the Danish Galathea expedition II 1950-1952 which managed to make collections at the deepest parts of the trenches. Even today the trenches hold many mysteries although the focus has changed somewhat from biology to biochemistry, especially carbon sequestration (Shirayama 1997; Takeuchi et al. 1999; Nakamura & Inagaki 2005).

This is the third of a series of systematic papers on the Tanaidacea from Japanese waters and the surrounding deep sea. This study reports on the species collected by the Japanese KH-01-2 expedition to the Kurile-Kamchatka Trench and to the Japanese Trench. This expedition was a continuation of the R/V *Hakuho Maru* trench exploration cruises conducted by the University of Tokyo. These cruises also included surveys of the Japan Trench (cruise KH-81-4, KH-88-4, and KH-91-6), the Ryukyu Trench (cruise KH-88-4 and KH-05-1) and Philippine Trench (cruise KH-88-4 and KH-02-4). Specimens were collected in transects stretching from the surrounding edges (<1000 metres) to the hadal depth of the trench (>7700 metres). The Tanaidacean material was too large and diverse to be handled in a timely fashion by one or two authors thus this multi-authored special volume has been prepared.

Both the Kurile-Kamchatka Trench and the Japan Trench are formed by a subduction zone to the northeast of Japan. On the back arc of such subduction zones, volcanic island groups are formed and, indeed, the Japanese Islands themselves consist of a volcanic arc covering a fragment of continental crust. Both Trenches are part of the 'The Ring of Fire', an almost continuous circle of geologically active crust circling the Pacific Ocean. The Japan Trench stretches from the Bonin Islands east of Japan to the Japanese island of Hokkaido where it joins the Kurile-Kamchatka Trench, which in turn run northeast off the coast of Hokkaido, along the Kurile Islands, to the Kamchatka Peninsula on the coast of Eastern Siberia. To the north it joins the Aleutian Trench which continues eastwards across the northern Pacific to the North American mainland. The maximum depth in the Kurile-Kamchatka trench is 9750 metres and 8.513 metres in the Japan Trench.

Both trenches have been the focus of many biological expeditions and studies, but the Kurile-Kamchatka Trench is the most comprehensibly studied from a biological perspective. The best known expedition to the

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Kurile-Kamchatka Trench was the famous cruise 14 of R/V "Vitjaz' in 1953. The most comprehensive work on the location is probably Zenkevich & Beljaev (1970) - “Fauna of the Kurile-Kamchatka Trench and its environment”. Both vertebrates (Birstein & Vinogradov 1955) and numerous invertebrate taxa have been studied from the Kurile-Kamchatka Trench, including Cnidaria (Naumov 1971), annelids (Kupriyanova 1993), and ascidians (Vinogradova 1969). The studies on the crustaceans are well represented from this trench, especially the copepods (Vinogradov 1955; Heptner 1971) but also several of the peracaridean taxa including: isopods (Birstein 1970), amphipods (France 1993) and even the tanaidaceans (Kudinova-Pasternak 1970).

Several biological studies have also been made in the Japan Trench, including organisms as exotic as deep sea planktonic foramnifera (Tadamichi & Tatsuya 1992), bivalves (Okutani et al. 1999; Fujiwara et al. 2000), gastropods (Okutani & Fujikura 2002), holothurians (Kazuho et al 1993), and tanaid crustaceans (Kudinova-Pasternak 1976). The Japanese Trench is also the location hosting the deepest known chemosynthesis based community (Fujikura et al. 1999).

Even though Kudinova-Pasternak (1970) recorded 32 species of tanaids from the Kurile-Kamchatka Trench (of which 15 were new) and one new species from the Japan Trench (Kudinova-Pasternak (1976), the present study revealed an additional 21 new species. Clearly the trenches have yet to give up their last secrets. Several authors have suggested that the diversity of the Tanaidacea is much higher in the deep sea than in shallow water environments (Gardiner 1975; Wolff 1977; Sieg 1982; Larsen 2005). The results given in table 2, supports this hypothesis. With the new species described herein, 59 tanaid species (53 named) are now known from the Kurile-Kamchatka and Japan Trenches (more than has been recorded in the entire Arctic Ocean). Unfortunately, as often in deep-sea sampling, several additional new species were collected in numbers too small to be properly treated taxonomically.

Material and methods

The material for this study was collected during September 2001 from the Kurile-Kamchatka Trench north of Japan and Japan Trench east of Japan, using ORE Beam Trawls with a 3 or 4 metres opening frame. The material is deposited in the Kitakyushu Museum of Natural History & Human History, Japan.

Abbreviations are as follows: KMNH (Kitakyushu Museum of Natural History & Human History); ZMUC (Zoological Museum, University of Copenhagen); ZMMSU (Zoological Museum of Moscow State University).

For an overview of the older literature on Tanaidacea from Japan see Larsen & Shimomura (2006) and an overview of the shallow water species recorded from Japan is given in Larsen & Shimomura (2006, 2007).

The sampling station list is given in Table 1 and a list of tanaidacean species recorded from the trenches in Table 2.

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TABLE 1 Station List.

Station	Depth, metres	Latitude North	Longitude East	Gear	Date 2001
XR-1(1)	537–546	42°30.84'–42°29.82'	144°01.40'–144°00.85'	3m ORE BT	9/15
XR-2(1)	974–965	42°27.52'–42°26.85'	144°15.47'–144°12.98'	3m ORE BT	9/15
XR-2(2)	973–980	42°27.44'–42°27.00'	144°14.14'–144°13.44'	3m ORE BT	9/15
XR-3	2032–2074	42°27.52'–42°27.13.	145°04.88'–145°02.07'	3m ORE BT	9/16
XR-5	3145–3265	42°23.83'–42°22.06'	145°31.06'–145°27.70'	4m ORE BT	9/16
XR-6	3393–3395	42°21.90'–42°23.50'	145°50.40'–145°51.81'	3m ORE BT	9/16
XR-7	3853–3858	42°12.87'–42°12.10'	145°33.93'–145°32.05'	4m ORE BT	9/17
KCO (HC1)	1172–1219	42°10.79'–42°11.14'	144°11.04'–144°11.61'	3m ORE BT	9/18
XR-8	5695–5664	41°50.08'–41°49.70'	145°37.85'–145°35.18'	4m ORE BT	9/19
XR-9(1)	7238–7300	41°37.39'–41°36.25'	145°51.08'–145°46.86'	3m S-A BT	9/21
XR-9(2)	7138–7100	41°39.14'–41°39.30'	145°57.44'–145°54.94'	3m S-A BT	9/21
XR-9-3	7139–7080	41°38.11'–41°37.40'	146°55.11'–146°52.05'	3m S-A BT	9/23–24
XR-10	5564–5603	41°25.47'–41°26.20'	146°23.42'–146°23.03'	4m ORE BT	9/22
XR-11	5417–5346	42°17.83'–42°11.02'	146°18.96'–146°17.02'	4m ORE BT	9/23
XR-12	5473–5484	41°37.67'–41°37.08'	146°54.19'–146°52.72'	4m ORE BT	9/22–23
TD-1	500	39°36.76'–39°36.13'	142°18.19'–142°18.08'	3m ORE BT	9/25
TD-2	1040–1069	39°31.50'–39°32.03'	142°32.82'–142°33.57'	3m ORE BT	9/25
TD-3	2057–2047	39°14.92'–39°15.79'	143°09.37'–143°10.76'	3m ORE BT	9/25
TD-4	3272–3146	39°27.08'–39°29.15'	143°37.99'–143°38.52'	4m ORE BT	9/26
TD-5	4950–4736	39°16.98'–39°14.88'	143°49.66'–143°47.37'	4m ORE BT	9/26
TD-6	5270–5309	39°08.98'–39°11.05'	143°56.19'–143°57.39'	4m ORE BT	9/28
TD-7	7340–7433	38°47.93'–38°45.87'	144°08.07'–144°07.89'	3m S-A BT	9/30
TD-8	5762–5733	39°15.54'–39°17.01'	144°45.37'–144°42.46'	4m ORE BT	9/29

TABLE 2. Tanaidacean taxa recorded from the Kurile-Kamchatka Trench and Japan Trench.

Taxa	Authority	Reference	Depth, metres
Apseudomorpha,			
Family Apseudidae			
Apseudes vitjazi	Kudinova-Pasternak, 1970	Kudinova-Pasternak 1970	5050–5095
Carpoapseudes spinigena sp. n.	Bamber, 2007	This issue	965–974
Carpoapseudes varindex sp. n.	Bamber, 2007	This issue	3145–3265
Fageapseudes brachyomos sp. n.	Bamber, 2007	This issue	5473–5733
Neotanaidomorpha,			
Family Neotanaidae			
Neotanais hadalis	Wolf, 1956	Kudinova-Pasternak 1970 (as *N. serratispinosus*)	4895–5240
Neotanais tuberculatus	Kudinova-Pasternak, 1970	Kudinova-Pasternak 1970	4840–5876
Neotanais kuroshio sp. n.	Bamber, 2007	This issue	5733–5762
Neotanais oyashio sp. n.	Bamber, 2007	This issue	5733–5762
Neotanais sp. indet.	Bamber, 2007	This issue	5762–5733
Tanaidomorpha,			
Family Agathotanaidae			
Agathotanais hadalis sp. n.	Larsen, 2007	This issue	5473–5484
Agathotanais cf. *ingolfi*	Hansen, 1913	Kudinova-Pasternak 1970	1281–5620 (In the trenches 4895–5240)
Agathotanais splendidus	Kudinova-Pasternak, 1970	Kudinova-Pasternak 1970	5441
Paragathotanais abyssorum sp. n.	Larsen, 2007	This issue	5733–5762
Paranarthrura vitjazi	Kudinova-Pasternak, 1970	This issue	3080–5762
Paranarthrura zevinae	Kudinova-Pasternak, 1970	Kudinova-Pasternak 1970	3620–5240
Family Anarthruridae			
Anarthruropsis langi	Kudinova-Pasternak, 1976	Kudinova-Pasternak 1976	7795–8015
Siphonolabrum tenebrosus sp. n.	Bird	This issue	3146–7433
Family Colletteidae			
Collettea cf. *cylindrata*	(G.O. Sars, 1882)	Kudinova-Pasternak 1970	40– 6710 (In the trenches 4895–6135)
Tumidochelia cf *dentifera*	(G.O. Sars, 1896)	Kudinova-Pasternak 1970	60– 6225 (In the trenches 4895)
Leptognathiopsis langi	(Kudinova-Pasternak, 1970)	This issue	3146–7433
Family Leptocheliidae			
Heterotanoides ornatus	Kudinova-Pasternak, 1976	Kudinova-Pasternak, 1976	7370
Family Leptognathiidae			

Biarticulata greveae	Kudinova-Pasternak, 1976	Kudinova-Pasternak 1976	8185–8400
Biarticulata parelegans	(Kudinova-Pasternak, 1970)	Kudinova-Pasternak 1970	5240
Biarticulata tuberculata	(Hansen, 1913)	Kudinova-Pasternak 1970	2194– 4895 (In the trenches 4895)
Forcipatia rotundicauda	(Kudinova-Pasternak, 1970)	Kudinova-Pasternak 1970	3146–4945
Leptognathia aneristus sp. n.	Bird, 2007	This issue	3853–7433
Leptognathia breviremis	(Lilljeborg, 1864)	Kudinova-Pasternak 1970	11–7295 (In the trenches 4845–7295)
Family Pseudotanaidae			
Cryptocope arctica	Hansen, 1913	Kudinova-Pasternak 1970	18– 6710 (In the trenches 4895–6710)
Cryptocopoides pacificus sp. n.	McLelland	This issue	3145–3265
Pseudotanais nipponicus sp. n.	McLelland	This issue	3853–3858
Pseudotanais vitjazi	Kudinova-Pasternak, 1966	Kudinova-Pasternak 1970	4260–6065
Family Tanaidae			
Protanais birsteini	(Kudinova-Pasternak, 1970)	Kudinova-Pasternak 1970	6090–6135
Family Typhlotanaidae			
Larsenotanais kamchatikus sp. n.	Błażewicz-Paszkowycz, 2007	This issue	3145–3265
Meromonacantha setosa	(Kudinova-Pasternak, 1966)	Kudinova-Pasternak 1970	4895–6051
Peraeospinosus magnificus	(Kudinova-Pasternak, 1970)	Kudinova-Pasternak 1970	3610–4895
Peraeospinosus rectus	(Kudinova-Pasternak, 1966)	Kudinova-Pasternak 1970	3610–7370
Torquella angularis	(Kudinova-Pasternak, 1966)	Kudinova-Pasternak 1966, This issue	5473–6065 (In the trenches 5473–5695)
Typhlotanais compactus	Kudinova-Pasternak, 1966	Kudinova-Pasternak 1970, This issue	1550–6135 (In the trenches 4895–5095)
Typhlotanais grandis	Hansen, 1913	Kudinova-Pasternak 1970	1265– 6135 (In the trenches 4945–6135)
Typhlotanais kussakini	Kudinova-Pasternak, 1970	Kudinova-Pasternak 1970	2920–6135 (In the trenches 5240–6135)
Typhlotanais longicephala	Kudinova-Pasternak, 1970	Kudinova-Pasternak 1970	4895–5340
Typhlotanais mucronatus	Hansen, 1913	Kudinova-Pasternak 1970	1620–6710 (In the trenches 4840–6710)
Family *incertae sedis*			
Akanthophoreus crassicauda sp. n.	Bird, 2007	This issue	5473–5484

Akanthophoreus cf *gracilis*	(Krøyer, 1842)	Kudinova-Pasternak 1970 (as *Leptognathia gracilis*)	5–6710 (In the trenches 4895–6710)
Akanthophoreus imputatus sp. n.	Bird, 2007	This issue	5473–5762
Akanthophoreus cf *longiremis*	(Lilljeborg, 1864)	Kudinova-Pasternak 1977**	10–9174 (In the trenches 6770–6890)
Akanthophoreus undulatus sp. n.	Bird, 2007	This issue	3146–3858
Akanthophoreus sp.KK#1	Bird, 2007	This issue	3272–3146
Akanthophoreus sp.KK#3	Bird, 2007	This issue	5733–7433
Akanthophoreus sp.KK#5	Bird, 2007	This issue	3145–3265
Chauliopleona cf *armata*	(Hansen, 1913)	Kudinova-Pasternak 1970 (as *Leptognathia armata*)	530–8006 (In the trenches 3385–4895)
Chauliopleona spp.	Bird, 2007	This issue	5473–5484
Expina typica	Lang, 1968	Kudinova-Pasternak 1970	1687–4895 (In the trenches 2400–4895)
*Leptognathia birsteini**	Kudinova-Pasternak, 1965	Kudinova-Pasternak 1970	4895–7657 (In the trenches 4895–4945)
*Leptognathia microcephala**	Kudinova-Pasternak, 1977**	This issue	5473– 6330 (In the trenches 5473–5484)
*Leptognathia vinogradovoae**	Kudinova-Pasternak, 1970	Kudinova-Pasternak 1970	5240
*Leptognathia zenkevitchi**	Kudinova-Pasternak, 1970	Kudinova-Pasternak 1970	4945
Leptognathioides sp.KK#1	Bird, 2007	This issue	5473–5484
Robustochelia robusta	(Kudinova-Pasternak, 1970)	Kudinova-Pasternak 1970	2600–6850 (In the trenches 4945–5240)

* These species were removed from *Leptognathia* by Larsen & Shimomura 2007 but are not given replacement family designation.

** Listed as ‘1977’ by *Trudy Instituta Okeanologij*, and with 1977 printed on the cover, but did not physically appear in print until 1978.