Excavations at Emeelt Tolgoi Site: The third Report on Joint Mongolian-Japanese Excavations in Outer Mongolia

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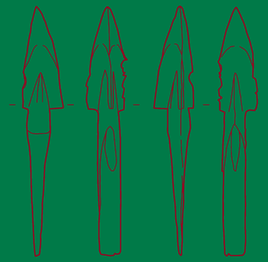

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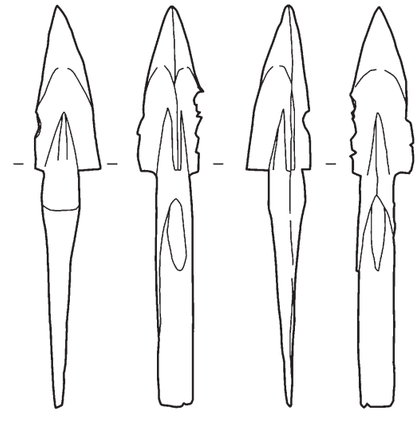

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Preface

Kazuo Miyamoto

This report presents the results of comprehensive excavations at Emeelt Tolgoi Site in Bayanhongor Aimag (Fig. 1). The excavations at Emeelt Tolgoi Site were carried out under a program of the Japan Society for the Promotion of Science (JSPS).

The Joint Mongolian-Japanese research groups excavated at Daram (Fig. 1) Site, Henty Aimag from 2009 to 2011 (Miyamoto & Obata ed. 2016), at Tevshi Site, Uvur Hangai Aimag (Fig. 1) in 2012 (Miyamoto & Obata ed. 2016) and at Bor Ovoo Site, Bayanhongor Aimag (Fig. 1) in 2013 (Miyamoto ed. 2017). The results of these excavations could help explain the processes by which slab graves changed over time (Miyamoto 2016).

Having finished excavations at Bor Ovoo Site, the following title was proposed for a JSPS research project running from 2015 to 2018 called, "Interdisciplinary Research on the Formation Process of Herding Societies in the Eastern Eurasian Grasslands," of which Prof. Kazuo Miyamoto (The Faculty of Humanities, Kyushu University) is representative. A research project group was established under a project entitled, "ANCIENT MONGOL KHUN PROJECT, 2015 - 2018," which was initiated under the Joint Mongolian-Japanese Research Project. This research group consisted of members of the Kyushu University Advanced Asian Archeological Center and the Institute of History and Archaeology, Mongolian Academy of Science. As part of this project, Khayr Kharaach Site, Govi Altai Aimag (Fig. 1) was excavated from July to August 2015. Two graves and two ritual stone structures belonging to the Bronze Age were excavated at this site (Miyamoto ed. 2017).

Through excavations at Bor Ovoo Site and at Khyar Kharaach Site, we gained a clearer picture of a section of the contents of Khirigsuur, which were distributed in the western Mongolian Plateau simultaneously with Stone-Slab graves in the eastern Mongolian Plateau. In order to obtain a fuller understanding of the processes of change which occurred with Khirigsuur, we decided to excavate at Emeelt Tolgoi Site (Fig. 2), which possesses a very similar burial system to that of Khyar Kharaach Site. In addition, Emeelt Tolgoi Site not only features Khirigsuur burials but also figured graves. Because of this coexistence of Khirigsuur and figured graves, we conducted surveys in the hope of finding keys to understanding the relationship between Khirigsuur and Stone-slab burial culture. This is the reason why we selected Emeelt Tolgoi Site along with excavations at Khyar Kharaach Site.

The excavations at Emeelt Tolgoi Site were also conducted under the project entitled, "ANCIENT MONGOL KHUN PROJECT, 2015 - 2018," which was initiated under the Joint Mongolian-Japanese Research Project. This research group consisted of members of the Kyushu University Advanced Asian Archeological Center and the Institute of History and Archaeology, Mongolian Academy of Science. As part

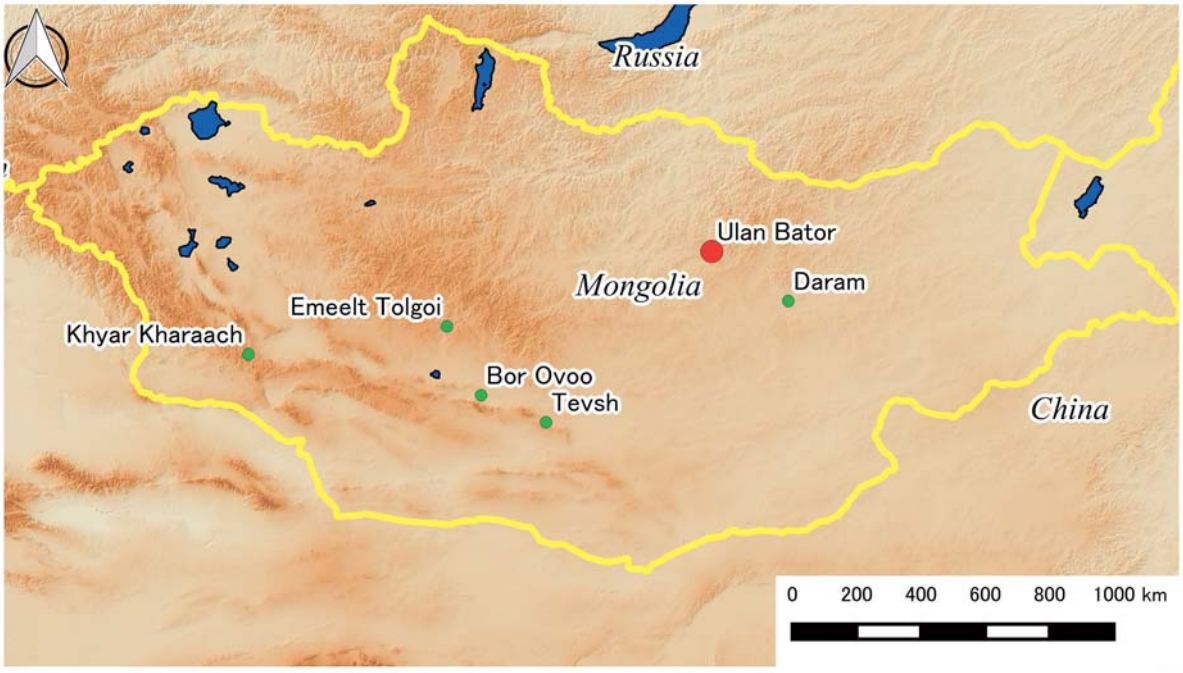


Fig.1 Location of excavations by Mongolian and Japanese joint research group

of this project, Emeelt Tolgoi Site was excavated in August 2016 and 2017, a total of two seasons (Fig. 2). One Khirigsuur, two round graves, two square graves and one figured grave belonging to the Bronze Age were excavated at this site.

These research projects were interdisciplinary in nature, covering not only archaeology but also physical anthropology and chemical archaeology. One of the goals of the research was to investigate the mobility of Bronze Age herding peoples in Mongolia. As such, Strontium analysis on human skeletal remains from Emeelt Tolgoi Site was conducted. Physical anthropological analysis and radiocarbon dating on the skeletal remains were also conducted. This interdisciplinary research was carried out with the goal of shedding light on the movement of groups of herding peoples and on the development of herding societies in Bronze Age Mongolia, as well as establishing a burial chronology for Khirigsuur culture of the Bronze Age in the western and middle Mongolian Plateau.

Fig.2 View of Emeelt Tolgoi Site

1 Excavations at Emeelt Tolgoi Site

Kazuo Miyamoto, Yoshinori Tajiri, Keita Matsumoto, Tsend Amgalantugs, Natsag Batbold, Dashzeveg Bazargur and Lhagvadorj Delgermaa

1. Purposes and location of the research site

Through excavations at Khayr Kharaach Site conducted in 2016 (Miyamoto ed. 2017), we excavated a round grave and a square grave, both Sagsai-shaped graves with four oval stones (Гантулга 2016). When we considered the locality of grave customs in the Mongolian Plateau, it became apparent that we needed a chronology of grave systems in western Mongolia. In order to resolve this issue, in 2014 we applied to undertake a research project of the Japan Society for the Promotion of Science (JSPS) entitled, "Interdisciplinary Research on the Formation Process of Herding Societies in the Eastern Eurasian Grasslands," which was accepted in 2015. Based on this JSPS Grant, the Kyushu University Advanced Asian Archaeological Research Center made an agreement on the "ANCIENT MONGOL KHUN PROJECT 2015 - 2018," a joint Mongolian-Japanese research project with the Institute of History and Archaeology, Mongolian Academy of Sciences. Following this, we conducted excavations at Emeelt Tolgoi Site. The excavations at Emeelt Tolgoi Site were conducted on a joint basis by the Kyushu University Advanced Asian Archaeology Research Center and the Institute of History and Archaeology, Mongolian Academy of Sciences from 27th July to 5th August, 2016. Professor Kazuo Miyamoto, Associate professor Yoshinori Tajiri, Dr. Keita Matsumoto, Mr. Masahiro Fukunaga and Mr. Toshimitsu Ozawa from Kyushu University, and Mr. Tsend Amgalantugus, Mr. Natsag Batbold and Ms. Lhagvadorj Delgermaa from the Institute of History and Archaeology, Mongolian Academy of Sciences participated in excavations at this site. We excavated Grave No. 30 and Grave No. 40 on this occasion. Following this, we continued excavations at Emeelt Tolgoi Site in the second year. These second excavations at Emeelt Tolgoi Site were conducted on a joint basis by Kyushu University Advanced Asian Archaeology Research Center and the Institute of History and Archaeology, Mongolian

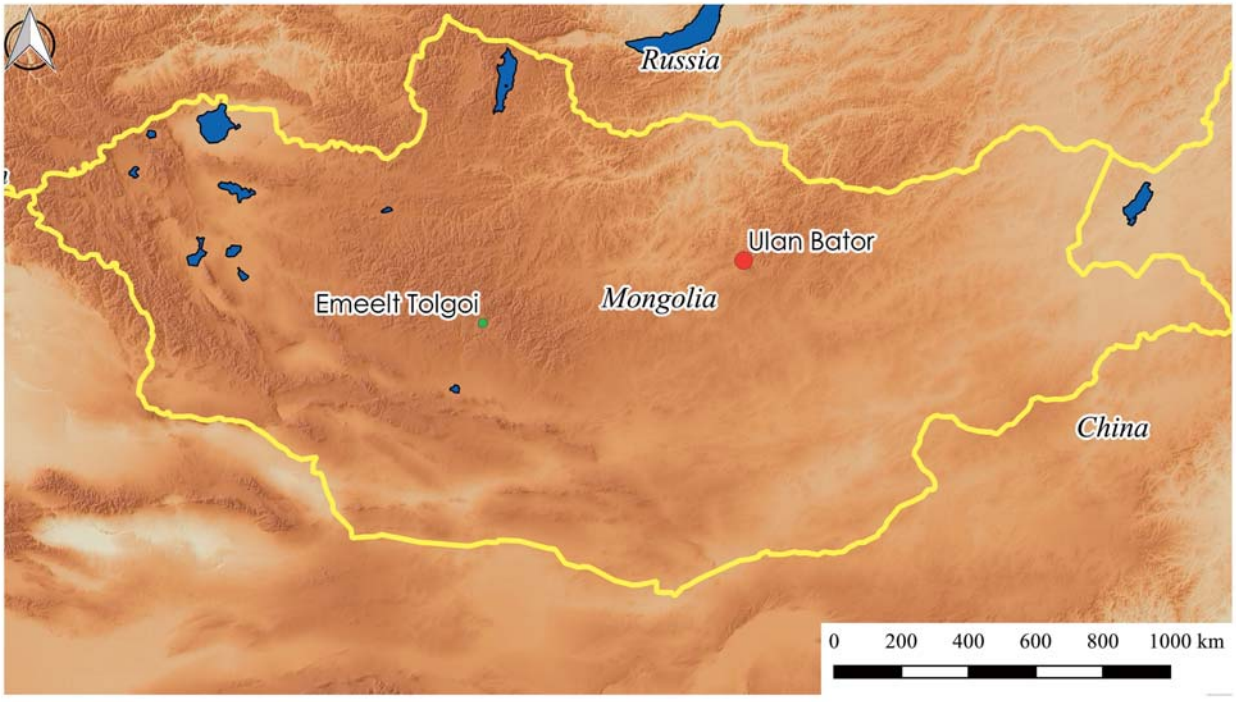


Fig.3 Location of Emeelt Tolgoi Site

Fig.4 Distribution of graves at Area No.1of Emeelt Tolgoi Site

Academy of Sciences from 9th to 23rd August, 2017. Professor Kazuo Miyamoto, Associate professor Yoshinori Tajiri, Dr. Keita Matsumoto, Mr. Masahiro Fukunaga and Mr. Toshimitusu Ozawa from Kyushu University, and Mr. Tsend Amgalantugus, Mr. Dashzeveg Bazargur and Ms. Lhagvadorj Delgermaa from the Institute of History and Archaeology , Mongolian Academy of Sciences participated in excavations at this site. We excavated Grave No.18, Grave No.44, Grave No. 49 and Grave No. 82 in the second year.

Emeelt Tolgoi Site is located on the southern slope of the Khangai Mountains in Galuut Som, Bayanhongor Aimag in Mongolia (Fig. 3). The site is situated on the southern slope of Mt. Emeelt Tolgoi, and the distribution of the site continues to the back of Mt. Emeelt Tolgoi and on the westward mountains (Fig. 2). We divided Emeelt Tolgoi Site into two sections: Area No. 1 and Area No. 2. Area No. 1 is located on Mt. Emeelt Tolgoi, on the back of this mountain (Fig. 4). Graves are concentrated from the top of mountain to the plains via the southern slope of the mountain. We chose this area as the target for our excavations. Area No. 2, located to the west of Mt. Emeelt Tolgoi, indicates another mountain, where graves are concentrated from the top of the mountain to the southern slope (Fig. 5).

In our general survey of this site, we focused on archaeological evidence suggesting that there are not only Khirigsuur but also Sagsai-shaped graves consisting of round graves and square graves. In addition, this site also features figured graves from the stone-slab grave burial culture. The grave composition in this cemetery is very similar to that of Maihan Tolgoi Site (Yerööl-Erdene et al. 2015). The purpose of our joint excavations was to ascertain the relationship among Khirigsuur, Sagsai-shaped graves and stone-slab graves through excavations.

2. Arrangement of archaeological features at Emeelt Tolgoi Site

Emeelt Tolgoi Site is divided into two areas based on two mountains: Area No. 1 and Area No. 2 (Fig. 6, Table 1). All of graves in Area No.1 (Table 1) is shown in Fig. 9 to Fig. 17. This site comprises of Khirigsuur, round graves, square graves, figured graves and ritual stone structures. Some of these have recently been referred to as Sagsai-shaped graves (Гантулга 2016). In this case, Sagsai-shaped graves are defined as graves having four large oval stones on four sides of the structure. Sagsai-shaped graves are seen among

Fig.5 Distribution of graves at Area No.2 of Emeelt Tolgoi Site

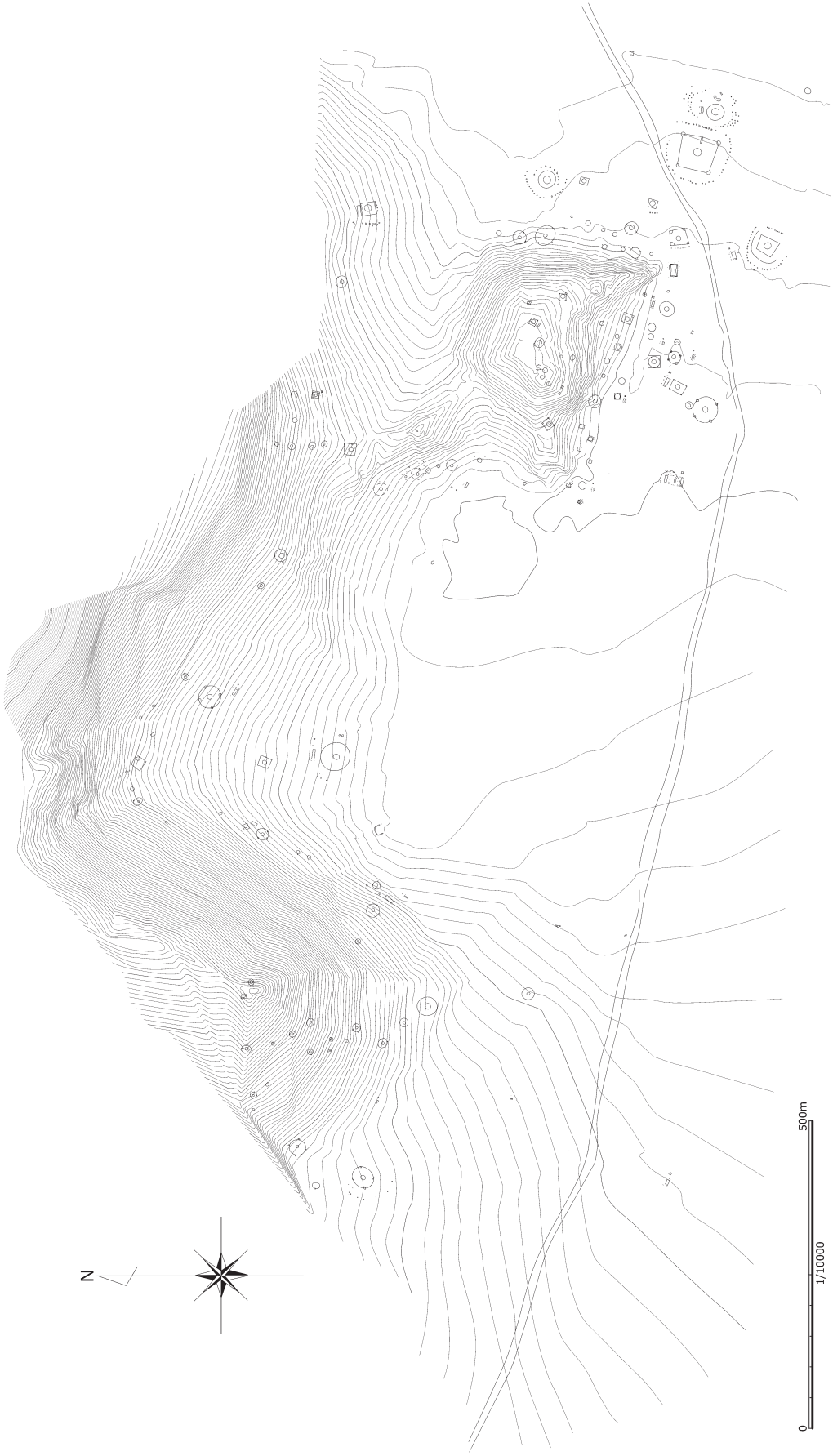


Fig.6 Cemeteries of Emeelt Tolgoi Site

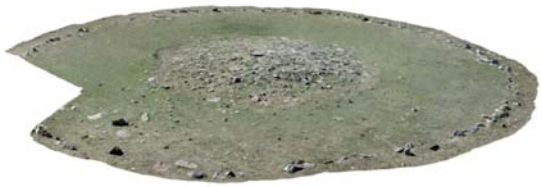
Fig.7 Grave No.18, No. 19 and No. 20 of Emeelt Tolgoi Site

Fig.8 Ritual stone structure No. 31 and grave No.32 of Emeelt Tolgoi Site

Table 1 Grave list of Emeelt Tolgoi Site

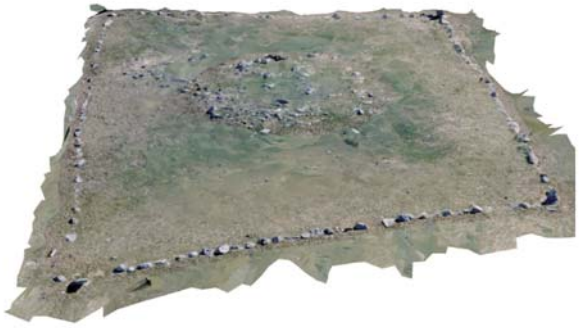
Unit	Grave No.	A Kind of grave	Latitude (N)	Longtitude (E)	Hight (m)	Size (m)
No.1	No.1	Round Khirigsuur	46.47468	99.53522	1980.1	ϕ27(10)m
No.1	No.2	Ritual rectangular stone construction	46.47475	99.53523	1980.4	7×10m
No.1	No.3	Square Khirigsuur	46.47476	99.5349	1983.4	55×58(13)m
No.1	No.4	Square Khirigsuur	46.47435	99.53423	1983.6	25×30(13)m
No.1	No.5	Ritual rectangular stone construction	46.47453	99.53414	1981.8	10×14m
No.1	No.6	Square Khirigsuur	46.47483	99.53423	1981.6	25×30(8)m
No.1	No.7	Square Khirigsuur	46.47498	99.53449	1982.3	12×15(8)m
No.1	No.8	Round Khirigsuur	46.47508	99.53429	1983.9	ϕ23(8)m
No.1	No.9	Round grave	46.47576	99.53418	1949.3	ϕ8m
No.1	No.10	Round Khirigsuur	46.47565	99.53416	1986.8	ϕ22(6)m
No.1	No.11	Round Khirigsuur	46.47552	99.53418	1988.2	ϕ35(5)m
No.1	No.12	Square grave	46.47544	99.53425	1984.5	2×2m
No.1	N0.13	Round grave with four corner stones	46.47523	99.53426	1983.7	ϕ6m
No.1	No.14	Round grave with four corner stones	46.47516	99.53423	1984.1	ϕ8m
No.1	No.15	Round grave with four corner stones	46.47521	99.53413	1986.6	ϕ8m
No.1	No.16	Round Khirigsuur with four corner stones	46.47505	99.53411	1986.8	ϕ17.5m
No.1	No.17	Round grave with four corner stones	46.47496	99.5341	1985.3	ϕ5m
No.1	No.18	Figured grave	46.47481	99.53398	1928.2	11.25×18.9m
No.1	N0.19	Round grave	46.47486	99.53382	1986	ϕ5m
No.1	No.20	Round Khirigsuur with four corner stones	46.47486	99.53369	1987.2	ϕ25(7)m
No.1	No.21	Ritual rectangular stone construction	46.47494	99.53372	1986.2	7×13m
No.1	No.22	Square Khirigsuur	46.47506	99.5336	1991.5	17×18(7)m
No.1	No.23	Round grave with four corner stones?	46.47511	99.53344	1993.4	ϕ7m
No.1	No.24	Round grave with four corner stones	46.47493	99.53354	1988.8	ϕ13m
No.1	No.25	Round grave with four corner stones	46.47493	99.53347	1989.9	ϕ9m
No.1	No.26	Ritual rectangular stone construction	46.47487	99.53343	1988.6	5×8m
No.1	No.27	Round grave with four corner stones?	46.47479	99.53345	1988.9	ϕ10m
No.1	No.28	Round Khirigsuur with four corner stones	46.47481	99.53333	1988.7	ϕ20(7)m
No.1	No.29	Ritual rectangular stone construction	46.47471	99.53333	1988	4×9m
No.1	No.30	Round Khirigsuur with four corner stones	46.47483	99.53314	1988.9	18.75(7.5)m
No.1	No.32	Square Khirigsuur with four corner stones	46.47477	99.5331	1988.3	18×20(8)m
No.1	No.33	Round Khirigsuur with four corner stones	46.4747	99.53297	1988.5	ϕ13(5)m
No.1	No.34	Round Khirigsuur with four corner stones	46.47462	99.53294	1989	ϕ32(9)m
No.1	No.35	Round grave with four corner stones	46.47508	99.53311	1981	ϕ10m
No.1	No.36	Round grave with four corner stones	46.47511	99.53336	1991.6	ϕ13m
No.1	No.37	Round grave with four corner stones	46.47521	99.53354	1997.3	ϕ7m
No.1	No.38	Round grave with four corner stones	46.47516	99.53326	1992	ϕ10m
No.1	No.39	Round grave with four corner stones	46.47517	99.53314	1991.9	ϕ6m
No.1	No.40	Round grave with four corner stones	46.47508	99.53299	1989.3	ϕ10m
No.1	No.41	Ritual rectangular stone construction	46.47505	99.53297	1988.2	5×7m
No.1	No.42	Round Khirigsuur with four corner stones	46.47521	99.53294	1990.8	21(8)m
No.1	No.43	Round grave with four corner stones	46.47526	99.53274	1992.1	ϕ8m
No.1	No.44	Round grave with four corner stones	46.47522	99.53266	1985.6	6×7.5m
No.1	No.45	Round grave with four corner stones	46.47527	99.53257	1991.2	ϕ6.5m
No.1	No.46	Ritual rectangular stone construction	46.4752	99.53248	1989.5	4×5m
No.1	No.47	Round grave with four corner stones	46.47523	99.53228	1983.7	ϕ13m
No.1	No.48	Round grave with four corner stones	46.47533	99.53229	1991.1	ϕ8m
No.1	No.49	Square grave	46.47527	99.53217	1988.7	3.3×3.6m
No.1	No.50	Ritual rectangular stone construction	46.47517	99.53227	1986.7	6×7m
No.1	N0.51	Ritual rectangular stone construction	46.4748	99.53239	1988.6	11×15m
No.1	No.52	Ritual rectangular stone construction	46.47471	99.53238	1987.3	11×15m
No.1	No.53	Ritual rectangular stone construction	46.47465	99.53237	1986.9	10×15m
No.1	No.54	Round grave with four corner stones	46.47553	99.53228	1990.7	5×5m
No.1	No.55	Round grave with four corner stones	46.47578	99.53241	1988.9	5×7m
No.1	No.56	Round Khirigsuur	46.47536	99.53462	1985.8	12×14(8)m
No.1	No.57	Round Khirigsuur	46.47554	99.53461	1984.6	ϕ29(13)m
No.1	No.58	Square grave	46.47515	99.53562	1989	4×6m
No.1	No.59	Round grave with four corner stones?	46.47499	99.53378	1988.8	ϕ6m
No.1	No.60	Round grave	46.47421	99.53543	1979.5	ϕ9m
No.1	No.61	Square grave	46.4754	99.53435	1983.9	2×3m
No.1	No.62	Round grave with four corner stones	46.47521	99.53413	1986.8	ϕ7m
No.1	No.63	Round grave with four corner stones	46.47515	99.53423	1984.4	ϕ8m
No.1	N0.64	Square grave	46.47486	99.534	1986.9	ϕ6m
No.1	No.65	Square Khirigsuur with four corner stones	46.47541	99.53373	2016.1	12×12(6)m
No.1	No.66	Square grave with four corner stones	46.47558	99.53366	2020.6	5×6m
No.1	No.67	Square Khirigsuur with four corner stones	46.47556	99.53352	2026.2	11×11(7)m
No.1	No.68	Ritual rectangular stone construction	46.47551	99.53351	2024	2×7m
No.1	No.69	Round Khirigsuur	46.47551	99.53336	2027	ϕ15(9)m
No.1	No.70	Round grave	46.4754	99.53326	2020.7	ϕ6m
No.1	No.71	Round grave	46.47534	99.53326	2014.3	ϕ8m
No.1	No.72	Round grave with four corner stones	46.47551	99.53317	2032.1	ϕ7m
No.1	No.73	Round grave	46.47547	99.53315	2028.2	ϕ8m
No.1	No.74	Round grave	46.47549	99.5331	2029.4	ϕ6.5m
No.1	No.75	Round grave	46.47545	99.53305	2028.5	ϕ5m

No.1	No.76	Round grave with four corner stones	46.47538	99.53303	2019.8	ϕ4m
No.1	No.77	Round grave with four corner stones	46.47538	99.53298	2019.2	ϕ3m
No.1	No.78	Square Khirigsuur with four corner stones	46.47544	99.53274	2005.6	13×15(7)m
No.1	No.79	Square Khirigsuur	46.48047	99.53432	2000.1	12×12m
No.1	No.80	Figured grave	46.48051	99.5343	2001.6	12×18m
No.1	No.81	Round grave with four corner stones	46.48058	99.53375	2003.6	ϕ19m
No.1	No.82	Square grave with four corner stones	46.48068	99.53287	2021.3	9.75×12m
No.1	No.83	Round grave	46.4808	99.53286	2029	ϕ13m
No.1	No.84	Square Khirigsuur	46.48048	99.53247	2016.7	20×20(7)m
No.1	No.85	Round Khirigsuur	46.48063	99.5325	2022	ϕ11(5)m
No.1	No.86	Round Khirigsuur	46.48069	99.53248	2026.3	ϕ13(4)m
No.1	No.87	Round grave	46.4808	99.53247	2031.8	ϕ13m
No.1	No.88	Round grave with four corner stones	46.48087	99.53248	2038.8	ϕ6m
No.1	No.89	Round grave with four corner stones	46.48079	99.53267	2030.6	ϕ8m
No.1	No.101	Round Khirigsuur with four corner stones	46.47593	99.53237	1994.4	ϕ18(5)m
No.1	No.102	Round grave	46.48	99.53236	1995.4	ϕ6m
No.1	No.103	Round grave with four corner stones	46.48006	99.53233	1995.5	ϕ8m
No.1	No.104	Round Khirigsuur with four corner stones	46.48008	99.53236	1997.4	ϕ10(2)m
No.1	No.105	Round Khirigsuur with four corner stones	46.4801	99.53229	1995.7	ϕ18(6)m
No.1	No.106	Round Khirigsuur with four corner stones	46.48016	99.53226	1997.5	ϕ10(3)m
No.1	No.107	Round Khirigsuur with four corner stones	46.48029	99.53215	1999.9	ϕ21(6.5)m
No.2	No.108	Round Khirigsuur with four corner stones	46.48079	99.53155	2024.8	ϕ19(10)m
No.2	No.109	Round grave with four corner stones	46.48087	99.53132	2021.6	ϕ12m
No.2	No.110	Round Khirigsuur	46.48038	99.53007	1996.5	ϕ47(10)m
No.2	No.111	Square Khirigsuur	46.48074	99.52598	1996.4	16×18(7)m
No.2	No.112	Round Khirigsuur	46.48107	99.53042	2017.2	ϕ35(8)m
No.2	No.113	Round grave with four corner stones?	46.48138	99.53032	2029.2	ϕ12m
No.2	No.114	Round grave	46.48135	99.53008	2025.4	ϕ4m
No.2	No.115	Round grave	46.48142	99.52589	2028.3	ϕ5m
No.2	No.116	Square grave with four corner stones	46.48147	99.52578	2030.9	6×6m
No.2	No.117	Round grave with four corner stones	46.48123	99.52543	2028	ϕ7m
No.2	No.118	Round grave with four corner stones?	46.48095	99.52554	2012.6	ϕ10.5m
No.2	No.119	Square grave with four corner stones	46.4808	99.52546	2007.8	7×10m
No.2	No.120	Round Khirigsuur	46.48071	99.52543	2005.6	ϕ20(7)m
No.2	No.121	Round grave with four corner stones	46.48052	99.52531	2004.8	ϕ6m
No.2	No.122	Round grave with four corner stones	46.48046	99.52528	2001.7	ϕ7m
No.2	No.123	Round grave with four corner stones	46.48015	99.52512	1996.1	ϕ11m
No.2	No.124	Round grave with four corner stones	46.48009	99.52513	1994.2	ϕ13m
No.2	No.126	Round grave with four corner stones	46.48015	99.52469	2017.9	ϕ9m
No.2	No.127	Round Khirigsuur with four corner stones	46.48009	99.52493	2000.1	ϕ23(6)m
No.2	No.128	Ritual rectangular stone construction	46.48001	99.52503	1995.4	6×15m
No.2	No.129	Ritual rectangular stone construction	46.47593	99.52508	1991.9	4×7m
No.2	No.130	Turkic grave	46.4751	99.52497	1994.7	3×4m
No.2	No.131	Turkic grave	46.47511	99.52497	1995.8	3×4m
No.2	No.132	Turkic grave	46.47513	99.52498	1995.8	2×3m
No.2	No.133	Round Khirigsuur	46.47523	99.52446	2001.8	ϕ22(6)m
No.2	No.134	Round Khirigsuur with four corner stones	46.47575	99.52426	2013.2	ϕ31(9)m
No.1	No.135	Ritual rectangular stone construction	46.47583	99.53222	1987.3	5×8m
No.1	No.136	Ritual rectangular stone construction	46.47592	99.53219	1988.3	3×3m
No.2	No.137	Ritual rectangular stone construction	46.48049	99.5301	2000.9	8×20m
No.2	No.138	Ritual rectangular stone construction	46.48094	99.53048	2016.1	7×15m
No.2	No.139	Square Khirigsuur	46.48139	99.5259	2032	18×19(6)m
No.2	No.140	Round grave with four corner stones	46.4815	99.52573	2037.1	ϕ7m
No.2	No.141	Round grave with four corner stones	46.48141	99.52555	2035.1	ϕ6m
No.2	No.142	Round grave with four corner stones?	46.48138	99.52556	2032.4	ϕ12m
No.2	No.143	Round grave with four corner stones	46.48123	99.52542	2030.9	ϕ4m
No.2	No.144	Ritual rectangular stone construction	46.48078	99.52549	2008.7	10×10m
No.2	No.145	Round grave with four corner stones	46.48069	99.52427	2087.2	ϕ12m
No.2	No.146	Round Khirigsuur with four corner stones	46.48067	99.52377	2072.7	ϕ10(4)m
No.2	No.147	Ritual rectangular stone construction	46.48073	99.52369	2070.3	4×4m
No.2	No.148	Round grave with four corner stones	46.48044	99.52391	2062.5	ϕ14m
No.2	No.149	Round grave	46.48054	99.52384	2064.8	ϕ6m
No.2	No.150	Round grave with four corner stones	46.48036	99.52402	2053.1	ϕ10m
No.2	No.151	Round grave with four corner stones	46.48034	99.5238	2046	ϕ12m
No.2	No.152	Round Khirigsuur with four corner stones	46.48024	99.52382	2037.5	ϕ7(2)m
No.2	No.153	Round grave with four corner stones	46.48016	99.52392	2031.6	ϕ7m
No.2	No.154	Round Khirigsuur with four corner stones	46.48011	99.52402	2028.6	ϕ13(4)m
No.2	No.155	Round grave with four corner stones	46.47596	99.52393	2018.4	ϕ15m
No.2	No.156	Round Khirigsuur	46.47587	99.5241	2013	ϕ15(4)m
No.2	No.157	Round grave	46.48024	99.52382	2040.9	ϕ6m
No.2	No.158	Round grave with four corner stones	46.48036	99.52403	2056.8	ϕ14m
No.2	No.159	Round grave	46.48054	99.52383	2067.2	ϕ5m
No.2	No.160	Round Khirigsuur with four corner stones	46.48035	99.52307	2031.6	ϕ26(5)m
No.2	No.161	Round grave with four corner stones	46.48023	99.5228	2027.6	ϕ10m
No.2	No.162	Round Khirigsuur with four corner stones	46.47599	99.5229	2024.1	ϕ33(7)m
No.2	No.163	Ritual rectangular stone construction	46.47596	99.52348	2020.9	4×7m
No.2	No.164	Ritual rectangular stone construction	46.4744	99.52312	2000.3	5×10m



1 Grave No. 1

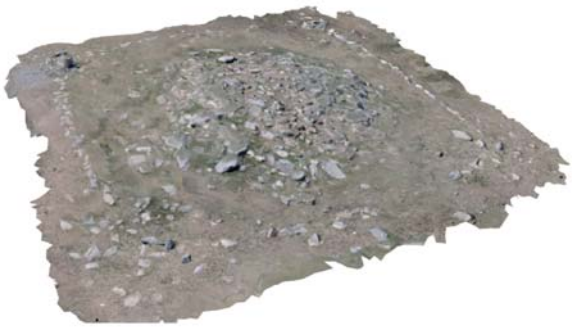
2 Grave No. 2



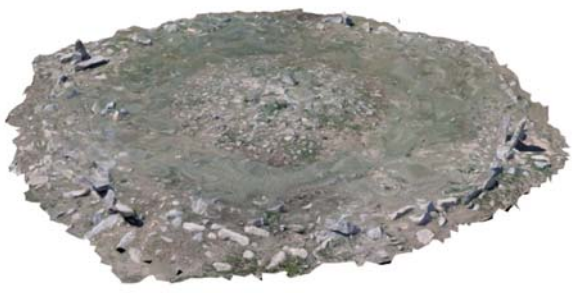
3 Grave No. 4

4 Grave No. 5

5 Grave No. 6



6 Grave No. 7

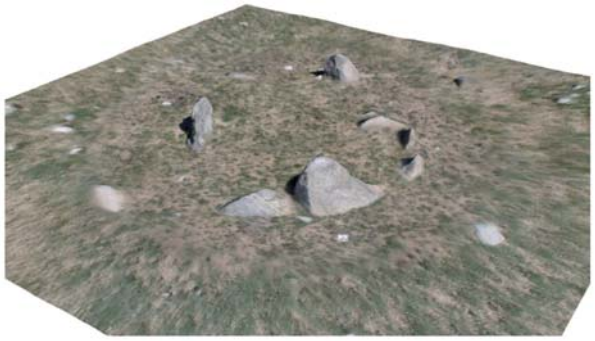


7 Grave No. 8

8 Grave No. 9

Fig.9 View of graves at Area No.1 of Emeelt Tolgoi Site

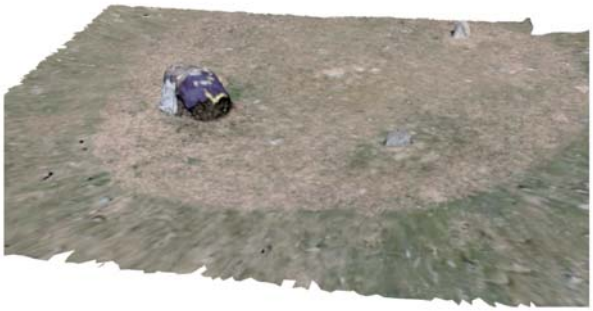
1 Grave No. 10



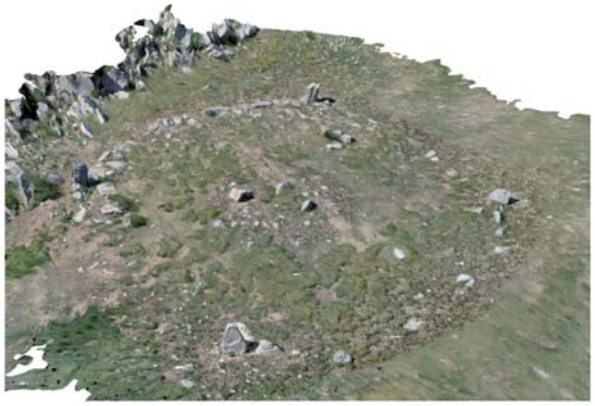
2 Grave No. 12

3 Grave No. 13

4 Grave No. 14



5 Grave No. 15



6 Grave No. 16

7 Grave No. 17

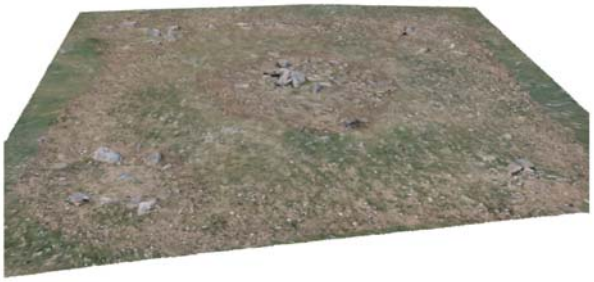
8 Grave No. 18

Fig.10 View of graves at Area No.1 of Emeelt Tolgoi Site

1 Grave No. 19

2 Grave No. 20

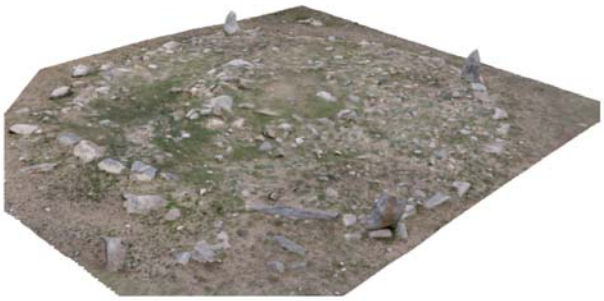
3 Grave No. 21



4 Grave No. 22

5 Grave No. 23

6 Grave No. 24



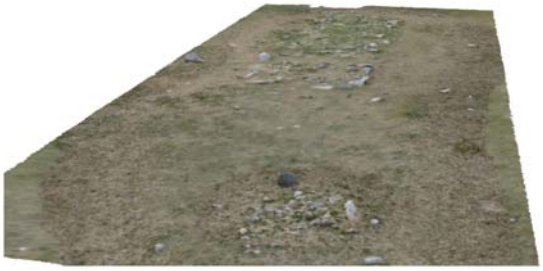
7 Grave No. 25

8 Grave No. 26

Fig.11 View of graves at Area No.1 of Emeelt Tolgoi Site

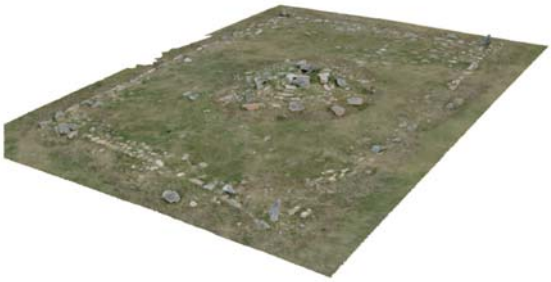
1 Grave No. 27

2 Grave No. 28

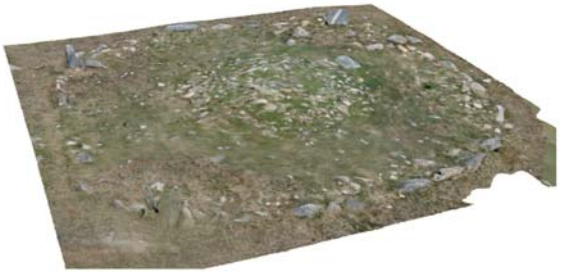


3 Grave No. 29

4 Ritual stone structure No. 31



5 Grave No. 32

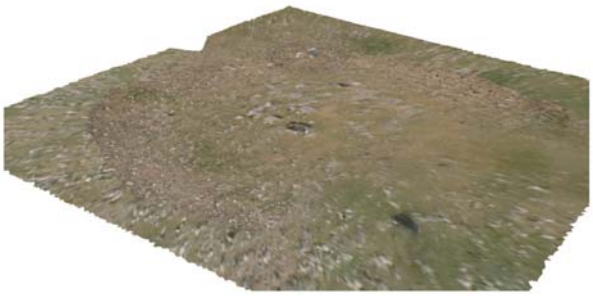


6 Grave No. 33

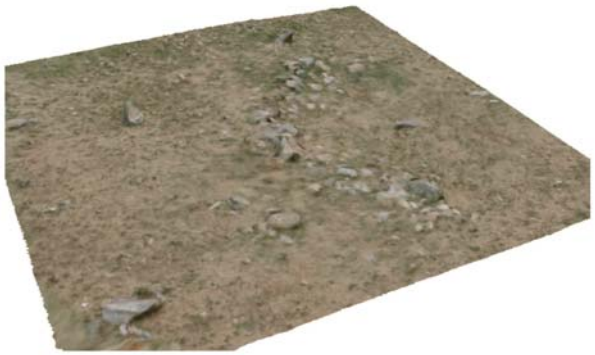
7 Grave No. 34

8 Grave No. 35

Fig.12 View of graves at Area No.1 of Emeelt Tolgoi Site



1 Grave No. 36

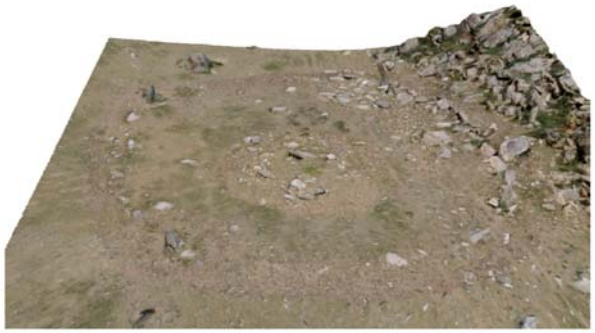


2 Grave No. 37

3 Grave No. 38

4 Grave No. 39

5 Ritual stone structure No. 41



6 Grave No. 42

7 Grave No. 43

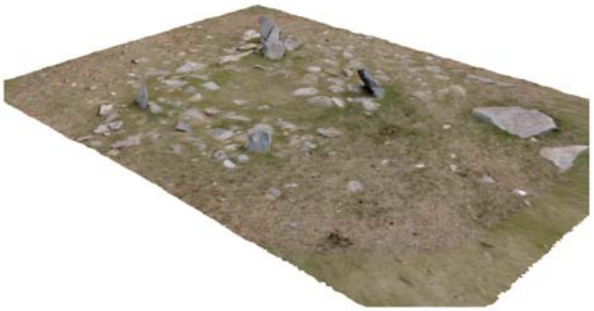
8 Grave No. 44

Fig.13 View of graves at Area No.1 of Emeelt Tolgoi Site

1 Grave No. 46

2 Grave No. 47

3 Grave No. 48



4 Grave No. 49

5 Ritual stone structure No. 50

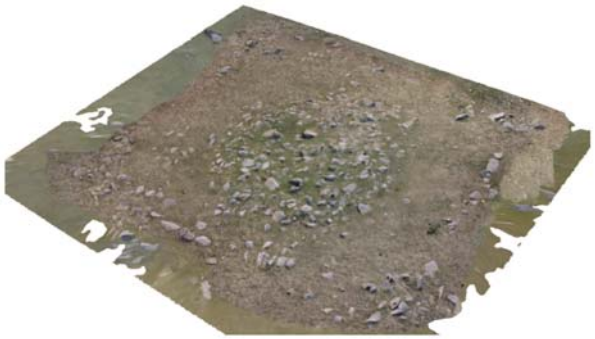
6 Ritual stone structure No. 51

7 Ritual stone structure No. 52

8 Grave No. 53

Fig.14 View of graves at Area No.1 of Emeelt Tolgoi Site

1 Grave No. 55



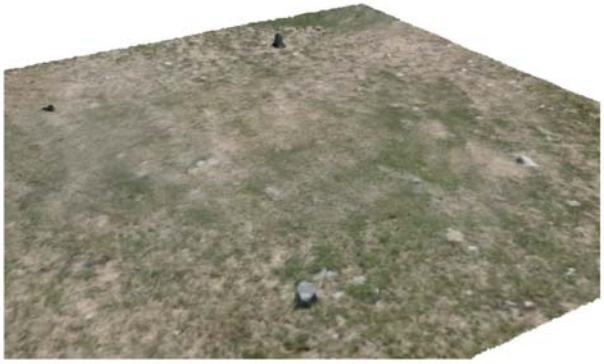
2 Grave No. 56

3 Grave No. 57

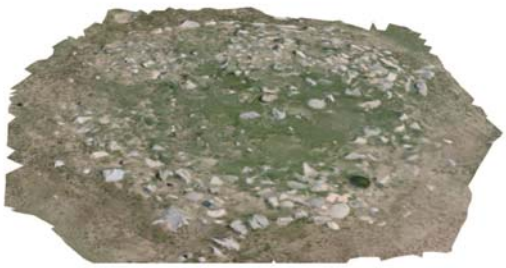
4 Grave No. 58

5 Grave No. 60

6 Grave No. 61

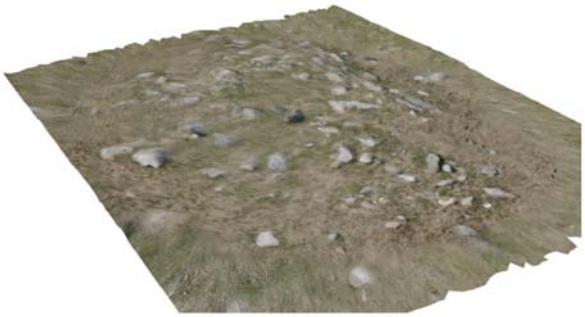


7 Grave No. 62



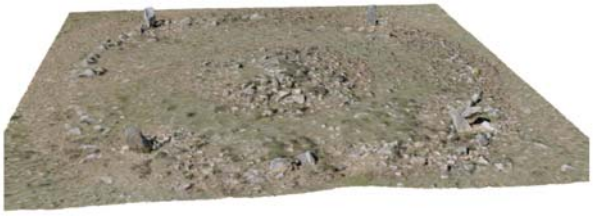
8 Grave No. 63

Fig.15 View of graves at Area No.1 of Emeelt Tolgoi Site



1 Grave No. 64

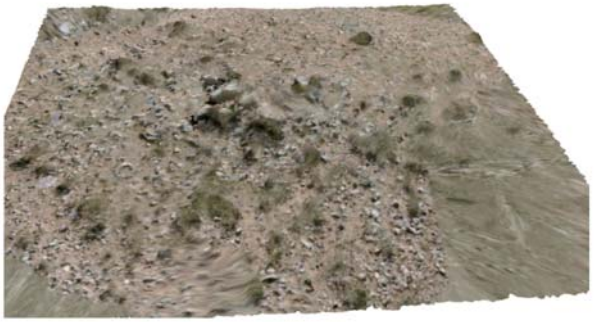
2 Grave No. 71



3 Grave No. 81

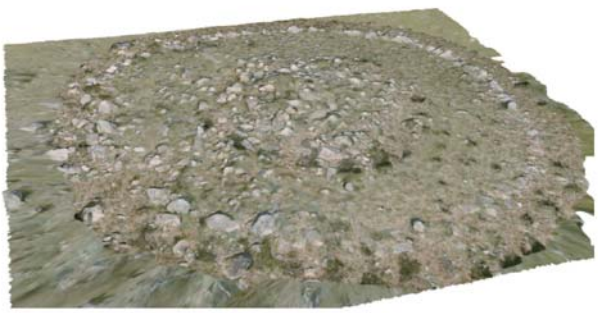
4 Grave No. 82

5 Grave No. 82



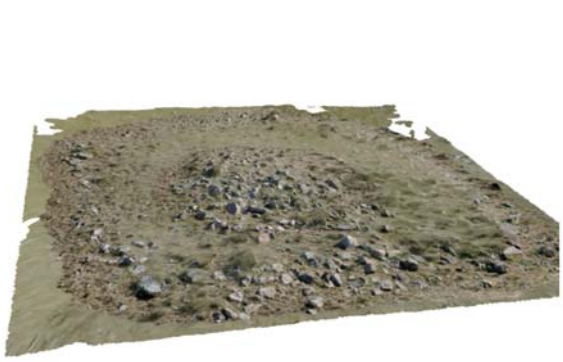
6 Grave No. 83

7 Grave No. 84

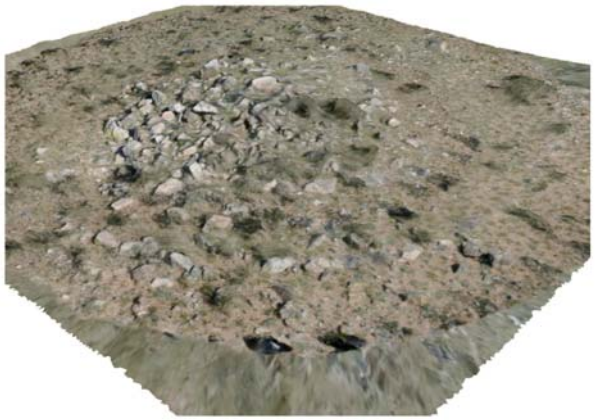


8 Grave No. 85

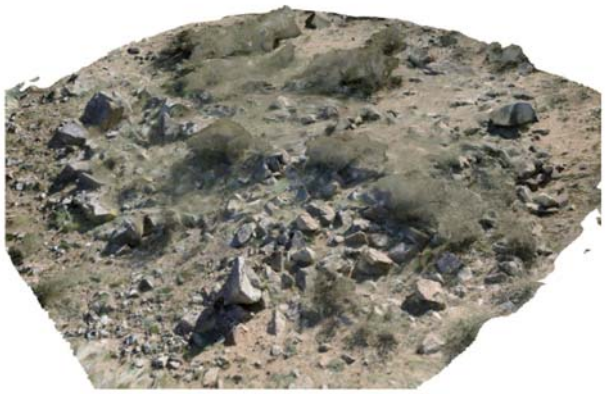
Fig.16 View of graves at Area No.1 of Emeelt Tolgoi Site



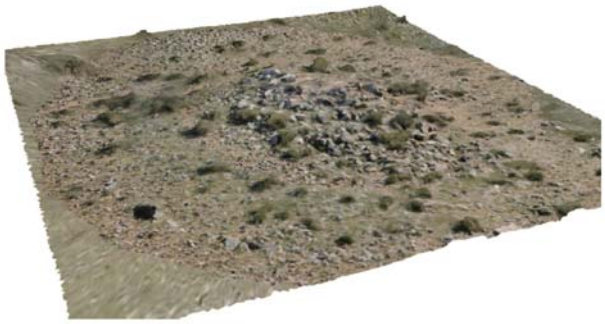
1 Grave No. 86



2 Grave No. 87



3 Grave No. 88



4 Grave No. 89

Fig.17 View of graves at Area No.1 of Emeelt Tolgoi Site

Khirigsuur, round graves and square graves. Khirigsuur can also be divided according to the shape of fence stones: round and square fence stones. In this excavation report, round fence stones of Khirigsuur are called Type 1. Square fence stones of Khirigsuur are called Type 3. Round graves without round fence stones are called Type 2. Square graves without square fence stones are called Type 4. All types except Type 4 differ in terms of whether or not they have four large oval stones. Those graves without four large oval stones are called Type 1a, Type 2a, and Type 3a. Those graves with four large oval stones on four sides of the structure are called Type 1b, Type 2b, Type 3b, and Type 4. The latter groups with four large oval stones correspond to Sagsai-shaped graves. In addition, Type 4 can be divided into two types: Type 4a and Type 4b. Type 4a has a square stone rim which is not clear with four corner stones. Type 4b has a square or rectangular stone rim, which is clearly made.

The graveyards at Emeelt Tolgoi site are distributed over the two mountain peaks (Fig. 18). Type 1 and Type 2 are mainly seen on both of the mountains (Fig. 19, 20). Type 3 and Type 4 are mainly located in Area No. 1 and the eastern part of Area No. 2 (Fig. 21). Figured graves and Type 4a square graves are only concentrated in Area No. 1 (Fig. 22). The ritual stone structures seen at Khyar Kharaach Site are also found at this site (Fig. 8). The distribution of ritual stone structures seems to be arbitrary and not planned (Fig. 23). Some are located on the southern plain outside the graveyards. On the other hand, the graveyards extend from the top of the mountains to the plains on every mountain in Area No. 1 and Area No. 2 (Fig. 18).

Type 1, which consists of Khirigsuur with round fence stones, is divided into two types according to whether or not there are four large oval stones on four sides of the structure: Type 1a and Type 1b. Type 1a graves are located in a relatively eastward position comparted to those of Type 1b in both Area 1 and Area 2 (Fig. 19). Type 2, which consists of round graves, is divided into two types according to whether or not there are four large oval stones: Type 2a and Type 2b. No clear differences can be found in the distributions of these two types, and the two groups which comprise the two types are seen in clearly different locations between Area No. 1 and Area No. 2 (Fig. 20).

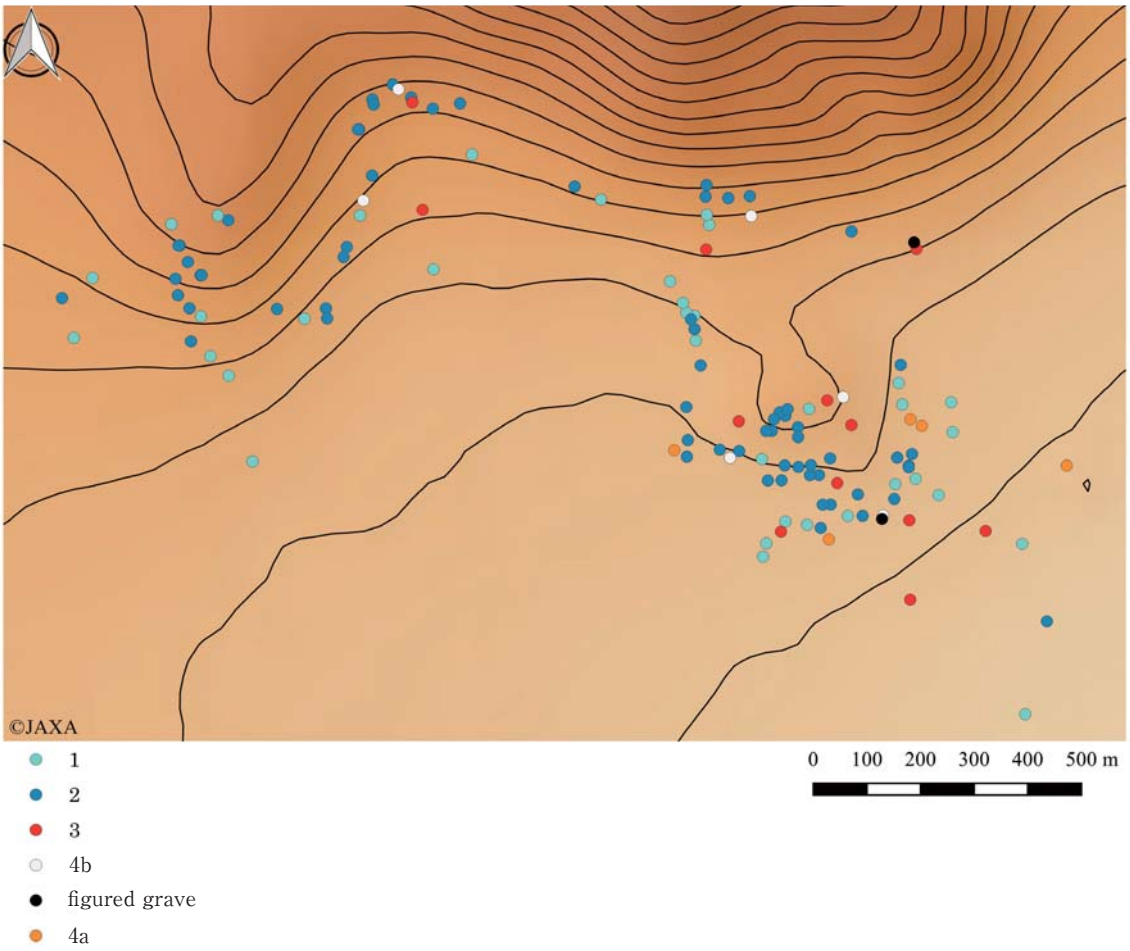


Fig.18 Distribution of all archeological futures at Emeelt Tolgoi Site

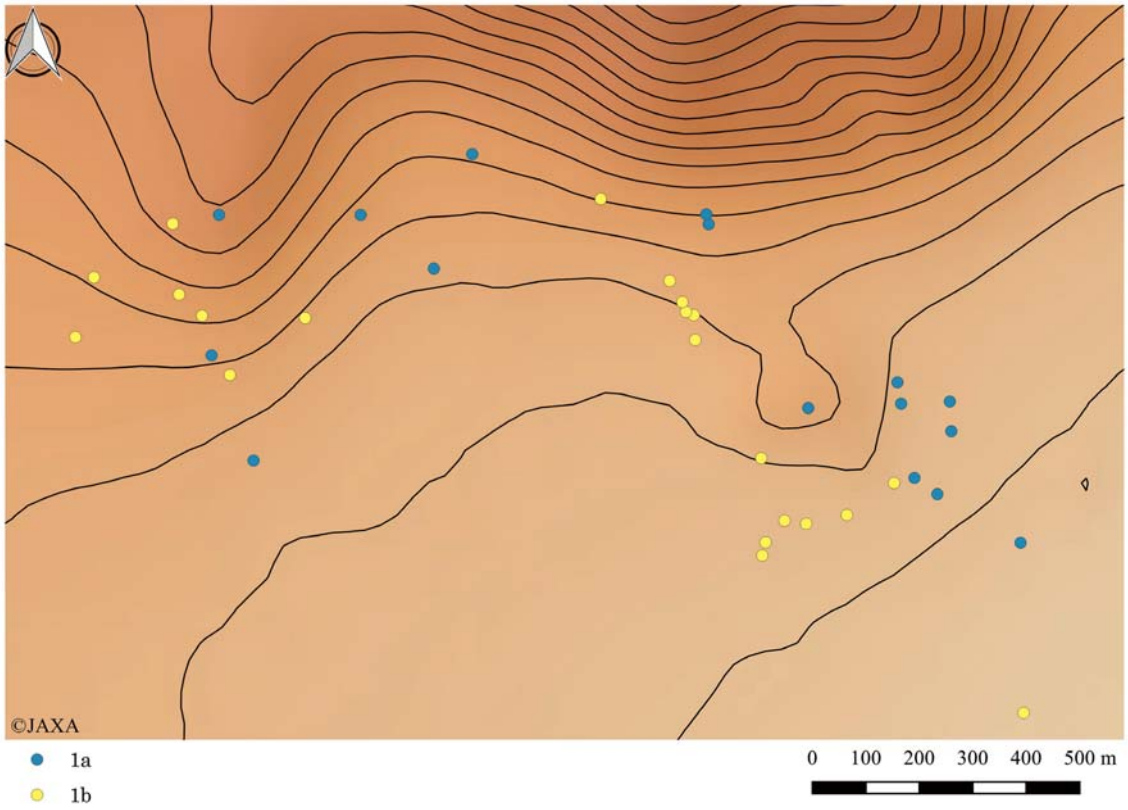


Fig.19 Distribution of all graves at Emeelt Tolgoi Site

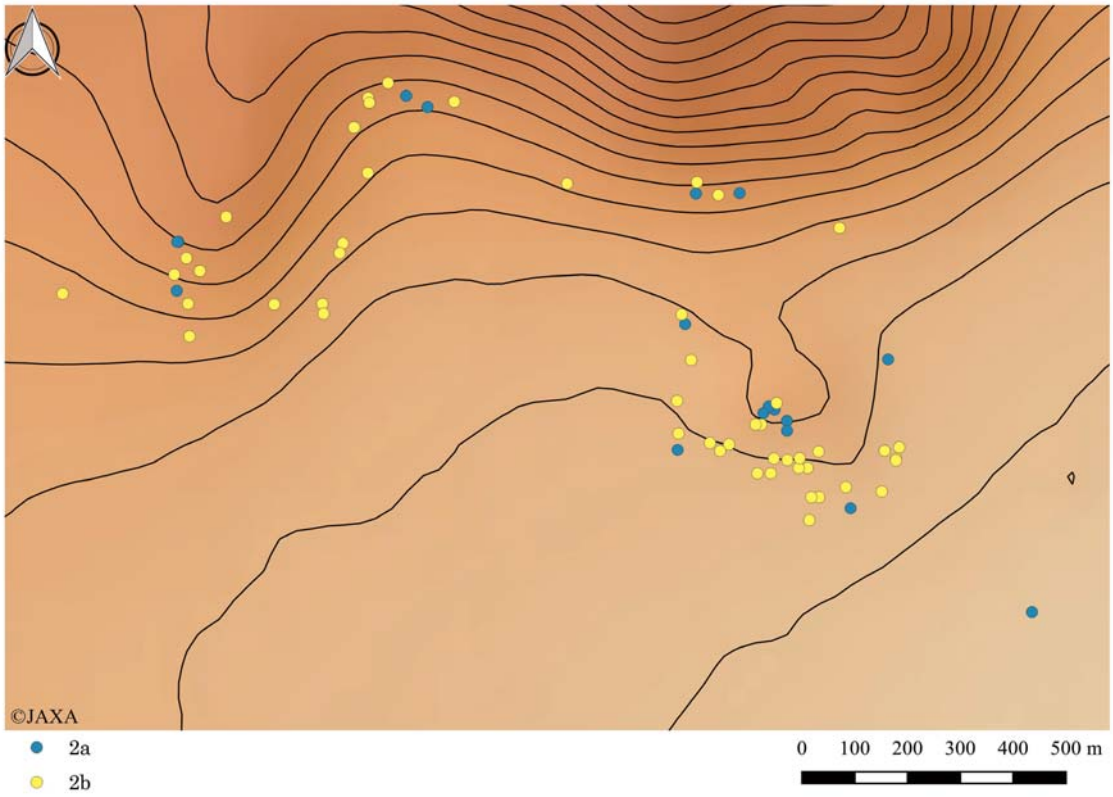


Fig.20 Distribution of Type 1a and Type 1b graves at Emeelt Tolgoi Site

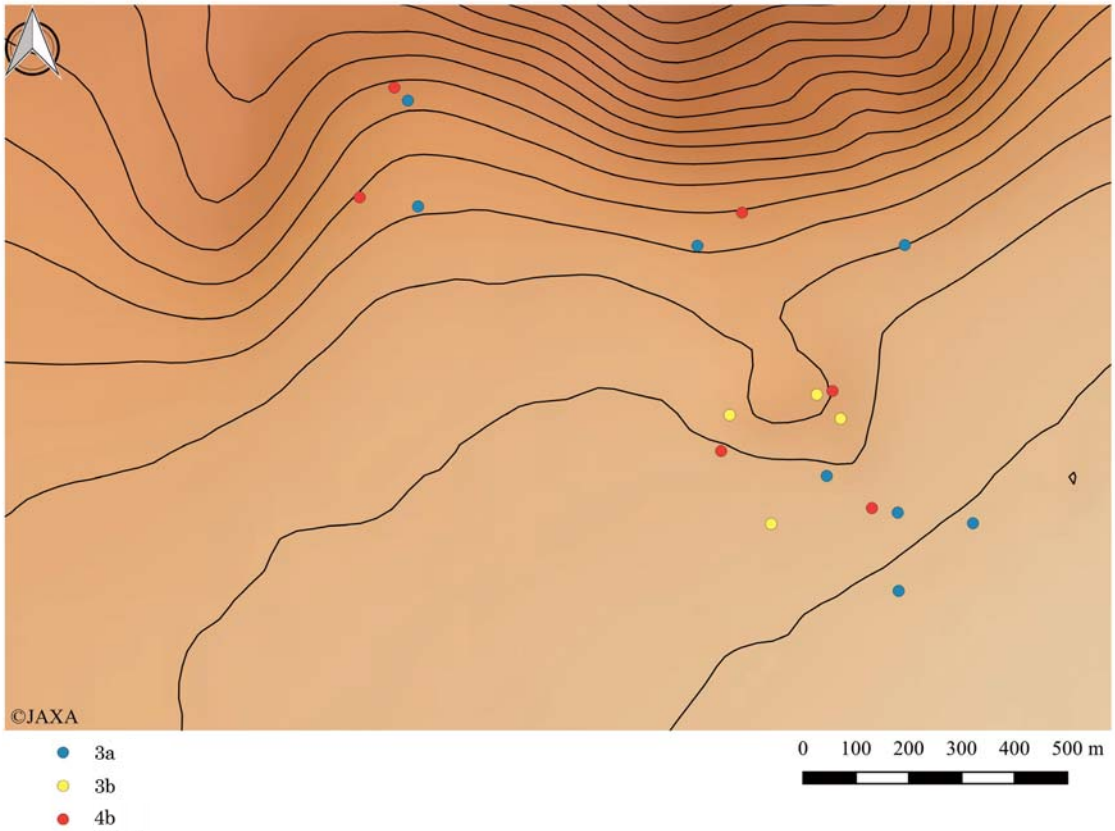


Fig.21 Distribution of Type 2a and Type 2b graves at Emeelt Tologoi Site

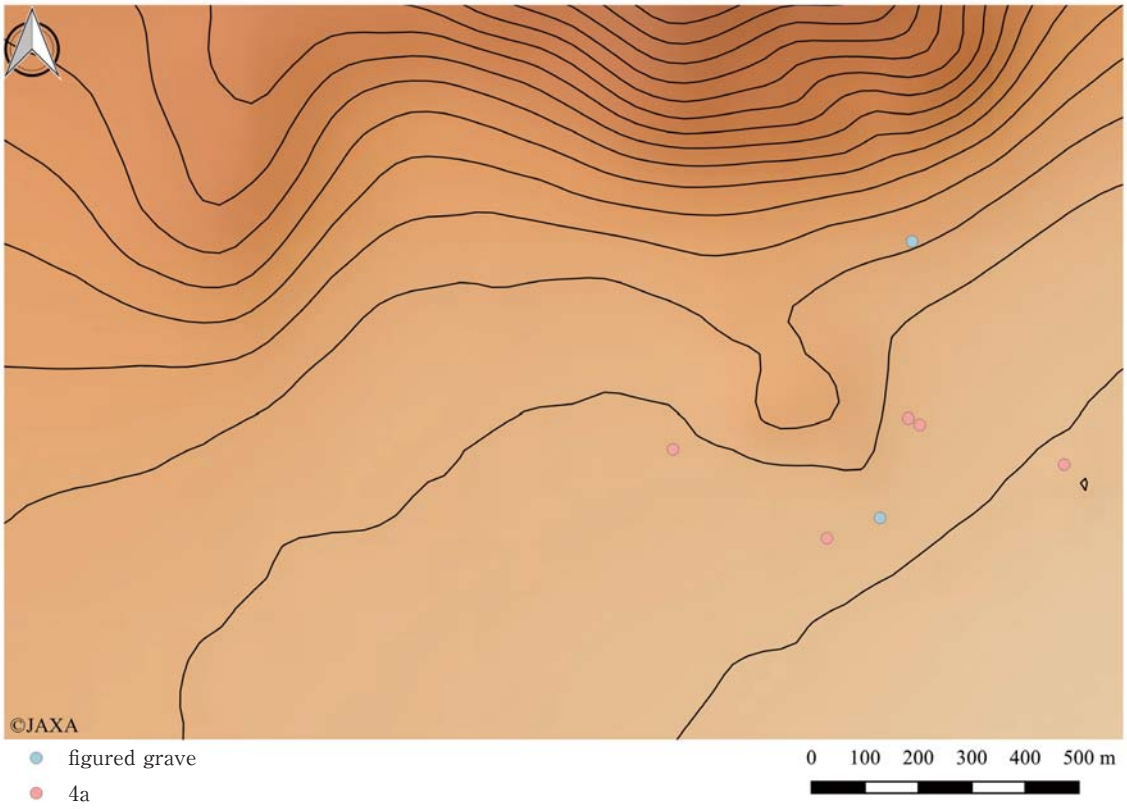


Fig.22 Distribution of Type 3 and Type 4 graves at Emeelt Tologoi Site

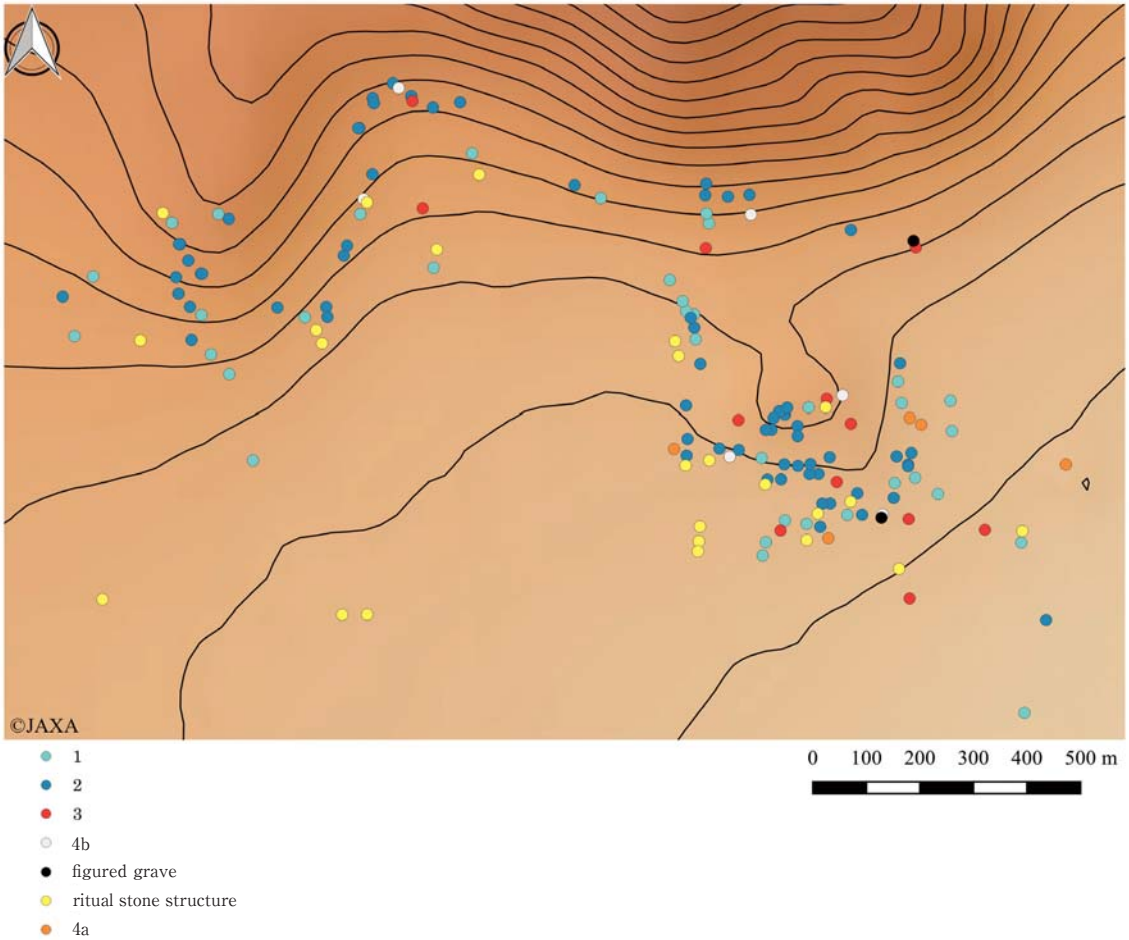


Fig.23 Distribution of Square graves and Figured graves at Emeelt Tologoi Site

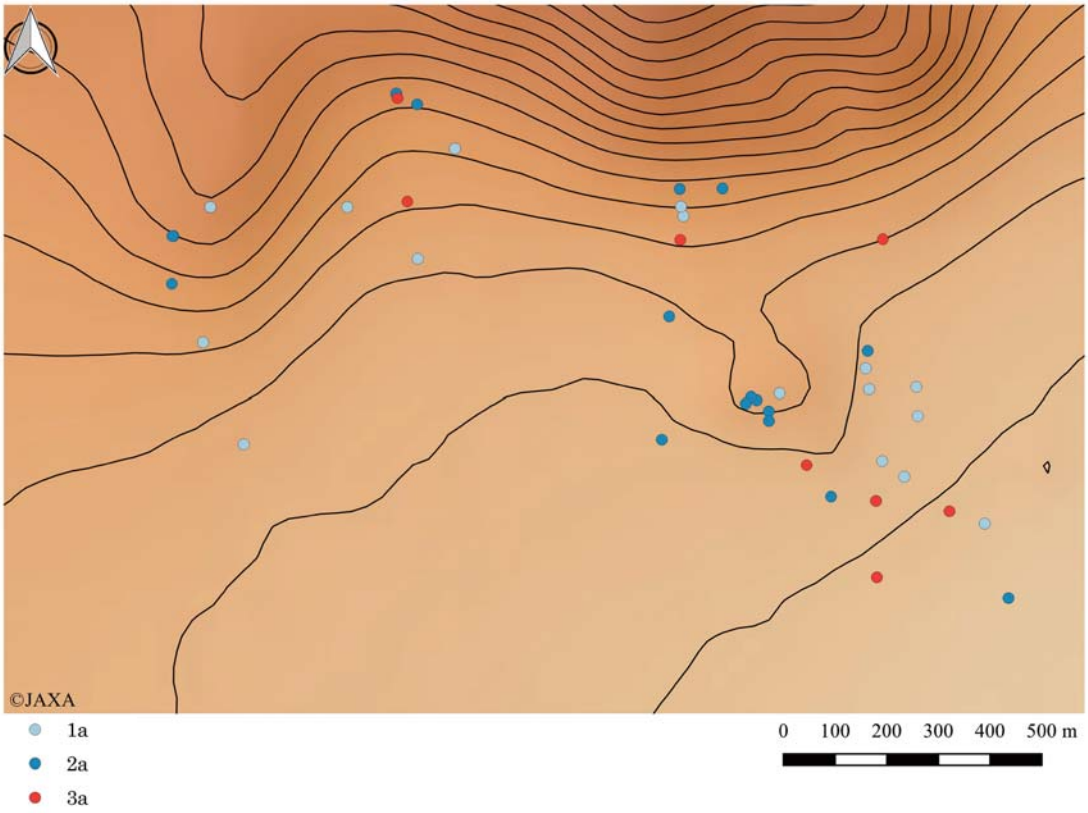


Fig.24 Distribution of Type 1a, Type 2a and Type 3a graves at Emeelt Tologoi Site

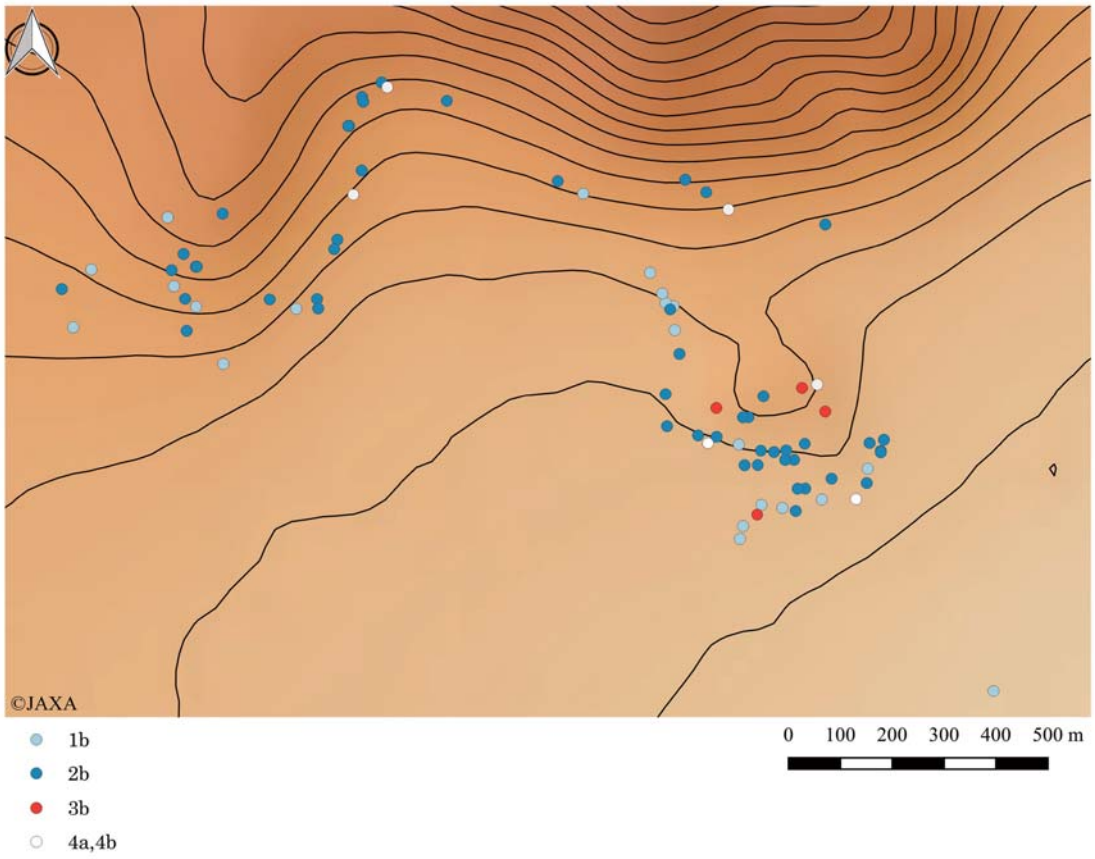


Fig.25 Distribution of Type 1b, Type 2b, Type 3b and Type 4 graves at Emeelt Tologoi Site

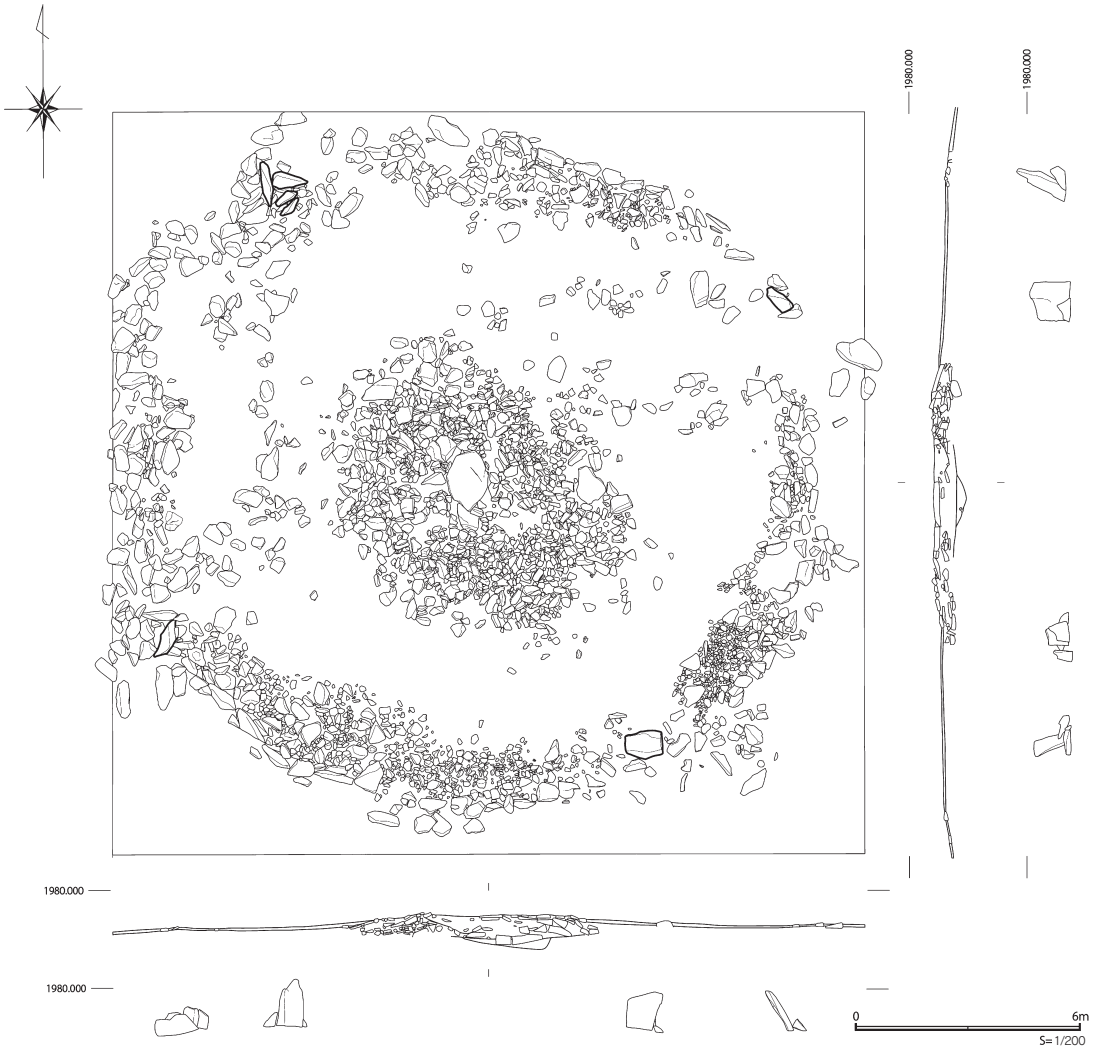


Fig.26 Grave No. 30 at Emeelt Tolgoi Site

1 Before excavation *2 After removal of surface soils*

Fig.27 Grave No. 30 at Emeelt Tolgoi Site

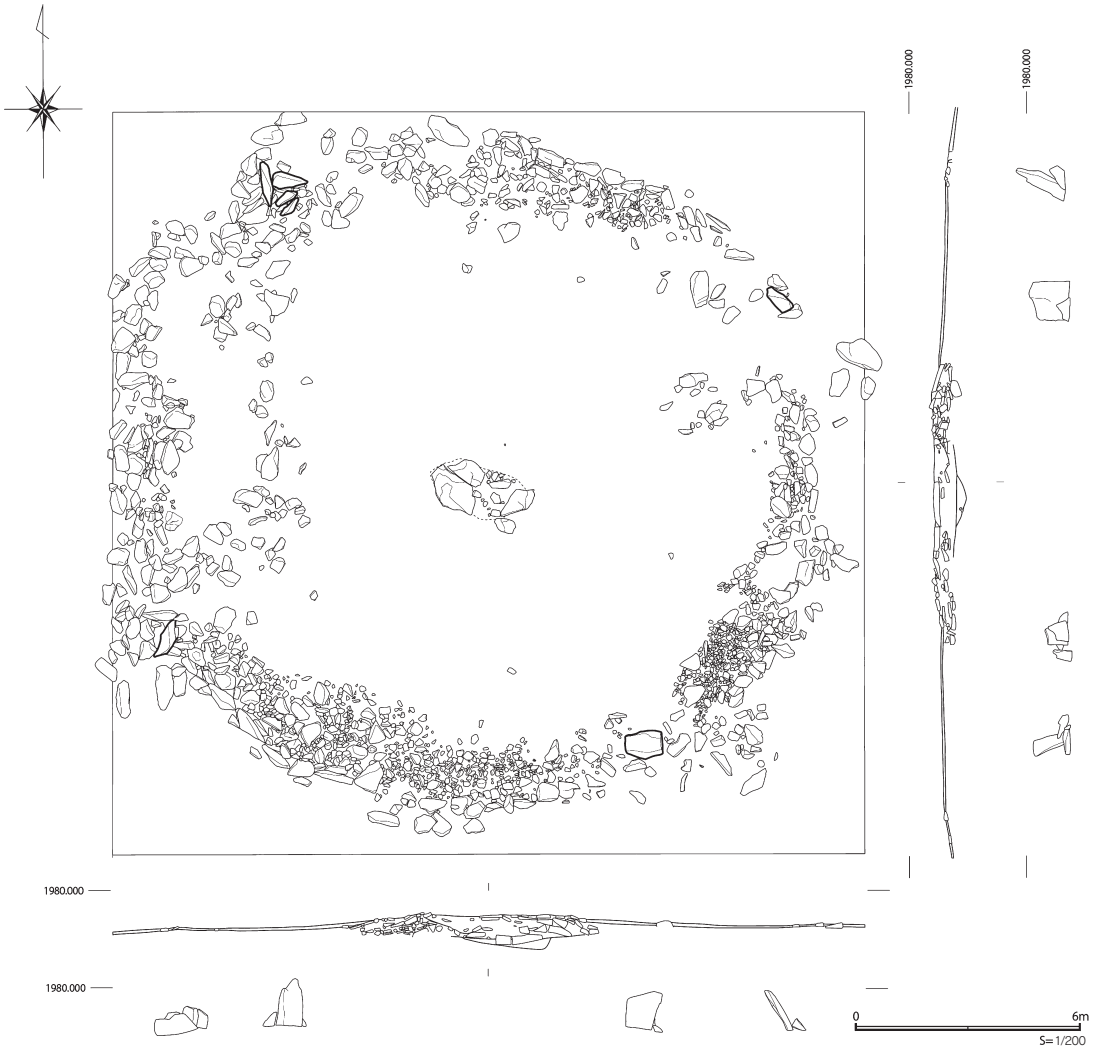


Fig.28 Stone fence and cover stones of Grave No. 30 at Emeelt Tolgoi Site

1 After removal of surface soils *2 After removal of surface soils*

Fig.29 Grave No. 30 at Emeelt Tolgoi Site

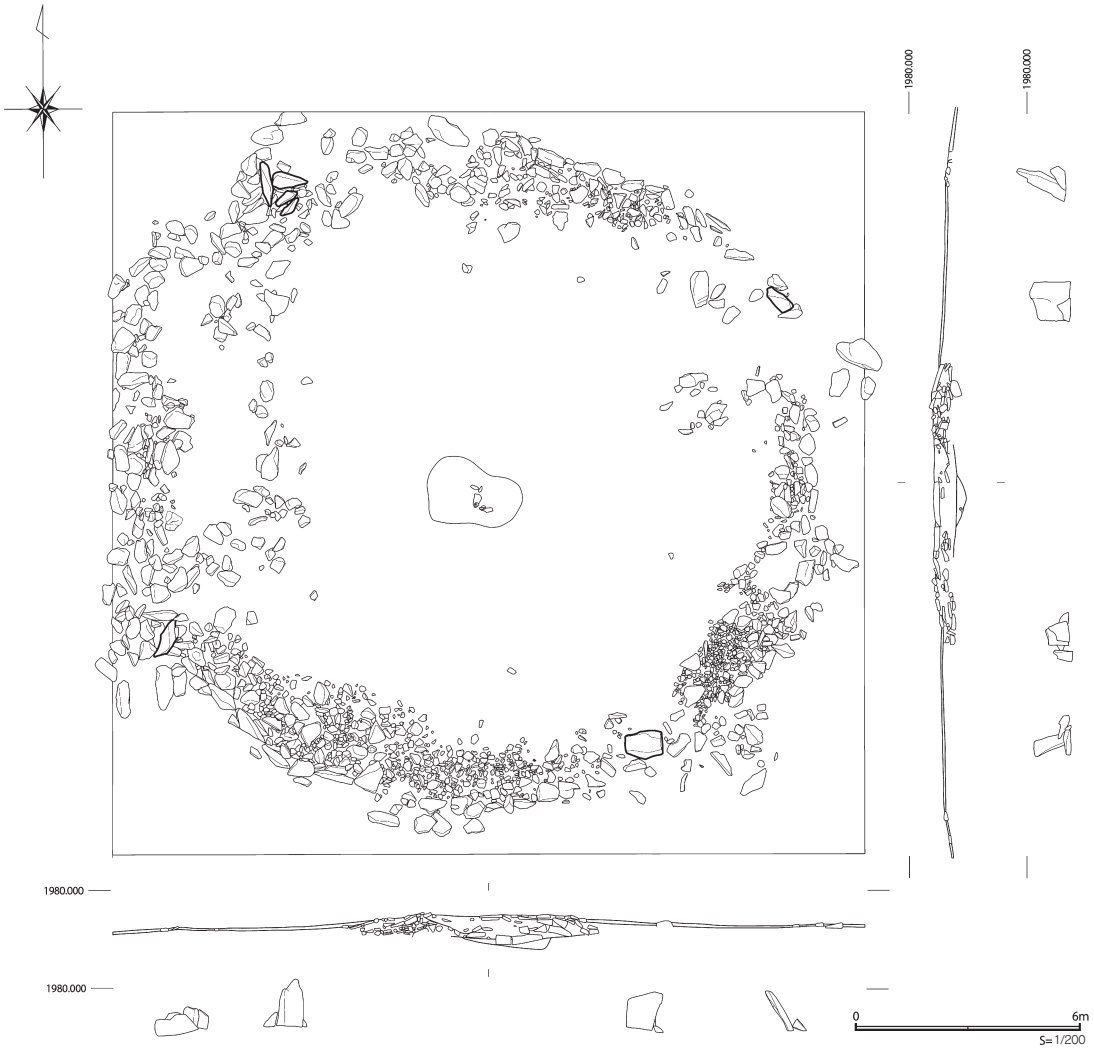


Fig.30 Grave No. 30 at Emeelt Tolgoi Site

1 A cover stone *2 A cover stone*

Fig.31 Grave No. 30 at Emeelt Tolgoi Site

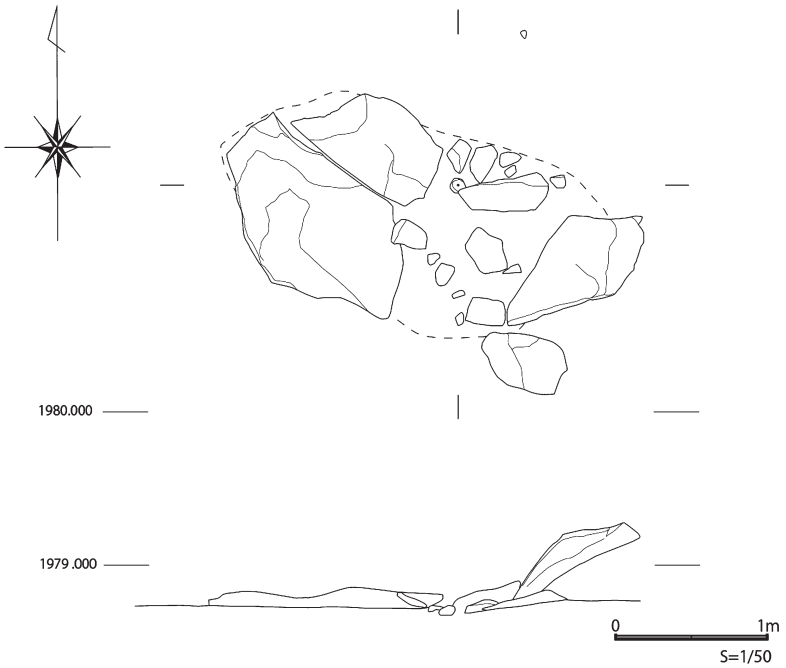


Fig.32 A cover stone of grave No. 30 at Emeelt Tolgoi Site

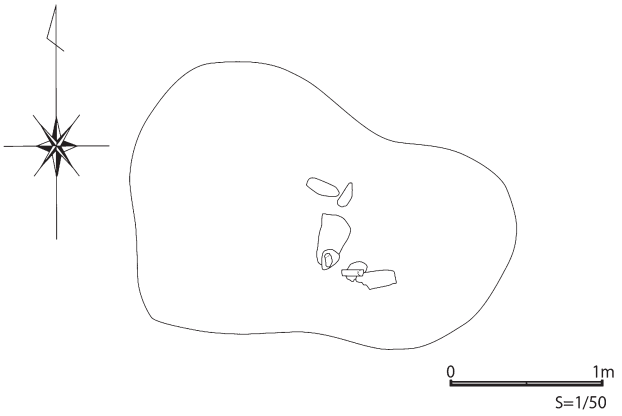


Fig.33 Burial pit and fragments of human skeletons of Grave No. 30 at Emeelt Tolgoi Site

Fig.34 Burial pit and fragments of human skeletons of Grave No. 30 at Emeelt Tolgoi Site

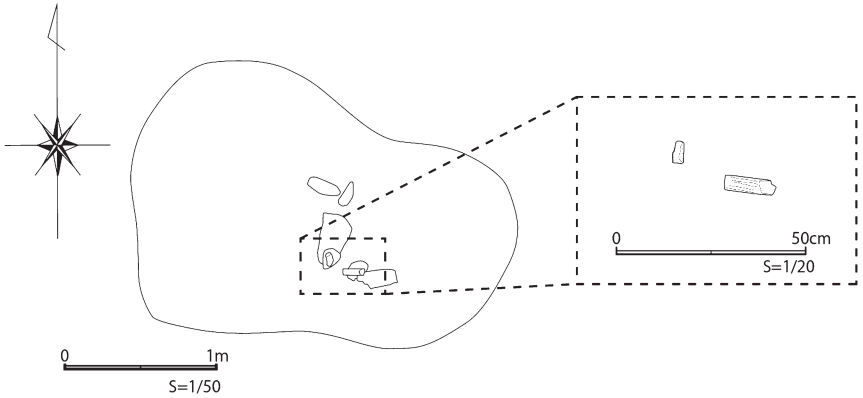


Fig.35 Fragments of human skeletons of Grave No. 30 at Emeelt Tolgoi Site

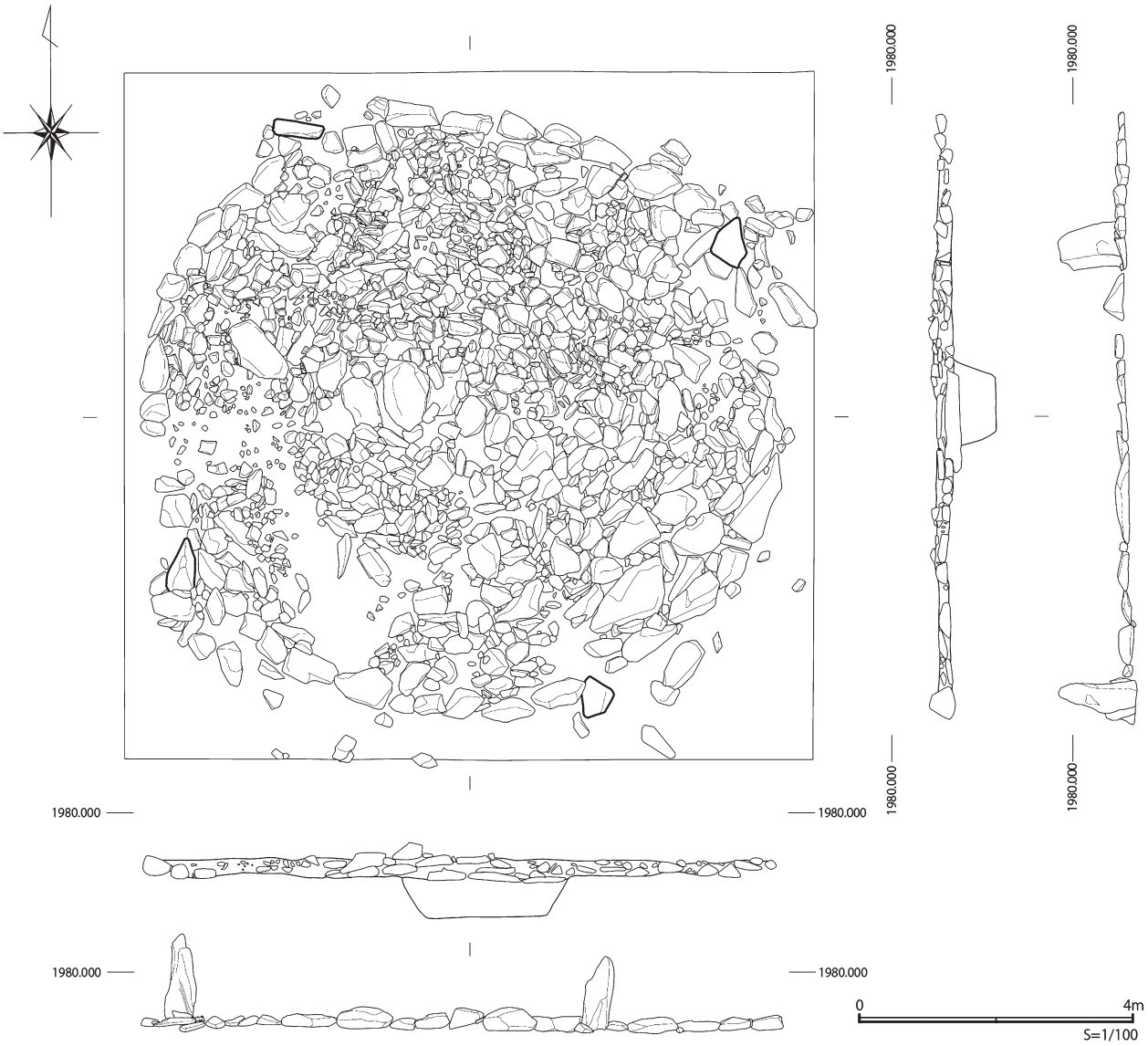


Fig.36 Grave No. 40 at Emeelt Tolgoi Site

1 After removal of surface soils *2 After removal of surface soils*

Fig.37 Grave No. 40 at Emeelt Tolgoi Site

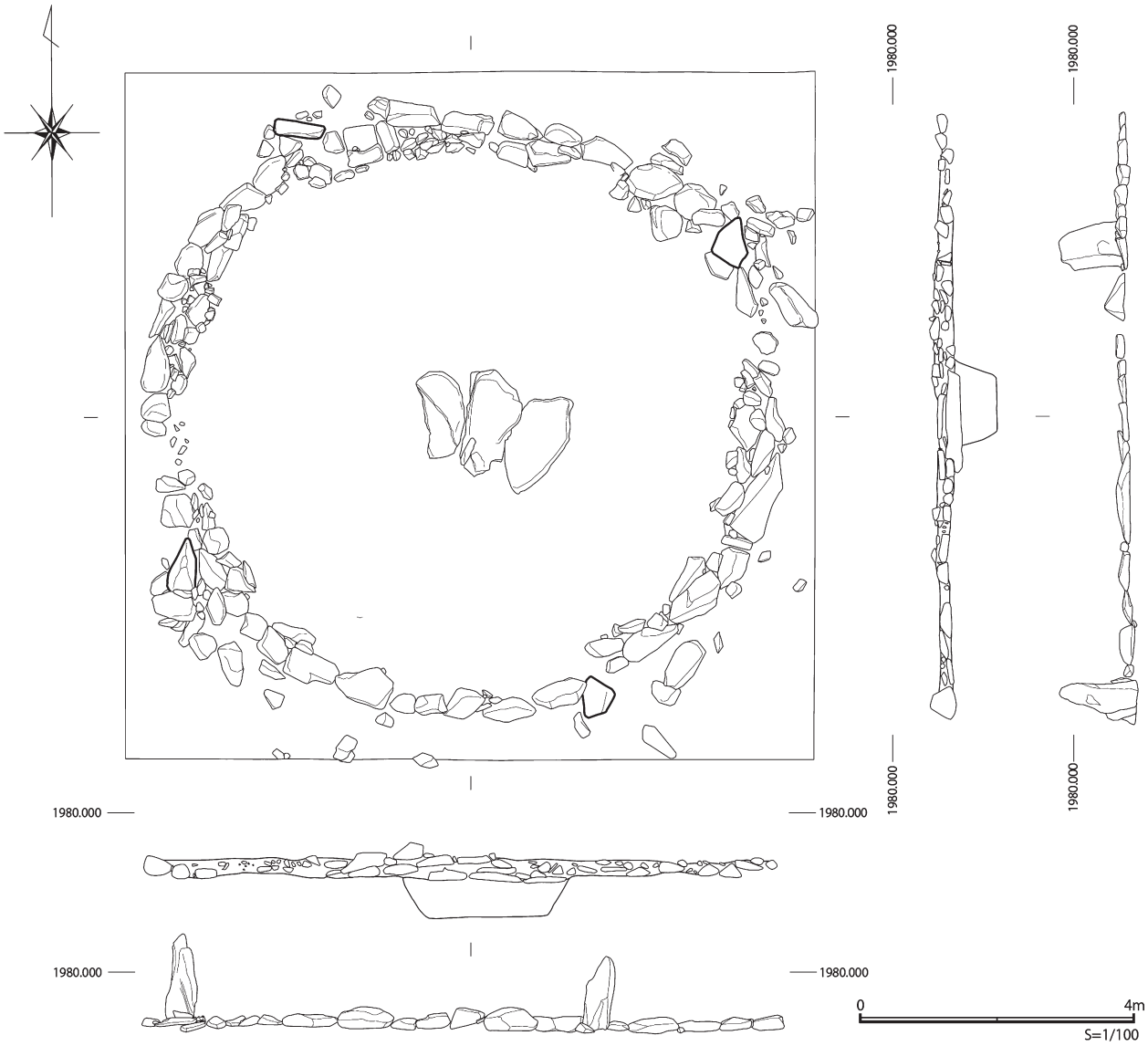


Fig.38 Cover stones of grave No. 40 at Emeelt Tolgoi Site

1 Cover stones *2 Cover stones*

Fig.39 Cover stones of grave No. 40 at Emeelt Tolgoi Site

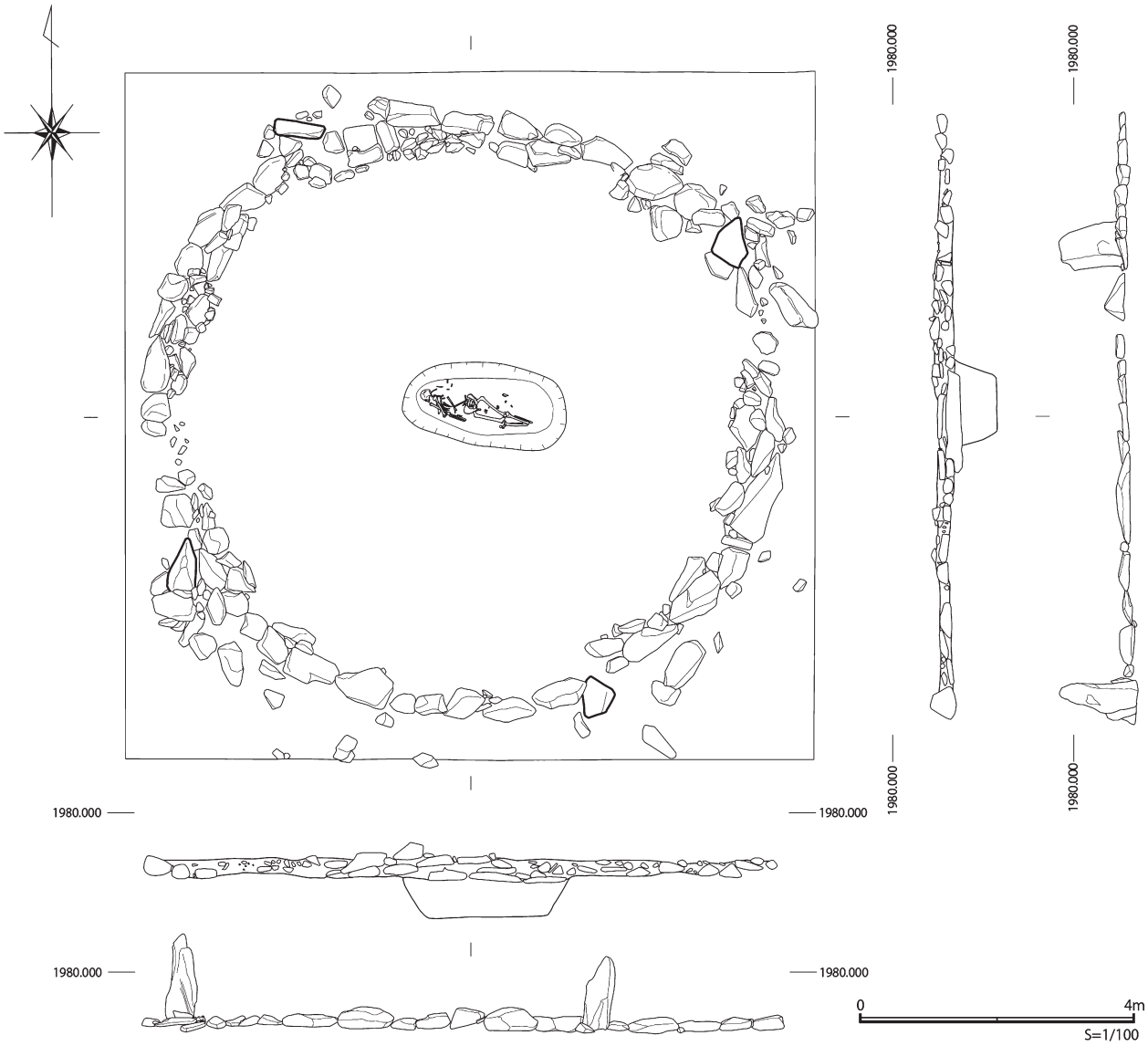


Fig.40 Grave No. 40 at Emeelt Tolgoi Site

1 Finding of human skeletons *2 Finding of human skeletons*

Fig.41 Human skeletons from Grave No. 40 at Emeelt Tolgoi Site

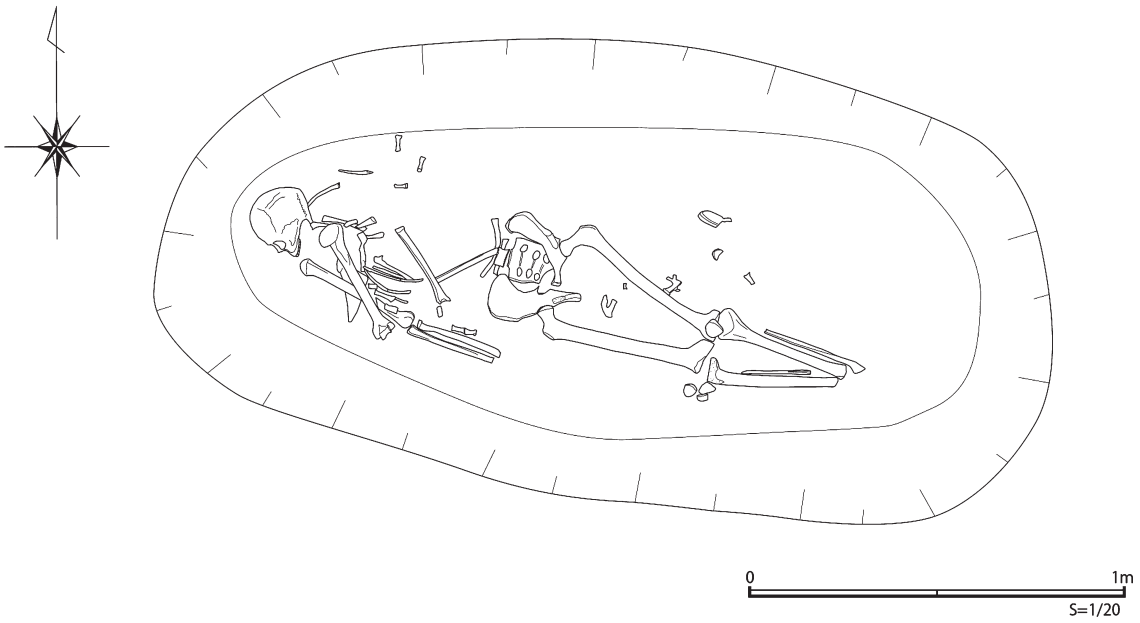


Fig.42 Human skeletons from Grave No. 40 at Emeelt Tolgoi Site

Type 1a, Type 2a and Type 3a are round Khirigsuur, round graves and square Khirigsuur without four large oval stones. Their distributions are divided into three groups: Unit 1, Unit 2, and Unit 3 (Fig. 24). Type 1b, Type 2b Type 3b, and Type 4, which correspond to Sagsai-shaped graves, are round Khirigsuur, round graves, and square Khirigsuur with four large oval stones. Their distributions are not divided into three groups (Fig. 25). On the other hand, Type 3 and Type 4 are distributed according to Unit 2 and Unit 3 (Fig. 21). Type 3b and Type 4b are Khirigsuur with square fence stones and square graves with four large oval stones. The square shape of the grave structure is thought to indicate some relationship between Type 3 and Type 4. However, Type 3b Khirigsuur with four large oval stones are only located in Unit 3 which is Area No. 1 (Fig. 21).

3. Graves

We excavated graves in Area No. 1 (Fig. 4). We selected a Type 1b round Khirigsuur, a Type 2b round grave, Type 4a and Type 4b square graves, and a figured grave as the targets for excavations in Area No.1.

Khirigsuur Grave No. 30 (Fig. 26 - 35)

This grave has a round fence measuring 15.5 m by 18.0 m along with four erected large stones on the round fence (Fig. 26, 27). We call this type of grave a

1 *2*

Fig.43 Grave No. 44 at Emeelt Tolgoi Site

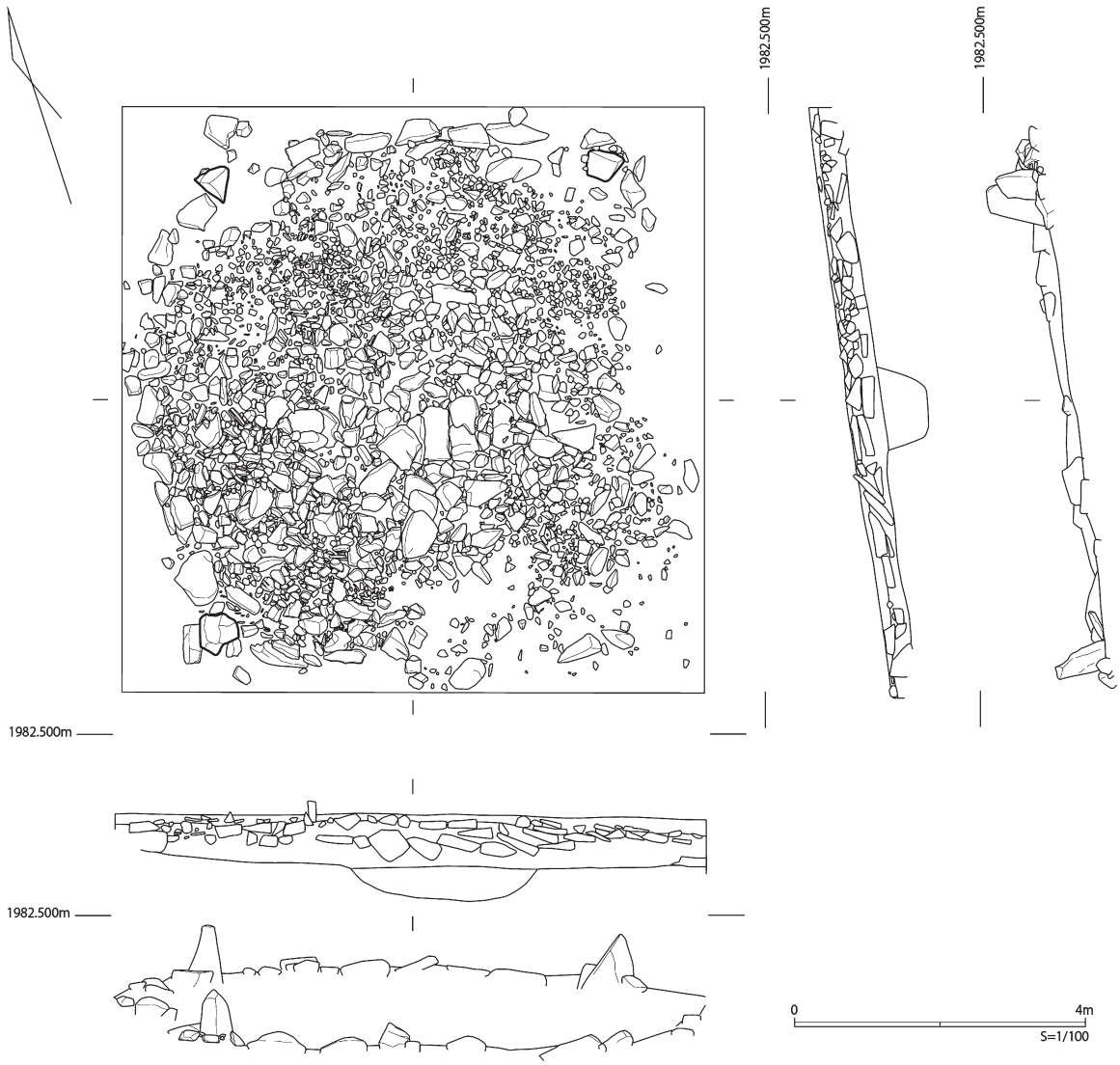


Fig.44 Grave No. 44 at Emeelt Tolgoi Site

1 After removal of surface soils *2 After removal of surface soils*

Fig.45 Grave No. 44 at Emeelt Tolgoi Site

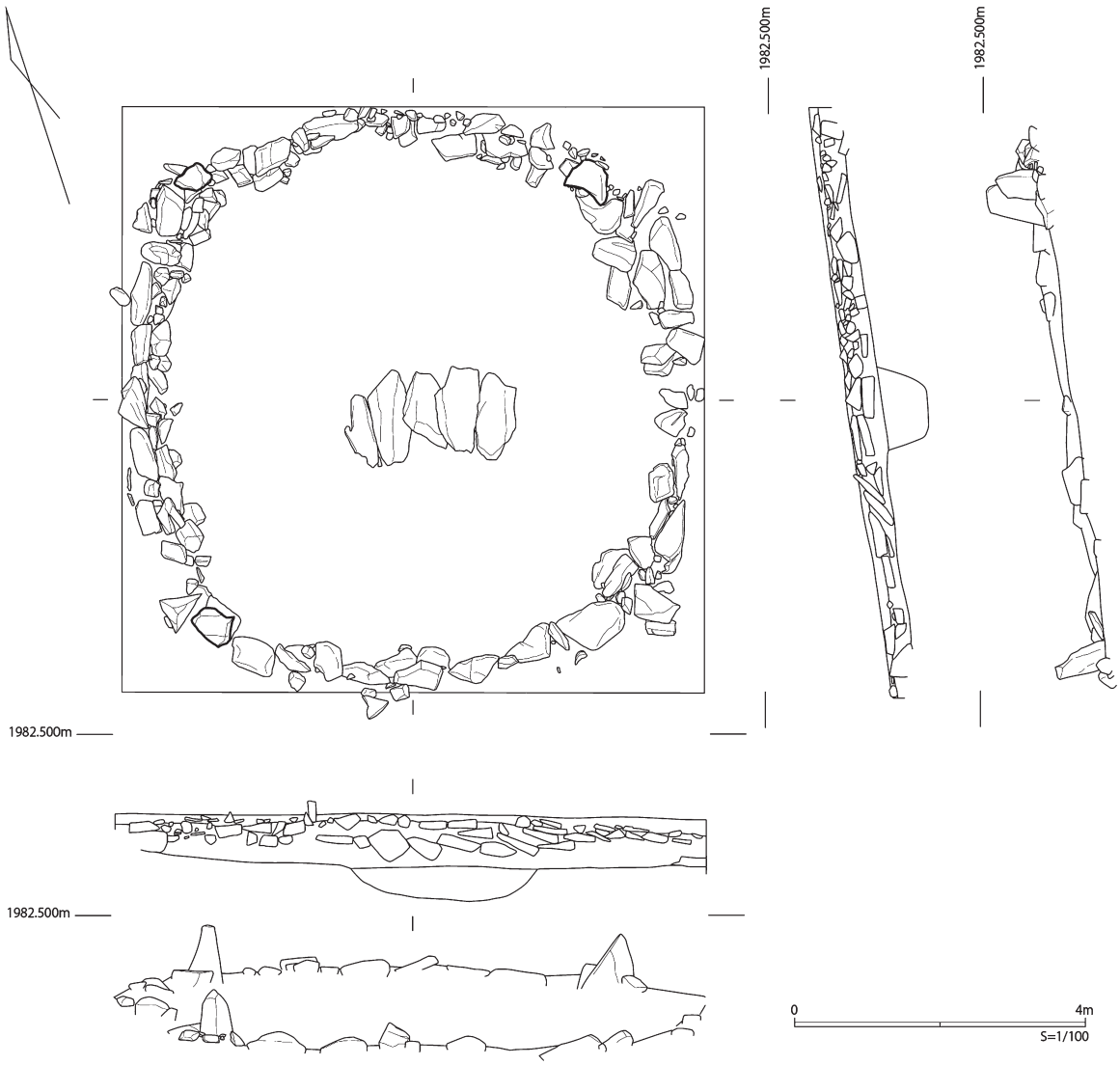


Fig.46 Grave No. 44 at Emeelt Tolgoi Site

1 A part of stone mounds *2 Cover stones*

Fig.47 Cover stones of grave No. 44 at Emeelt Tolgoi Site

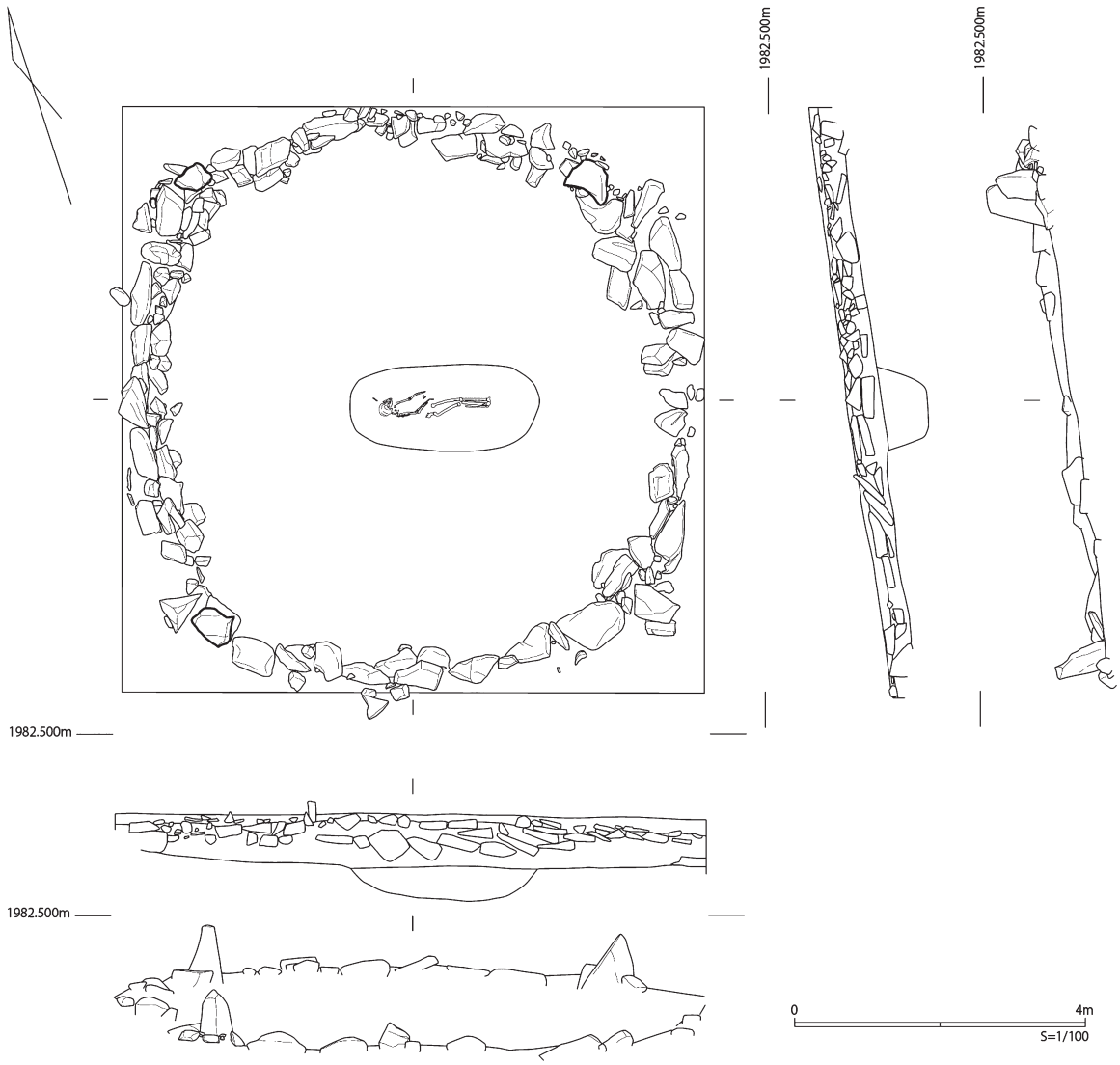


Fig.48 Grave No. 44 at Emeelt Tolgoi Site

1 Cover stones *2 Burial pit and stone fence*

Fig.49 Cover stones of grave No. 44 at Emeelt Tolgoi Site

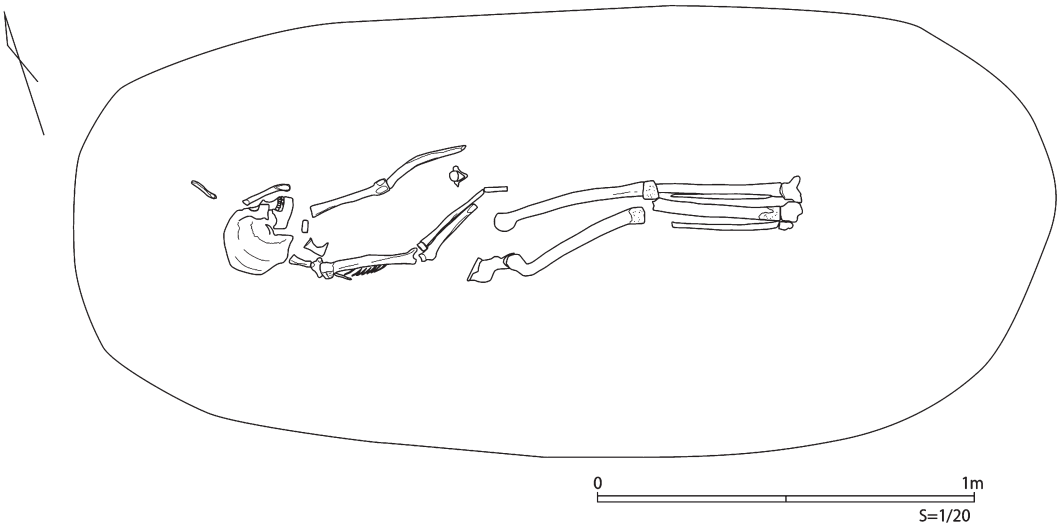


Fig.50 Human skeletons from Grave No. 44 at Emeelt Tolgoi Site

1 Finding of human skeletons *2 Finding of human skeletons*

Fig.51 Human skeletons from Grave No. 44 at Emeelt Tolgoi Site

Type 1b Khirigsuur. This type of grave has also recently been referred to as a Sagsai-shaped grave. The round fence is composed of relatively large rectangular stones and small pebbles which have cascaded down from the stone mound. A stone mound measuring 4 m in diameter and 0.5 m in height is also present in the center and is surrounded by the round fence (Fig. 28, 29). The burial pit had already been looted and destroyed (Fig. 30). The center of the cover stone which had been placed over the burial pit has also already been destroyed (Fig. 31, 32). It is assumed that the inside of the burial pit has also been looted. The deceased individual is thought to have been placed in a burial pit measuring 2.6 m by 1.4 m, which is relatively shallow (Fig. 33, 34). However, while the individual's bones were largely no longer present, some limb bones had been preserved (Fig. 35). Our initial uncorrected dating of the human bones, which didn't include a stable carbon amount, dated them to 1007BC - 905BC (95.4%). We conducted a second dating of the human bones, and dated them to 1303BC - 1191BC (85.2%, 2σ), an acceptable date range.

Round Grave No. 40 (Fig. 36 - 43)

This grave has no round or square fence, and only has a round stone mound with four oval erected stones measuring 9.0 m in diameter (Fig. 36, 37). This type is called a Type 2b round grave. Today, all that is left is a flat round stone construction, but it possibly had a stone mound heaped up in the center. There is a pit burial under the stone mound. Three cover stones were placed on the burial pit (Fig. 38, 39). The burial pit measures 2.4 m in length, 1.2 m in width and 0.6 m

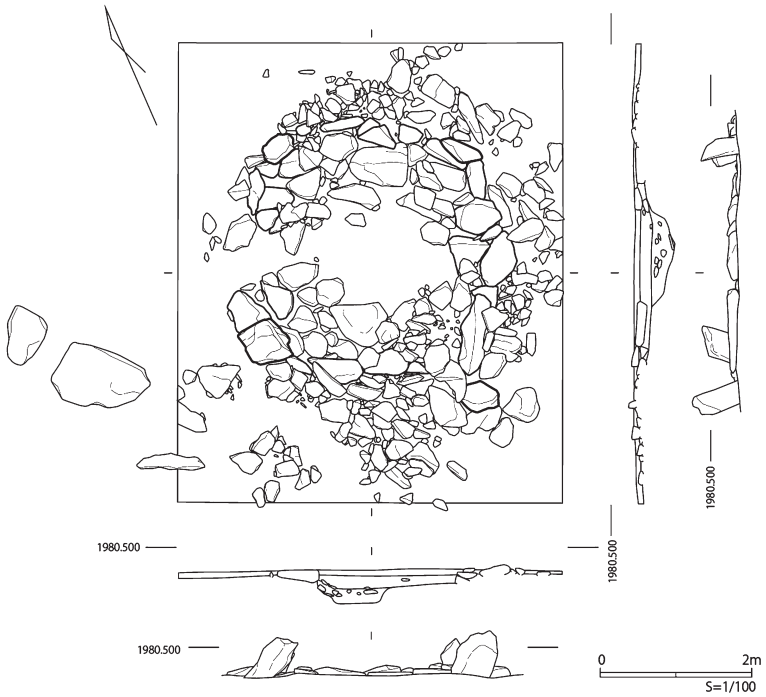


Fig.52 Grave No. 49 at Emeelt Tolgoi Site

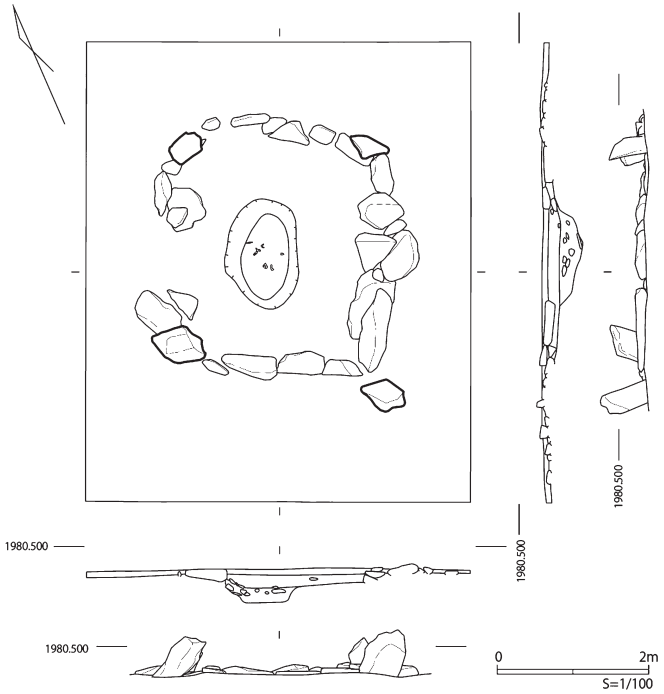


Fig.53 Grave No. 49 at Emeelt Tolgoi Site

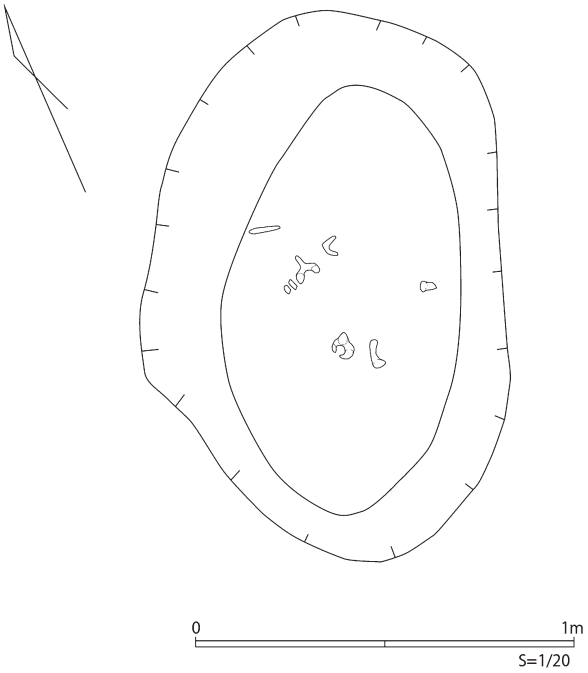


Fig.54 Burial pit and fragments of human skeletons of Grave No. 49 at Emeelt Tolgoi Site

1 Before excavation

2 After removal of surface soils

3 After removal of surface soils

4 After removal of surface soils

5 Finding of human bones in the burial pit

6 burial pit

Fig.55 Grave No. 49 at Emeelt Tolgoi Site

in depth under the surface. Human bones were found in a state of good preservation (Fig. 40). The deceased individual's face was oriented to the south and was placed sideways in the burial pit (Fig. 41, 42). The individual was placed in the burial pit stably wrinkled with feathers or clothes. The lower foot bones under waist was dropped with wrinkled organic covers by the destruction of organic materials. The buried individual has an estimated height of 171.0 cm, and has been identified through physical anthropological analysis to be a male in his twenties. Carbon dating analysis of collagen from human bones dates the human bones to 1266 - 1125 cal. BC (2σ, 95.4%).

Round Grave No. 44 (Fig. 43 - 51)

This grave is 7.7 m in diameter. It has a slight heaped portion in the center, but the original stone mound has not been preserved (Fig. 43, 44, 45). The presence of an oval stone measuring 86 cm in height was confirmed and it is thought that four oval stones were erected on the rim stones of round graves shown to be

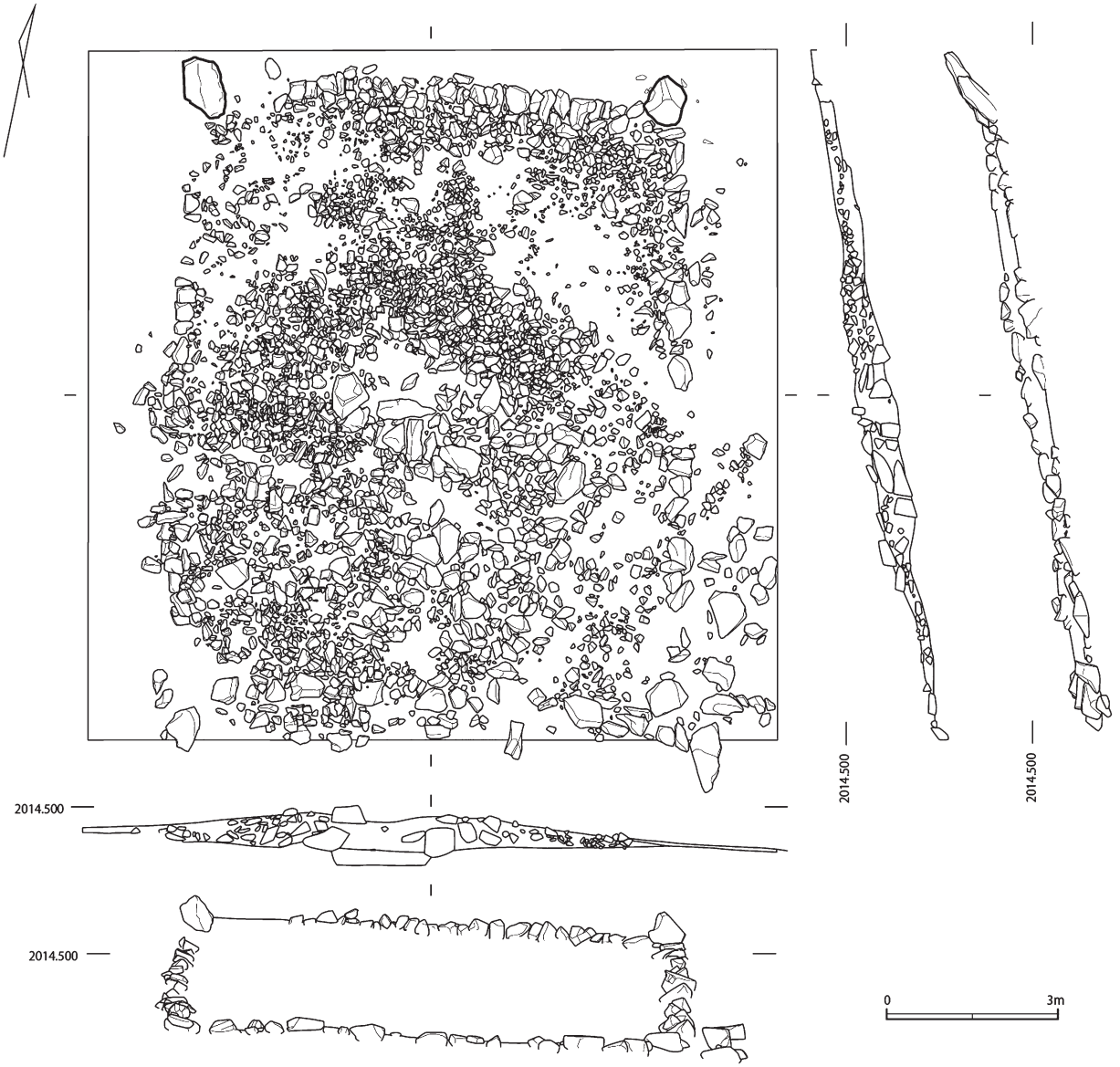


Fig.56 Grave No. 82 at Emeelt Tolgoi Site

1 Before excavation *2 After removal of surface soils*

Fig.57 Grave No. 82 at Emeelt Tolgoi Site

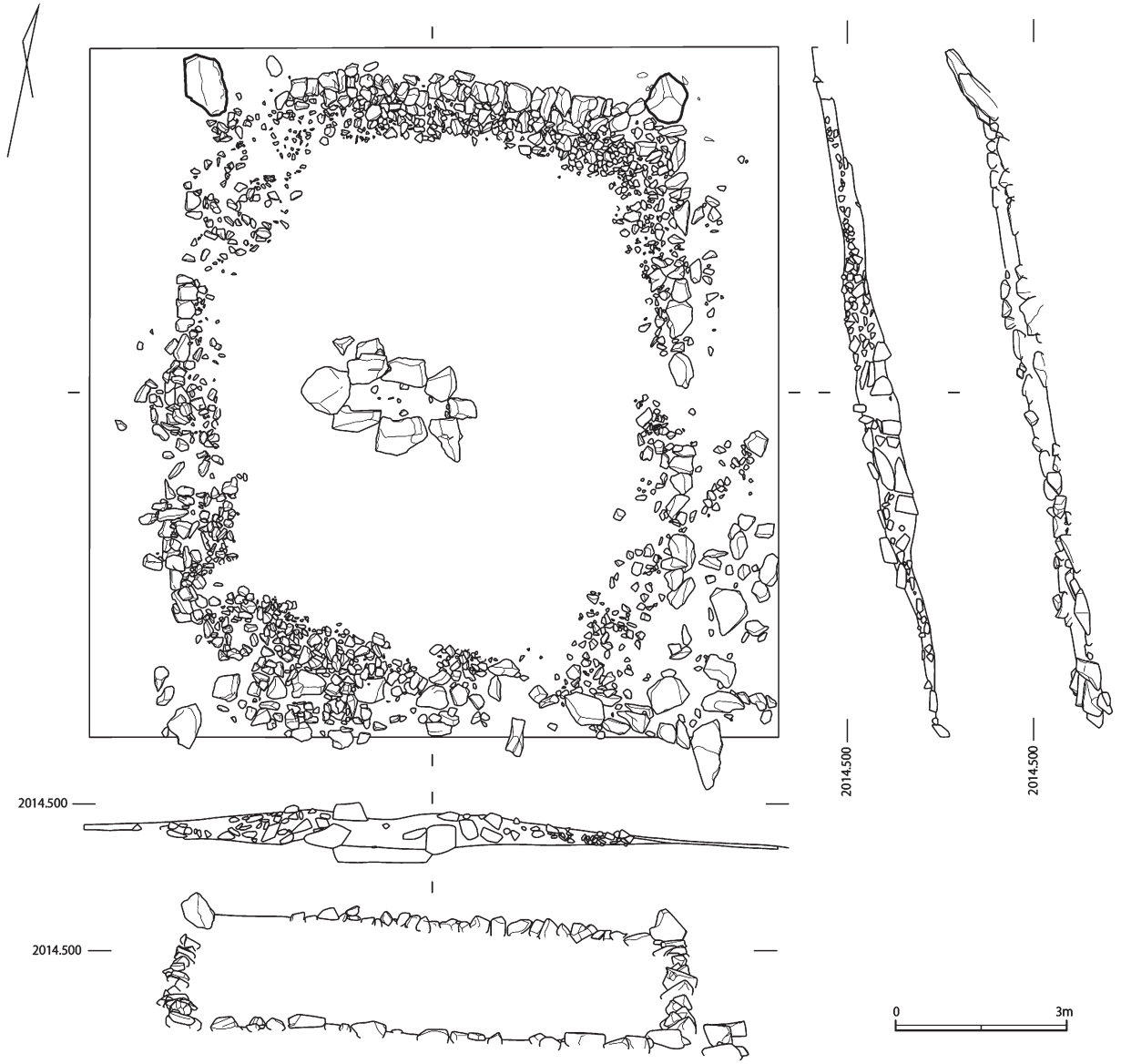


Fig.58 Grave No. 82 at Emeelt Tolgoi Site

1 After removal of stone mounds *2 Stone cist*

Fig.59 Grave No. 82 at Emeelt Tolgoi Site

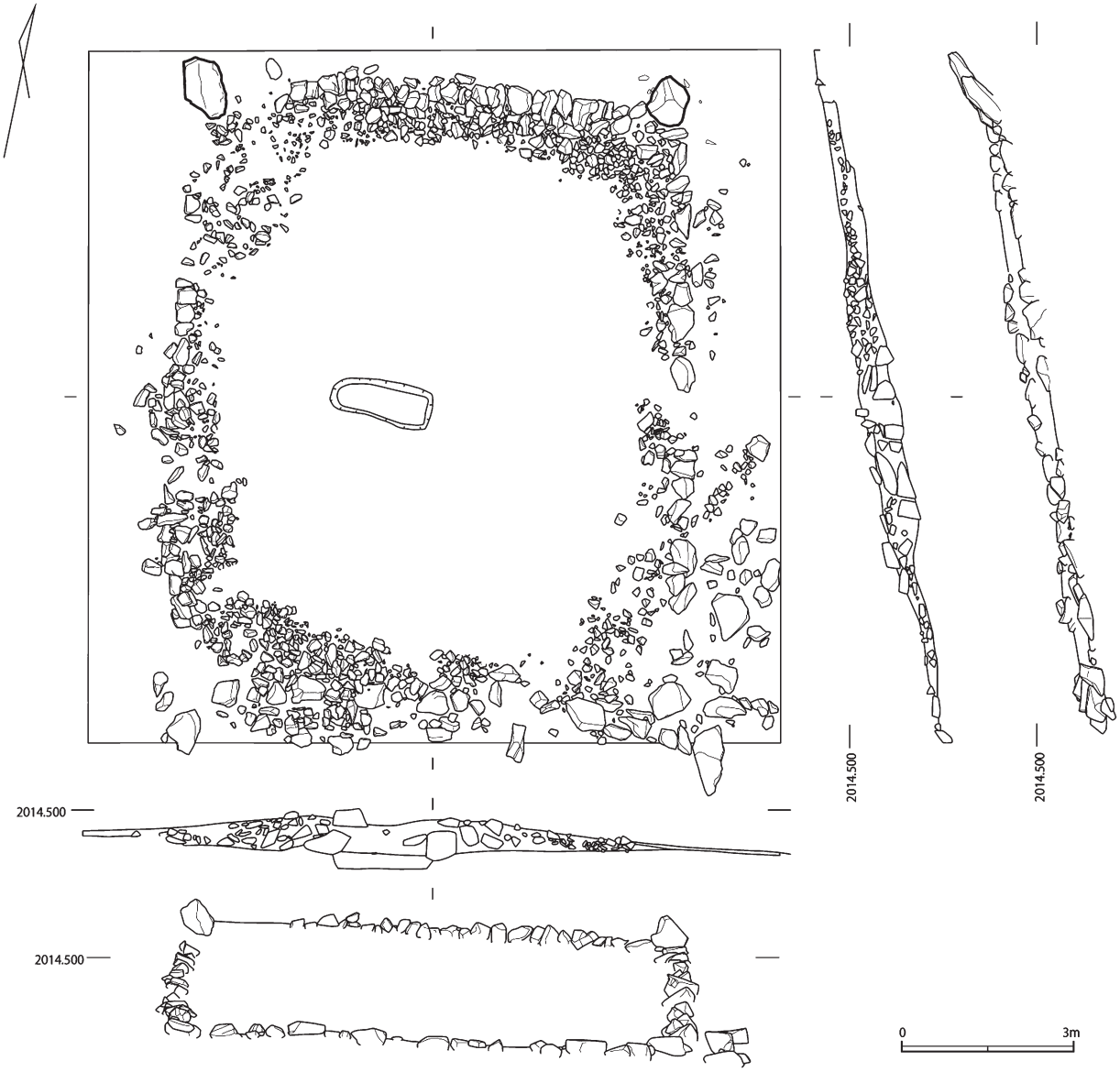


Fig.60 Grave No. 82 at Emeelt Tolgoi Site

1 Stone cist *2 Stone cist*

Fig.61 Stone cist of Grave No. 82 at Emeelt Tolgoi Site

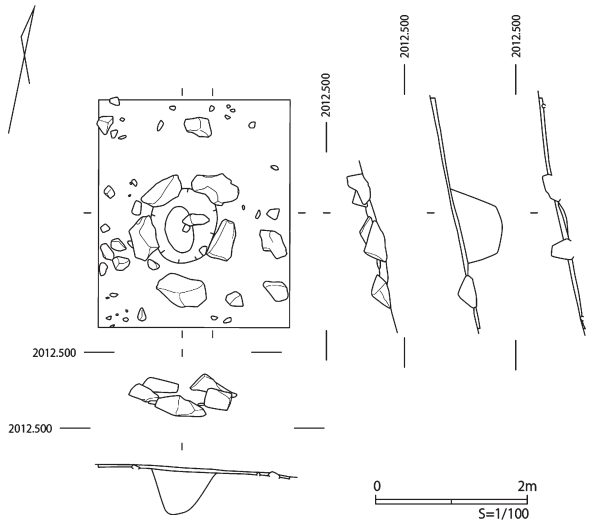
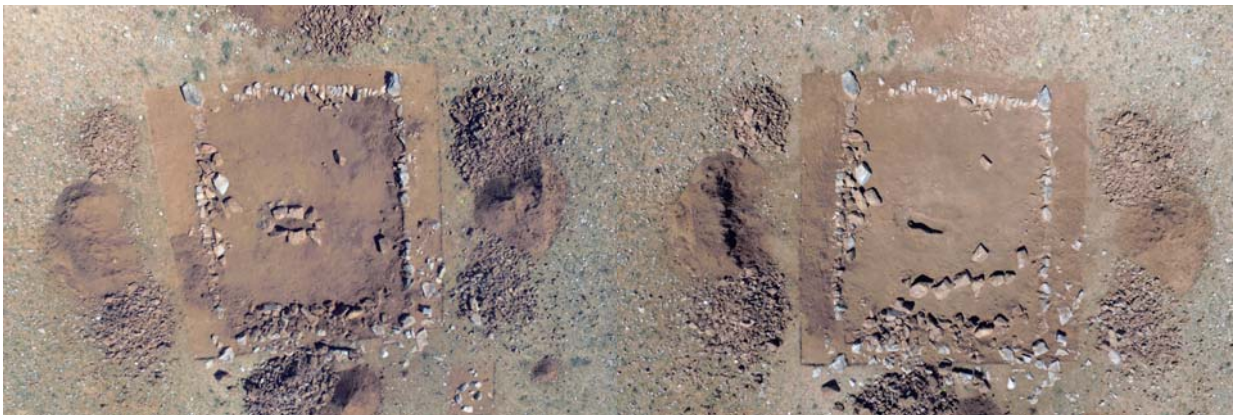


Fig.62 Sacrificed stone structure located alongside Grave No. 82 at Emeelt Tolgoi Site

Fig.63 Sacrificed stone structure located alongside Grave No. 82 at Emeelt Tolgoi Site



1 Stone cist *2 After excavation*

Fig.64 Stone cist of Grave No. 82 at Emeelt Tolgoi Site

Sagsai-shaped graves. This grave is also a Type 2b round grave. Five cover stones were placed on the burial pit (Fig. 46, 47). There is a burial pit measuring 2.6 m in length, 1.1 m in width, and 0.5 m in depth under the stone mounds (Fig. 48, 49). The deceased individual was oriented to the north, with the face placed sideways in the burial pit (Fig. 50, 51). The deceased individual is thought to have been buried in this state and covered with organic materials. Estimates based on physical anthropological analysis suggest that the human bones belong to a female in the latter half of her forties to fifties, as mentioned in Chapter 2. Carbon dating analysis of the collagen from human bones dates these bones to 1289BC - 1112BC (95.0%, 2σ).

Square Grave No. 49 (Fig. 52 - 55)

This is a small square grave measuring 3.4 m in length and 3.0 m in width (Fig. 52, 53). There is a burial pit under the surface in the center of a stone-slab grave. The deceased individual was placed in the burial pit, but the human bones were not in good condition due to looting (Fig. 54, 55-5). This grave looks like a typical stone-slab grave which was supporting stones around the rim line stone fence, and is classified as a Type 2b stone-slab grave. But no clear square fence for this grave was found and the stone fence is square in plan, despite Type 2 stone-slab graves having a rectangular plan with an erected stone fence. Based on these reasons, this grave is classified as a Type 4a square grave. Type 4a square graves also differ to the Type 1a rectangular graves of stone-slab burial culture found

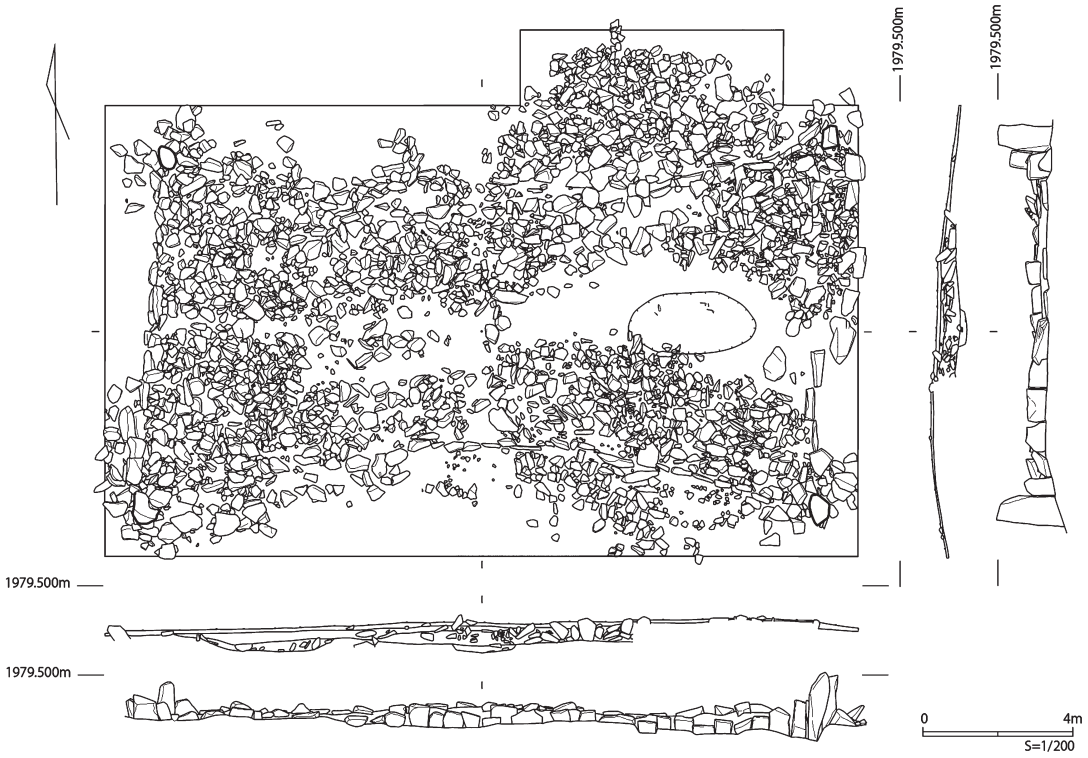


Fig.65 Grave No. 18 at Emeelt Tolgoi Site

1 Before excavation *2 Before excavation*

3 Before excavation *4 After removal of surface soils*

Fig.66 Grave No. 18 at Emeelt Tolgoi Site

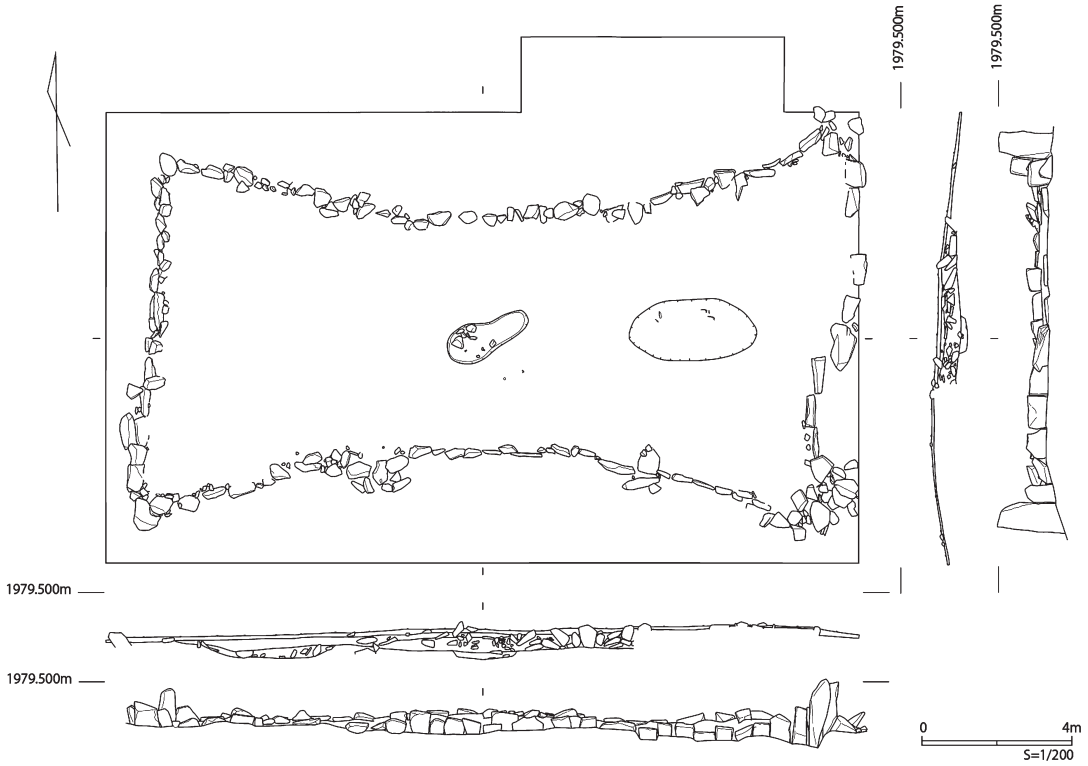


Fig.67 Grave No. 18 at Emeelt Tolgoi Site

1 After removal of surface soils

2 Finding of animal bones on the sacrificed pit

3 The sacrificed pit

4 Finding human bones alongside the burial pit

Fig.68 Grave No. 18 at Emeelt Tolgoi Site

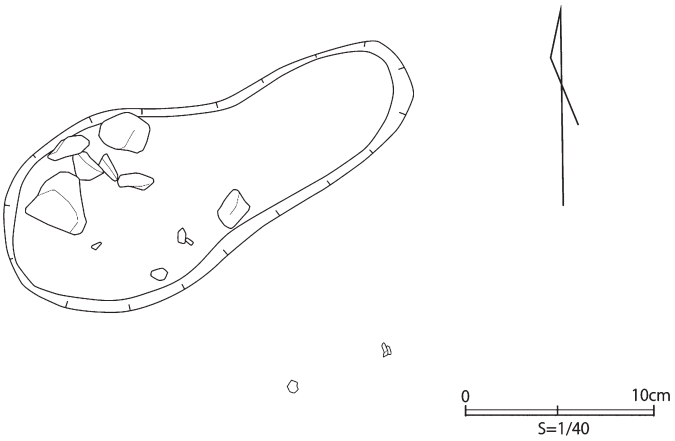


Fig.69 Burial pit of Grave No. 18 at Emeelt Tolgoi Site

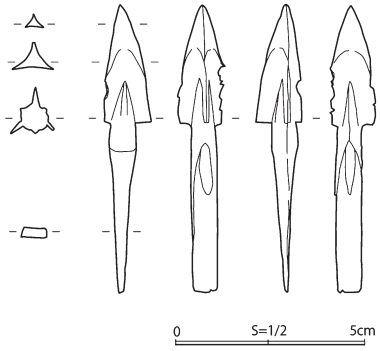


Fig.71 Finding a bronze arrowhead in the looted pit at Grave No. 18 of Emeelt Tolgoi Site

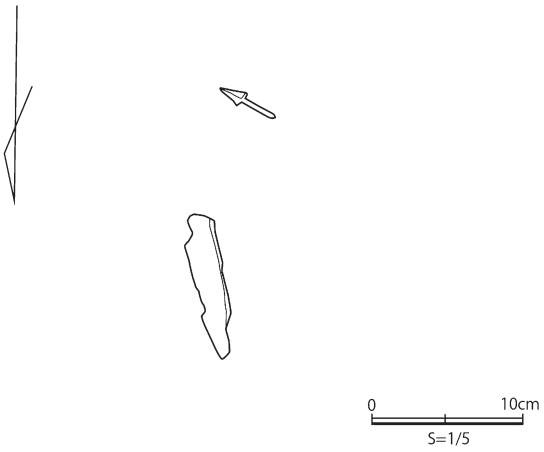


Fig.70 Grave No. 18 at Emeelt Tolgoi Site

Fig.72 Grave No. 18 at Emeelt Tolgoi Site

1 *2*

Fig.73 A bronze arrowhead in the looted pit at Grave No. 18 of Emeelt Tolgoi Site

Fig.74 Finding a bronze arrowhead in the looted pit at Grave No. 18 of Emeelt Tolgoi Site

in the eastern and middle Mongolia Plateau.

Based on physical anthropological analysis, the deceased individual buried in this grave is estimated to be adult of unknown sex. Because the burial pit is small, measuring 1.4 m in length, 0.9 m in width and 0.2 m in depth, the adult individual might have been female or buried in a flexed position. If this grave is of the flexed burial custom, it indicates an earlier state than other graves at this site. The carbon dating of collagen from human bones dates this individual to 1435BC - 1372BC (57.4%, 2σ) and 1411BC - 1269BC (95.4%, 2σ). The dating of this square grave indicates an earlier date among rectangular graves. This grave is classified as Type 4a.

Square Grave No.82 (Fig. 56 - 64)

This grave is a square kern. This type of grave is called a Type 4b square grave. The grave's stone mound was heaped 0.66 m high from the rim stones to the center. This square grave is also a Sagsai-type grave which has four oval erected stones on the four corners. The square rim line fence, which has a rectangular shaped plan, measures 11 m in length and 9 m in width (Fig. 56, 57). A stone cist was placed on the bottom of the stone grave. It is thought that the deceased individual was placed in the stone cist, although few human bones were found in it. These human bones were not in a good state of preservation, but we found several fragments of human bones. The stone cist measures 3 m by 2 m (Fig. 58, 61). This burial structure is the same as that of Khyar Kharaach Grave No. 1. We called graves such as these Type 4b square graves, which have a different rim line of stone structures to Type 4a, such as Grave No. 49 at Emeelt Tolgoi Site. The rim line of this grave's square plan is clear and has a heaped stone mound in the center, the same as that of Khyar Kharaach Grave No.1. Type 4a square graves are believed to date to a later period than Type 4b square graves.

We found animal bones in the stone structure of the grave. The animal bones date to 52AD - 133AD (95.4%). This grave is thought to have been disturbed during the Hunu period. On the other hand, carbon dating of collagen from human bones gives a dating of 545BC - 407BC (82.3%), 731BC - 691BC (11.0%). This date is relatively later among Type 4b square graves. Therefore, this dating provides some proof for the hypothesis that Type 4b square graves developed into typical Type 2a stone-slab graves in the chronological scheme (Miyamoto 2016).

Figured Grave No. 18 (Fig. 65 - 74)

This grave is a large figured grave measuring 19 m in length and 11 m in width along the short side (Fig. 65, 66). The long axis side of this grave is curved to a relatively considerable degree. The particular nature of this grave form in the plan indicates a Type 3b stone-slab grave burial (Miyamoto 2016).

The center of this grave had already been looted, but we found one bronze arrowhead with three wings, which is thought to have been part of the grave goods (Fig. 71). The bronze arrowhead was found with horse bones in the looted pit (Fig. 70, 72). We found a sacrifice pit including bones of sheep or goats and horses under the looted pit. This sacrifice pit, measuring 2.3 m in length, 1.04 m in width and 15 cm in depth, is a large but shallow pit (Fig. 67, 68). We understand that the arrowhead was originally placed in the sacrifice pit and was subsequently disturbed and ended up in the looted pit (Fig. 69, 73). Human bones were found scattered near to the burial pit in the looted pit (Fig. 68-4). Those bones were destroyed during looting. Based on physical anthropological analysis, the deceased individual has been identified as a female of an unknown age.

The horse (Fig. 70, 72) found near to the arrowhead in the looted pit was dated to 1762AD - 1803AD (47.5%, 2σ). We understand that this dating

indicates the time of looting. The sheep or goat found in the sacrifice pit dates to 930BC - 815BC (95.4%, 2σ). Because the arrowhead is believed to have originally been placed in the sacrifice pit, the dating of the arrowhead is also assumed to be the 10th to 9th centuries BC. However, the human bones date to 1565BC - 1450BC (80.2%, 2σ) and 1516BC - 1426BC (95.4%, 2σ). It is difficult to understand the difference in period between the human bones and sacrificed animal bones. A simple interpretation would be that the deceased individual was buried here, and that, following the elapse of a long period of time from the burial, another group of people dug the sacrifice pit. But the type of this figured grave is Type 3b of the stone-slab burial culture, which is believed to date to the 10th to 8th centuries BC (Miyamoto 2016). The inferred dating of typology accords with the dating of the sacrifice pit. Therefore, we may rather understand that the deceased individual was buried during the 16th - 15th century BC, and that this grave was then reconstructed to be a figured grave during the 10th - 9th centuries BC. We can infer that new groups of stone-slab graves came to this cemetery, with the individuals who built these reconstructing the figured grave to become their group symbol.

We found an arrowhead with three wings, which was few discoveries in excavations in Outer Mongolia (Fig. 71, 74). We recognize that the arrowhead is accompanied with the sacrificed pit dating to 10th - 9th centuries BC, because of the finding location of arrowhead. The arrowhead with three wings has a flat tang, a popular style from the Minusinsk basin to western Mongolia. This dating accords with the dating of horse bone, 827-795 cal. BC found at Khoshoo Tsaidam, Feature 1 with burial goods of the same type of arrowhead with three wings (Enkhtor et al. 2018).

4. Conclusion

The cemetery at Emeelt Tolgoi Site consists of round Khirigsuur and round graves, as well as square Khirigsuur and square graves. These kinds of graves represent the usual grave systems found in western Mongolia. Some of the round Khirigsuur, square Khirigsuur, round graves and all square graves have four oval stones on four corners. Such graves are referred to as Sagsai-type, which are also found at Kkyar Khraach Site. Among them, round Khirigsuur with four corner stones on the enclosure and round graves with four corner stones were classified as Khyar Kharaach-type culture (Miyamoto & Tajiri et al 2017). Those graves are the main graves at Emeelt Tolgoi Site. In addition, this cemetery contains square Khirigsuur and square graves. We can classify round grave groups and square grave groups between the former type and the latter type, as shown in Chapter 5. At Emeelt Tolgoi Site, the grave distribution indicates two different areas: Area No. 1 and Area No. 2. Round grave groups are seen in both areas. However, square groups are limited to Area No. 1. Based on carbon dating, Type 4a first occupied Area No. 1. And both groups, round type and square type, originated at the same time, although the square type continued until a relatively later time. Square type graves like Type 4 are mainly distributed in central northern Mongolia. Therefore, it is thought that this cemetery exhibits not only the particularities of western Mongolia but also those of central northern Mongolia. This is believed to be based on the site location in central Mongolia.

Although Grave No. 82 at Emeelt Tolgoi Site is the same Type 4b square grave as that of Grave No. 1 at Khyar Kharaach Site, this grave dates to a later period than that of Grave No. 1 at Khyar Kharaach Site. It is believed that Type 4b square graves date from the 13th to 8th centuries BC based on carbon dating. The dating of Grave No. 82 at this site proves the hypothesis that Type 4b square graves developed into the typical Type 2a stone-slab graves seen in western Mongolia during the 9th - 8th centuries BC.

In addition, at this site we also found many ritual stone structures which are very similar to Ritual Stone Structure No. 18 at Khyar Kharaach Site. We could not ascertain any regular locational relationship between ritual stone structures and graves. However, it is believed that these ritual stone structures are related to round Khirigsuur and round graves with four oval stones, which are called Sagsai-type graves, because these ritual stone structures are found in both Area No. 1 and Area No. 2, where round Khirigsuur and round graves are located. In this way, the archaeological evidence indicates that Emeelt Tolgoi Site possesses very similar conditions to that of Khyar Kharaach Site. It is believed that the particularities of both sites made them popular for burial systems in western Mongolia, in that there are round Khirigsuur and round graves. This site also exhibits the particularities of north Mongolia, in that there are square Khirigsuur and square graves. And at the end of this site, the figured grave Grave No. 18 was constructed under the influence of eastern Mongolia. In such a relationship between western Mongolia and eastern Mongolia, Type 4b square graves spread to eastern Mongolia and developed into the typical Type 2a slab-graves seen during the 9th - 8th centuries BC.

2 Morphological analysis on the human bones unearthed from the Emeelt Tolgoi Site

Kenji Okazaki and Shiori Yonemoto

1. Introduction

In 2016-2017, Mongolian (the Mongolian Academy of Sciences) Japanese (Kyushu University) joint team had excavated the Emeelt-Tolgoi Site in the Bayankhongor province and found six individuals of human skeletal remains at the Bronze Age. In this chapter, we repot basic information based on the morphological traits of these human bones.

2. Methods

Aging and sexing were primarily judged on the basis of the standards arranged by Buikstra and Ubelaker (1994). In sexing, as far as the preservation condition of material perimits, we used a dominant sexing method using bones such as a hip bone (Phenice, 1969) and followed the method in Nakahashi and Nagai (1986) for poorly preserved material. Adult age was estimated based on age-related changes of the morphology of pubic symphysis and auricular surfaces (Todd, 1920; Lovejoy et al., 1985) and followed cranial suture closure (Meindl and Lovejoy, 1985).

We primarily followed the measurement method of Martin (Baba, 1991). Cranial and limb measurements were done by K.O., aging and sexing by the both authors.

3. Basic information: preservation, sex, age, and observations

The states of preservation were very good in the both individuals of M40 and M44 while there were only pieces of fragile bones in the rest of individuals. Table 2 showed the cranial measurements of the both individuals of M40 and M44. Table 3 indicated the estimated height of the both individuals of M40 and M44.

Burial individual M18

Preservation: Only fragments of bone were recovered. The inter orbital area of frontal (B1) and the diaphysis of right clavicles (B2, B3) were found in the lower layer of burial pit while the diaphysis of left clavicle, the spine of right scapular, and the diaphysis of left femur were excavated from the upper layer (Fig. 75).

Sex: Superciliary arch was not well-developed, the circumference of femur was relatively small. The biological sex could be therefore female.

Age: The age at the death reached adult but could not be estimated in detail due to its poor preservation.

Burial individual M30

Preservation: Only pieces of bone were found. The following parts were confirmed: the piece of right parietal, the diaphyses of right femur and left fibula, the upper half of right patella, metatarsals and foot phalanges, and left calcaneus.

Sex: The biological sex was unknown due to its poor preservation.

Age: The age at the death reached adult but could not be estimated in detail due to its poor preservation.

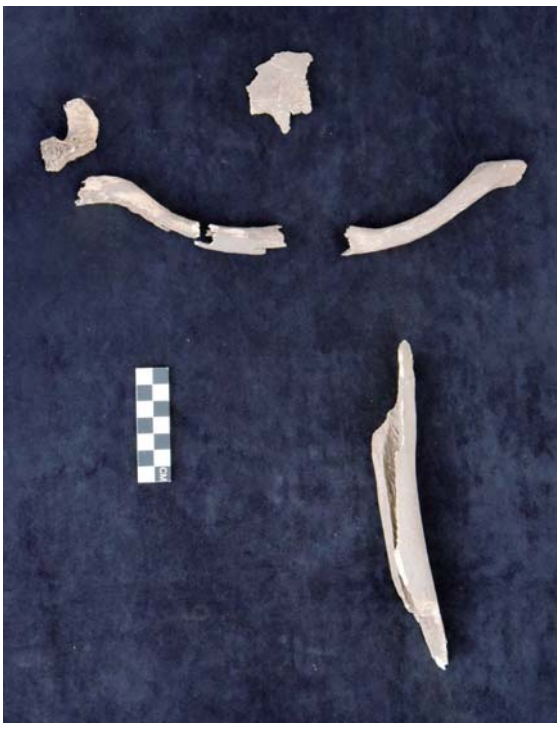


Fig.75 The Emeelt Tolgoi M18 individual.

76-a) the whole skeletal body

76-b) the front view of cranium

76-c) the obliquely front view of cranium

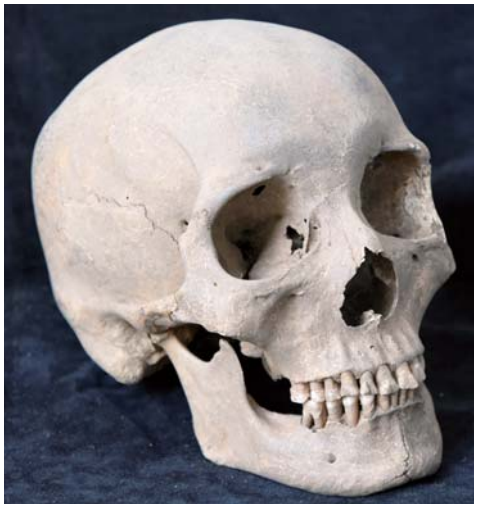
76-d) the side view of cranium

76-e) the top view of cranium

Fig.76 The Emeelt Tolgoi M40 individual.

77-a) the whole skeletal body

77-b) the front view of cranium



77-c) the obliquely front view of cranium

77-d) the side view of cranium.

77-e) the top view of cranium

Fig.77 The Emeelt Tolgoi M44 individual.

Fig.78 The right elbow joint of the Emeelt Tolgoi M44 individual.

Fig.79 The maxillary dental arch of the Emeelt Tolgoi M44 individual.

Fig.80 The Emeelt Tolgoi M49 individual.

Burial individual M40

Preservation: The preservation was very good. The most of part were recovered except for mandible, left scapula, parts of ribs, vertebrae, hand and foot (Fig. 76a-e).

Sex: The angles of subpubic area and the greater sciatic notch were relatively narrow. The biological sex was judged as male.

Age: The union did not yet finish between sternal end and diaphysis of clavicle. The condition of the auricular surface of os coxae was assigned to the first or second stage according to the standard of Lovejoy et al. (1985). These stages ranged the twenties.

Observations: A Schmorl node was present at the middle level of thoracic vertebra. A depression was observed at the body of the right maxillary, which could follow some facial fracture.

Estimated height: 171.0cm calculated based on the Pearson formula (Table 3).

Burial individual M44

Preservation: The preservation was very good. The following parts were missing: sternum, left radius, pubes, ischia, left patella, the parts of ribs, vertebrae, hand and foot (Fig. 77a-e).

Sex: The greater sciatic notch seemed to be relatively wide even though the part of it was not preserved. The biological sex was judged as possible female.

Age: The condition of the auricular surface of os coxae was assigned between the stages of sixth and eighth according to the standard of Lovejoy et al. (1985). These stages ranged from the latter half of forties to fifties.

Observations: The mild bone lipping was present along the edges of the right elbow and hip joint (Fig. 78). Wear extended to the lingual surface of maxillary anterior teeth (Fig. 79).

Estimated height: 154.3cm calculated based on the Pearson formula (Table 3).

Burial individual M49

Preservation: Only pieces of bone were found. The following parts were confirmed: the vertebral arches of the seventh cervical or the first thoracic, the first and the second lumber, a hand phalange and a metatarsal (Fig. 80).

Sex: The biological sex was unknown due to its poor preservation.

Age: The age at the death reached adult but could not be estimated in detail due to its poor preservation.

Fig.81 The Emeelt Tolgoi M82 individual.

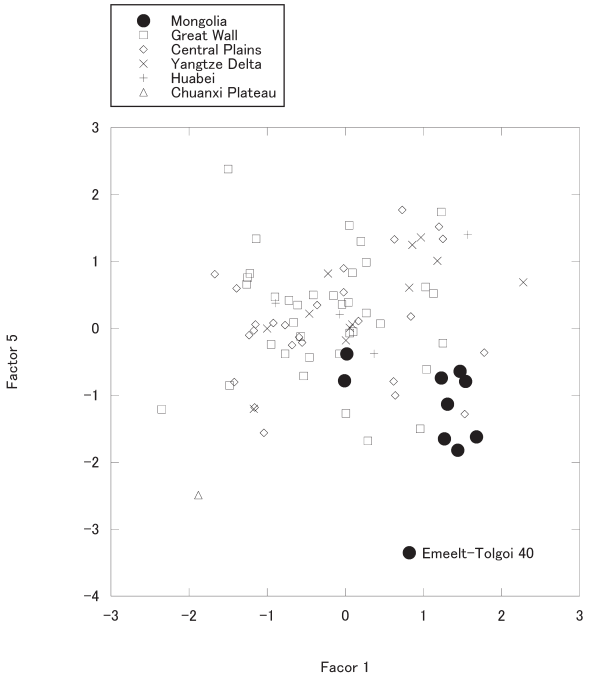


Fig.82 The distribution of factor 1 and factor 5 based on the principal component analysis using 18 items of cranial measurements.

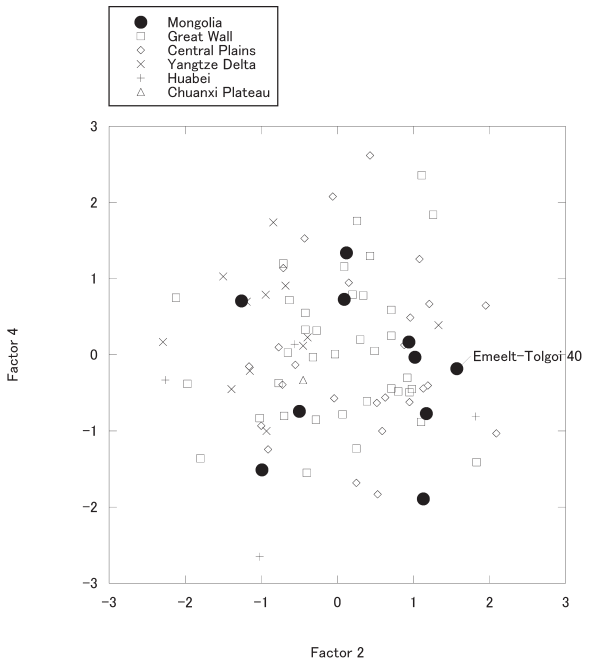


Fig.83 The distribution of factor 2 and factor 4 based on the principal component analysis using 18 items of cranial measurements.

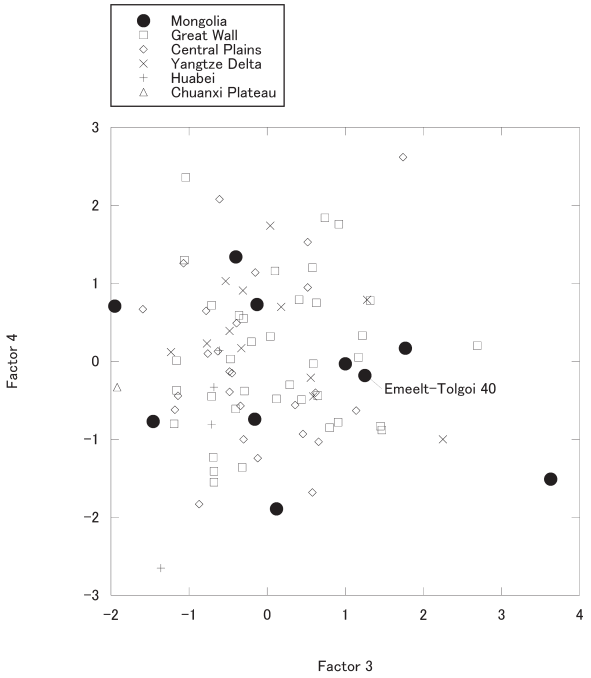


Fig.84 The distribution of factor 3 and factor 4 based on the principal component analysis using 18 items of cranial measurements.

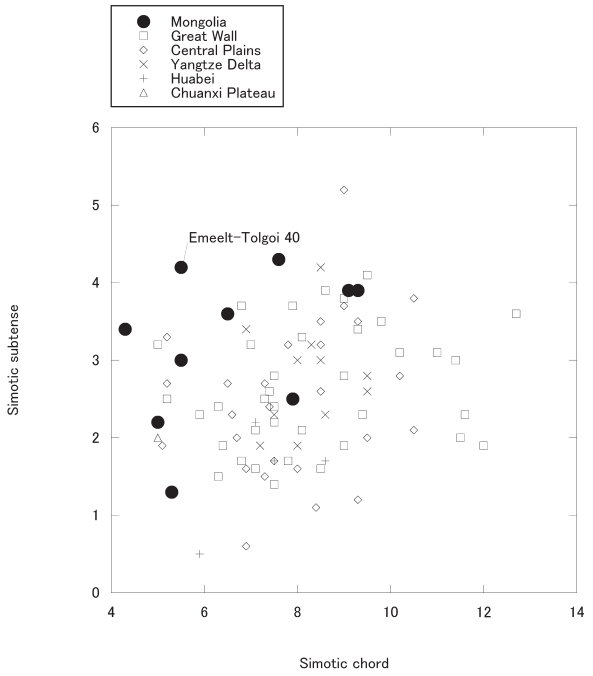


Fig.85 The distribution of simotic chord and simotic subtense.

Table 3 Height (mm) estimated based on the maximum length of femur.

site	Emeelt-Tolgoi	
ID	M40	M44
sex	Male	Female?
Maximum length	477	419
Height (Pearson)	1709.8	1543.4
Height (Stevenson)	1780.0	-
Height (Fujii)	1728.1	1554.7

The names in parentheses show the formula used for estimated height (Hiramoto, 1981).

Table 2 Measurements of cranium

Site	Emeelt-Tolgoi	
Sample No.	M40	M44
Sex	Male	Female?
1. Maximum cranial length	188	168
5. Basal length	108	97
8. Maximum cranial breadth	155	148
9. Minimum frontal breadth	99	95
17. Basi-bregmatic height	126	121
23. Horizondal circumference	547	500
24. Transverse arc	322	307
25. Total sagittal arc	355	337
40. Facial profile length	106	94
45. Bizygomatic breadth	151.5	132
46. Bimaxillary breadth	105	103
47. Total facial height	-	114
48. Upper facial height (sd)	76	70
50. Anterior interorbital breadth	15.2	19.9
IA. Anterior interorbital arc	18.2	24.1
51. Orbital breadth	45	43
52. Orbital height	37	34
54. Nasal breadth	25	26
55. Nasal height	58	52
57. Least nasal breadth	5.5	8.5
FC. Frontal chord	98.8	100.3
FS. Frontal subtense	14.6	16.8
SC. Simotic chord	5.5	8.5
SS. Simotic subtense	4.2	3.5
ZC. Zygomaxillary chord	99.3	98.2
ZS. Zygomaxillary subtense	13.9	18.3
72. Facial profile angle	88	88
73. Middle facial profile angle	93	93
74. Alveolar profle angle	78	76
8:1 Cranial length-breadth index	82.4	88.1
17:1 Cranial length-height index	67.0	72.0
17:8 Cranial breadth-height index	81.3	81.8
47:45 Kollmann's total facial index	-	86.4
48:45 Kollmann's upper facial index	51.5	55.3
47:46 Virchow's total facial index	-	110.7
48:46 Virchow's upper facial index	74.3	70.9
50:IA Prominence index of nasal root	83.5	82.6
52:51 Orbital index	81.1	79.1
54:55 Nasal index	43.1	50.0
FS:FC Frontal index of flatness	14.7	16.8
SS:SC Simotic index of flatness	77.0	41.1
ZS:ZC Zygomaxillary index of flatness	14.0	18.6
65 Bicondylar breadth	-	111
66 Bigonial breadth	-	96
68 Mandibular body length	-	73
69. Mandibular symphysis height	-	29
70 Mandibular ramus height	-	54
71 Mandibular ramus breadth	-	34
79 Mandibular angle	-	122
71:70 Index of mandibular ramus	-	62.6

Table 4 The loadings of each factors by the principal component analysis using 18 items of cranial measurements.

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1. Maximum cranial length	0.13	**0.72**	0.29	0.14	-0.16
5. Basal length	0.09	**0.84**	0.08	0.17	0.30
8. Maximum cranial breadth	0.53	0.03	0.37	-0.24	-0.22
9. Minimum frontal breadth	0.56	0.40	-0.05	0.17	0.04
17. Basi-bregmatic height	0.03	0.47	-0.12	-0.12	**0.64**
40. Facial profile length	0.14	**0.81**	0.11	-0.04	0.11
45. Bizygomatic breadth	**0.69**	0.06	0.45	-0.26	0.00
48. Upper facial height (sd)	0.05	0.23	**0.88**	-0.01	0.14
51. Orbital breadth	**0.82**	0.22	0.13	0.12	-0.08
52. Orbital height	0.37	0.03	0.49	0.38	-0.05
54. Nasal breadth	0.64	-0.10	0.06	0.08	0.23
55. Nasal height	0.20	0.12	**0.89**	0.14	0.01
FC. Frontal chord	**0.80**	0.28	0.06	0.16	0.10
FS. Frontal subtense	0.15	0.20	-0.17	**0.75**	0.21
SC. Simotic chord	-0.19	-0.08	0.21	0.56	0.41
SS. Simotic subtense	0.14	0.08	0.25	**0.70**	-0.22
ZC. Zygomaxillary chord	0.49	-0.07	0.27	-0.42	0.47
ZS. Zygomaxillary subtense	0.10	0.08	0.07	0.15	**0.76**

The varimax method was used. The loadings that exceed 0.6 are in bold face.

Burial individual M82

Preservation: Only pieces of bone were found. The following parts were confirmed: the left scapular spine and the diaphysis of the lower limb bone (femur or tibia) (Fig. 81).

Sex: The biological sex was unknown due to its poor preservation.

Age: The age at the death probably reached adult but could not be estimated in detail due to its poor preservation.

4. Morphological analysis on the M40 cranium

Morphological analysis was done on the crania of the M40 young adult male, which was well-preserved. The following comparative materials were used as male individuals of the Bronze Age or early dynastic periods: Khyar Kharaach, Tevsh, Delger-Khaan, Chandman, Egiin-Gol2015, Khushuut1, Khushuut2 in Mongolia (Okazaki et al., 2016, Okazaki and Yonemoto, 2017); Tuchengzi, Youyao, Nanerhai, Sanguan, Pinanbao in the northern Great Wall region; Xinghong, Zhouzhuang in the Central Plains (Nakahashi, 2014, unpublished data); Liangwangcheng, Laohushan, Wangtuanzhuang, Taowan, Huchang, Luying in the Yangtze Delta region (Nakahashi et al., 2002); Kashahu in the Chuanxi plateau of Sichuan (Nakahashi et al., 2013).

A principal component analysis was done using 18 items of cranial measurements. Table 4 indicated the factor loadings. Factor 1 had relatively high loadings in orbital breadth, frontal chord, and bizygomatic breadth, which could be interpreted as a vector to broad face. Factor 2 had relatively high loadings in basal length, facial profile length, and maximum cranial length, which could be interpreted as a vector to long head. Factor 3 had relatively high loadings in nasal height and upper facial height, which could be interpreted as a vector to high face. Factor 4 had relatively high loadings in frontal subtense and simotic subtense, which could be interpreted as a vector to three-dimensional upper face. Factor 5 had relatively high loadings in zygomaxillary subtense and basi-bregmatic height, which could be interpreted as a vector to prognathism and high head.

Figure 82 showed the distribution of factor 1 and factor 5. All Mongolian individuals were located on the right lower quarter of the figure. It meant that the Mongolian of the Bronze Age generally had broad face and less prognathism and high head. The Emeelt Tolgoi M40 had the broadest face among the comparative materials. Figure 83 showed the

distribution of factor 2 and factor 4. The Mongolian individuals widely varied regarding to the both vectors of long head and three-dimensional upper face. The Emeelt Tolgoi M40 had longer head and average three-dimensional upper face. Figure 84 showed the distribution of factor 3 and factor 4. The Mongolian individuals widely varied regarding to the vector of high face. The Emeelt-Tolgoi M40 had higher face among the comparative materials. Figure 85 showed the distribution of simotic chord and simotic subtense. The Emeelt Tolgoi M40 had relatively large simotic subtense and small simotic chord. As a result, the simotic index (77.0%) was the second highest among the comparative materials.

5. Summary

The biological sex and age were following: adult female for M18, adult and unknown sex for M30, young adult male for M40, middle adult female for M44, adult and unknown sex for M49, and adult and unknown sex for M82. Schmorl node and healed facial fracture was present for M40. Mild bone lipping was present on the right elbow and right hip joint, and extra-masticatory wear on maxillary anterior teeth for M44. The M40 cranium were characterized as broader and higher face, longer head, and three-dimensional root of nasal bone among the comparative materials.

3 The Strontium analysis on the human skeletal remains from the Emeelt Tolgoi Site and Bor Ovoo Site in Bayanhongor, Mongolia

Shiori Yonemoto, Tatsuro Adachi, Kyoko Funahashi, Nobuhiko Nakano and Yasuhito Osanai

Introduction

Ericson (1985) first demonstrated that the strontium (hereafter Sr) isotope analyses in human bones and teeth could be used to study aspects of ancient human behavior based on geological and physiological principal. This analysis is based on the Sr isotope (hereafter $^{87}Sr/^{86}Sr$) ratios in soil, groundwater, vegetation, and fauna largely reflect underlying $^{87}Sr/^{86}Sr$ bedrock values. The $^{87}Sr/^{86}Sr$ ratios change little as they pass from weathering rocks, through soil and water, into food chain (Slovak and Paytan, 2011). Humans that eat animals and plants and drink water in the food chain acquire the $^{87}Sr/^{86}Sr$ ratio of local. Although human bone remodels continuously, tooth enamel is not reformed after being formed as infancy and childhood (Hillson 1996). The $^{87}Sr/^{86}Sr$ ratio in tooth enamel reflects childhood diet and the geology of the place where one has been brought up. Conversely, $^{87}Sr/^{86}Sr$ values in bone will reflect adult diet and adult local (Ericson, 1985). Recently, many archaeologists have used $^{87}Sr/^{86}Sr$ signatures in human enamel and bone apatite to reconstruct ancient mobility patterns and to distinguish between individuals of local and non-local origins at archaeological sites (e.g. Bently et al. 2004; Bently 2006; Slovak and Paytan, 2011).

Most previous studies of Sr isotope analysis in archaeology have been performed using thermal ionization mass spectrometry (TIMS) which is applicable for solution of entire teeth. The third molar have used for these analyses, because there is little influence on morphological researches. However, third molar is generally most variable tooth in terms of their development, formed from 7 years old to 16 years old (Hillson 1996). Automatically, analyses of $^{87}Sr/^{86}Sr$ ratio are limited to this age stage. Although there is an advantage of third molars form after the period of weaning, these analyses cannot clarify about $^{87}Sr/^{86}Sr$ ratio in one's infancy and childhood. The advent of laser-ablation multi-collector inductively coupled plasma mass spectrometry (LA-MC-ICP-MS) enable us measure Sr isotope ratio with less damage to the samples than TIMS (Porhaska et al. 2002; Horstwood et al. 2008). Kyushu University Advanced Asian Archaeological Research Center established a method to measure $^{87}Sr/^{86}Sr$ ratio almost nondestructively using LA-MC-ICP-MS. Due to the character of less damage, it is possible to analyze for any tooth type, not only the third molar. Particularly, due to the analysis of the Sr value of the incisor, it enable to investigate the Sr value of their geological habitat at the age of 0-4. It means that it was possible to more directly reflect the Sr isotope ratio of the place of birth or person's childhood geological habitat than those from the third molar. While LA-MC-ICP-MS based enamel $^{87}Sr/^{86}Sr$ values were said to be less precise than the corresponding TIMS values, Slovak and Paytan (2011) argue that LA-MC-ICP-MS is sufficiently accurate to investigate their geographic origins and their mobility if the geologic units are considerably variable from one another.

Our researches have tried to explore rules of group composition who shared same graveyard at Bronze age in Mongolia using LA-MC-ICP-MS. We have shown that two persons who were buried in Khyar Kharaach site were very different in $^{87}Sr/^{86}Sr$ values (Yonemoto et al., 2017). Moreover, the two human remains who have different $^{87}Sr/^{86}Sr$ values were buried in different burial types and had different facial traits (Okazaki and Yonemoto, 2017: Miyamoto , 2017). We found that among the persons who were buried in Khyar Kharaach site, there were persons who may have been grew in different place. We have also discussed that there is a difference in $^{87}Sr/^{86}Sr$ ratio between Tevsh No.1 and Tevsh No.3 (Yonemoto et al., 2016). Thereafter, the number of analysis cases increased (Yonemoto at al., 2017). It was found that the $^{87}Sr/^{86}Sr$ ratios of these two individuals in Tevsh site differ, but both showed relatively high $^{87}Sr/^{86}Sr$ in the whole of analyzed Mongolian data. Based on this result, it follows that Tevsh No.1 and No.3 may have grown up in similar areas, but much work remains to be done in order to understand their origin.

There were still few analysis examples, and further analysis is necessary to clarify group

composition of population of Mongolian Bronze Age. In this article, we investigate $^{87}Sr/^{86}Sr$ values of human skeletal remains from Emeelt Tolgoi Site and from Bor Ovoo Site in Bayanhongor, Mongolia.

Materials and Method

For this study, we used samples of two individuals from the Emeelt Tolgoi Site and of two individuals from the Bor Ovoo Site. Also, we used a sample of individual from burial No.37 of the Egin Gol-2015 Site excavated by the Mongolian research team. Table 5-1 shows the details of individuals analyzed in this year. As comparative data, the samples from Tevsh Sites, Chandman Khar Sites (Yonemoto et al., 2016), Khyar Kharaarch Sites, Ulaan Boom Sites, Khushuut 1 and 2 sites, Houvsgol Sites (years excavated were 2006 and 2007) and Zuun Bel Sites (Yonemoto et al., 2017) were used (Table 5-1, 5-2).

The morphological analysis on the human skeletal remains from Emeelt Tolgoi Site is reported by Okazaki et al. in this book. The biological sex in Burial No.40 individual (ET40) is male and estimated age is twenties. The biological sex in Burial No.44 individual (ET44) is female and estimated age range from forties to fifty. The radiocarbon ages on the human skeletal remains from this site is reported by Yoneda et al. in this book. ET40 and ET44 were excavated in same graveyard and they were buried in same type of grave. Because these two are different sex, we cannot simply compare physical traits.

The morphological analysis on the human skeletal remains from Bor Ovoo Site was reported by Okazaki and Yonemoto (2017) and the radiocarbon ages was reported by Yoneda et al. (2017). The biological sex in Burial No.2 individual (BO2) was unknown and age ranged the first half of thirties. The biological sex in Burial No.8 individual (BO8) was unknown and age ranged from the late teens to twenties. Because the preservation of these two were not good, the details of their traits were also unknown. The Egin Gol-2015 Site is reported by Mongolian research team. The biological sex in this individual (EG37) is female and estimated age range from twenties to forties.

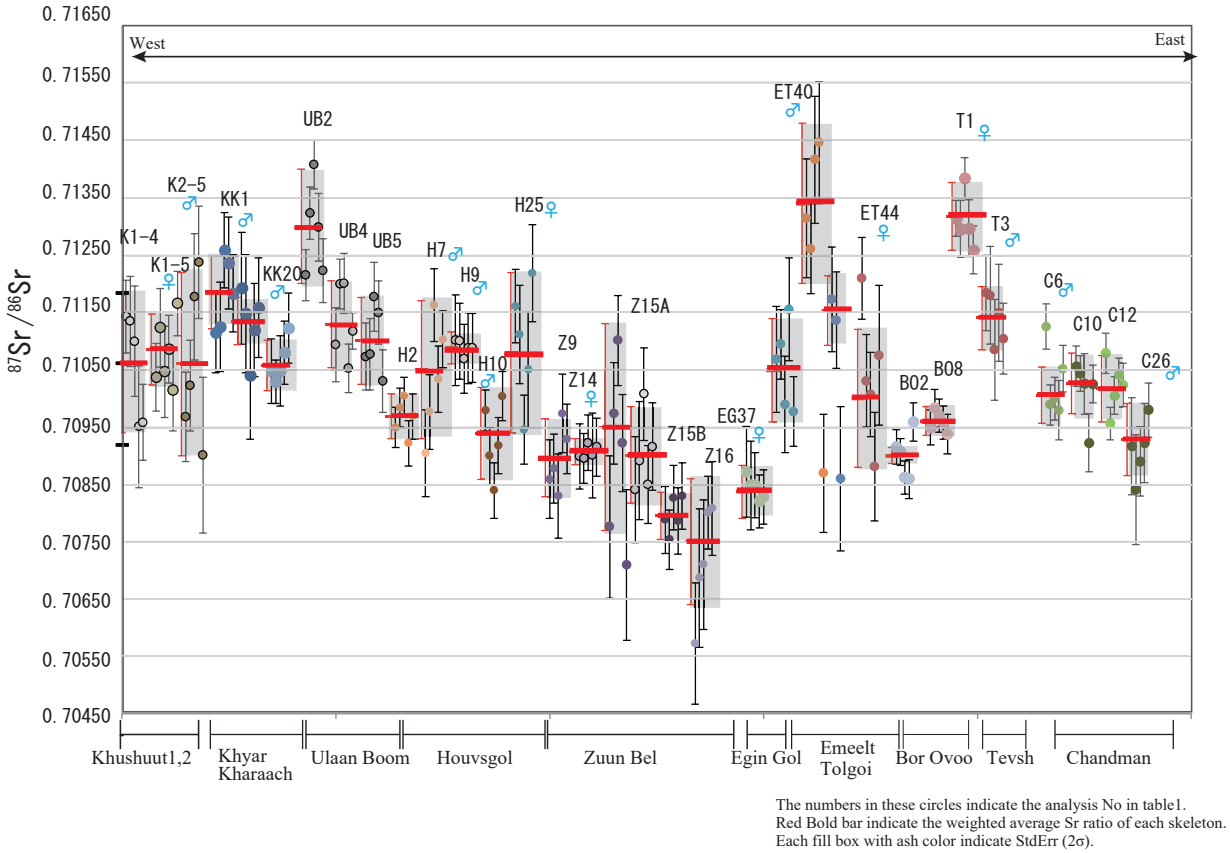
The teeth analyzed were left upper first incisor and left lower first premolar of ET40 and right upper first incisor of ET44. The odontogenesis age of the analysis point on ET40 was regarded as 2-6 years old. Since there were two parts analyzed in left lower first premolar of ET40, the odontogenesis age range of the analysis point was wide. The odontogenesis age of the analysis point on ET44 was regarded as 2-4 years old (Hillson 1996). The teeth analyzed were left upper first incisor of BO2 and right lower first molar of BO8. The odontogenesis age of the analysis point on BO2 was regarded as 2-4 years old and the odontogenesis age of the analysis point on BO8 was regarded as 11-12 years old (Hillson 1996). The teeth analyzed were right lower canine of EG37 and the odontogenesis age of the analysis point on this is regarded as 3-5 years old.

We used LA-MC-ICP-MS (Thermo Fisher Scientific, Neptune Plus) combined with LA system (Photon Machine, Analyte G2 Excimer laser) installed at Kyushu University, Japan. First, the state of analysis part was observed using an optical microscope in order to avoid weathered portion. The surface of teeth was polished from 3mm to 7mm using dental engine to make flat plane in order to obtain the stability of the signal. Second, isotopic analyses were performed using LA-MC- ICP-MS. Isotopic ratios were calculated based on data correction protocols described by Horstwood et al. (2008). In this paper, we analyzed not only $^{87}Sr/^{86}Sr$ ratios but also $^{43}Ca/^{88}Sr$ ratios. By checking $^{43}Ca/^{88}Sr$ ratios, content of Sr was estimated. Because main ingredient of teeth is apatite ($Ca_5 (PO_4)_3 (F, Cl, OH)_2$), the concentration of Ca is approximately constant. Finally, the analysis traces were observed using scanning electron microscope (SEM, Keyence VHX-D500). The analysis carried out for each tooth more than five lines which were used to calculate weighted means of $^{87}Sr/^{86}Sr$ ratios to check deviation of the obtained date. Weighted means of $^{87}Sr/^{86}Sr$ ratios were also used calculate probability density to reveal the cluster of these values

Results

The results and weighted mean are presented in Table 5-1 and 2, Figure 86 and figure 87 show $^{87}Sr/^{86}Sr$ ratios and $^{43}Ca/^{88}Sr$ ratios, respectively.

The $^{87}Sr/^{86}Sr$ ratios in LUI[1] of ET40 was 0.71049 ± 0.0009, in LLP_1 upper part of ET40 is 0.71340 ± 0.0014 and in LLP_1 lower part is 0.71153 ± 0.00061. There were two outliners in this individual. As figure 87 shows, the $^{87}Sr/^{86}Sr$ ratios of the ET40 varied relatively large. The $^{87}Sr/^{86}Sr$ ratios in RUI[1] of ET44 was 0.71000 ± 0.0012. There was an outliner in ET44. The $^{87}Sr/^{86}Sr$ ratios of the ET44 also varied relatively large. As shown in Figure 87, there was not difference in $^{87}Sr/^{86}Sr$ values between ET40 and ET44, although the $^{87}Sr/^{86}Sr$ ratios of these two individuals extremely had big unevenness. In the case of the ET40 and ET44, the variations and values of $^{43}Ca/^{88}Sr$ ratios for each analysis points were large (Fig.87). Particularly, the differences between types of teeth were large, but in one type of teeth the variation of $^{43}Ca/^{88}Sr$ ratios was



The numbers in these circles indicate the analysis No in table1.
Red Bold bar indicate the weighted average Sr ratio of each skeleton.
Each fill box with ash color indicate StdErr (2σ).

Fig.86 Diagram of $^{87}Sr/^{86}Sr$ ratio

relatively small. It means that Sr concentration was low. Hence, it is thought that the variation of $^{87}Sr/^{86}Sr$ ratios in ET40 and ET44 had some influenced by Sr concentration.

On the other hand, the $^{87}Sr/^{86}Sr$ ratios of Bor Ovoo were relatively in union (Fig.86). The $^{87}Sr/^{86}Sr$ ratios in LUI[1] of BO2 was 0.70900 ± 0.00046. There was not outliner in this individual. The $^{87}Sr/^{86}Sr$ ratios in RLM_3 of BO8 was 0.70960 ± 0.00014. There was not outliner in this individual. As shown in figure.2, the variations and values of $^{43}Ca/^{88}Sr$ ratios for each analysis points were relatively small except for an analysis point in BO2. The $^{87}Sr/^{86}Sr$ ratios of EG37 also were relatively in union (Fig.86). The $^{87}Sr/^{86}Sr$ ratios in RLC of EG37 was 0.70837 ± 0.00025. There was not outliner in this individual. The variations and values of $^{43}Ca/^{88}Sr$ ratios for each analysis points were relatively large (Fig.87).

Figure 88 demonstrates these $^{87}Sr/^{86}Sr$ values of all samples with probability density distribution. The values were arranged based on the location of sites from west to east. The calculated age by probability density distribution were 0.709186 ± 0.0000, 0.710617 ± 0.0001 and 0.71184 ± 0.0002. The obtained data means that there were three clusters based on three peak point in the $^{87}Sr/^{86}Sr$ ratios of all Mongolian samples in this study. The $^{87}Sr/^{86}Sr$ ratio of ET40 fluctuated from 0.710617 to 0.71184. The $^{87}Sr/^{86}Sr$ ratio of ET44 fluctuated from 0.709186 to 0.710617. On the other hand, the $^{87}Sr/^{86}Sr$ ratios of BO2 and BO8 both clustered around 0.709186. The $^{87}Sr/^{86}Sr$ ratios of EG37 also clustered around 0.709186.

The clusters having lowest point (i.e. 0.709186 ± 0.0000) were as follows; all samples excavated from Zuun Bel, C26 (i.e. Chandman burial no.26), H2 (i.e. Houvsgol2006 burial No.2), H10 (i.e. Houvsgol 2007 burial no.10), BO2, BO8 and EG37. The $^{87}Sr/^{86}Sr$ ratios of every individuals from Zuun Bel sites did not have the clear difference. What should be noted was that every individual from Zuun Bel sites and EG37 clustered around the lowest point and show lower values than that.

The clusters having highest point (i.e. 0.71184 ± 0.0002) were as follows; KK1, T1 (Tevsh burial No.1), UB2 (Ulaan Boom No.2), probably T3 (Tevsh burial No.3) and premolar of ET40. Other samples were belonged to middle cluster (i.e. 0.710617 ± 0.0001).

Discussions

These results of our experiments indicate that the dispersions in $^{87}Sr/^{86}Sr$ ratios of ET40 and ET44 are large. Their both $^{87}Sr/^{86}Sr$ ratios is hardly difference. Although we cannot compare their physical traits due

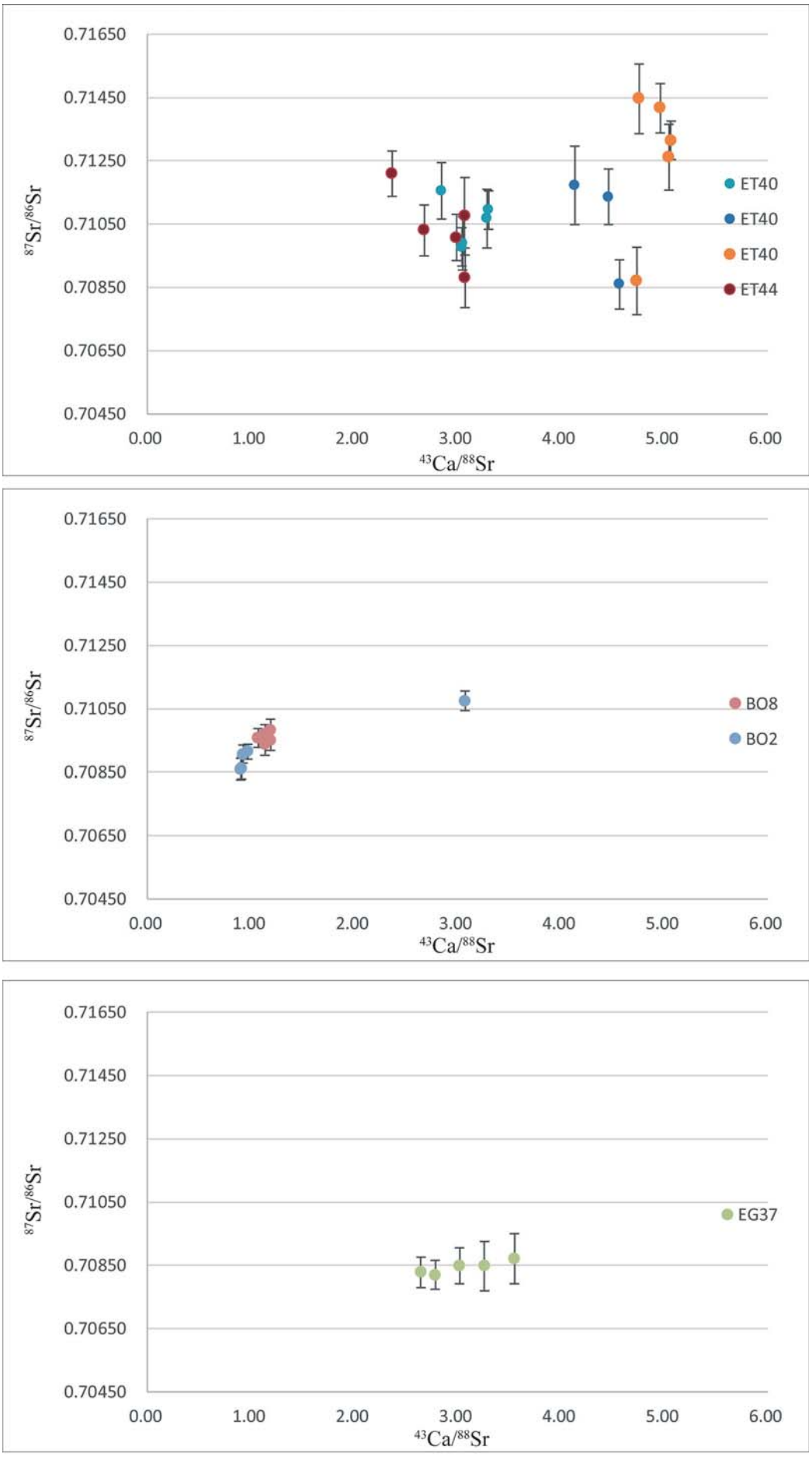


Fig.87 Diagrams of $^{43}Ca/^{88}Sr$ ratio vs $^{87}Sr/^{86}Sr$ ratio of each site

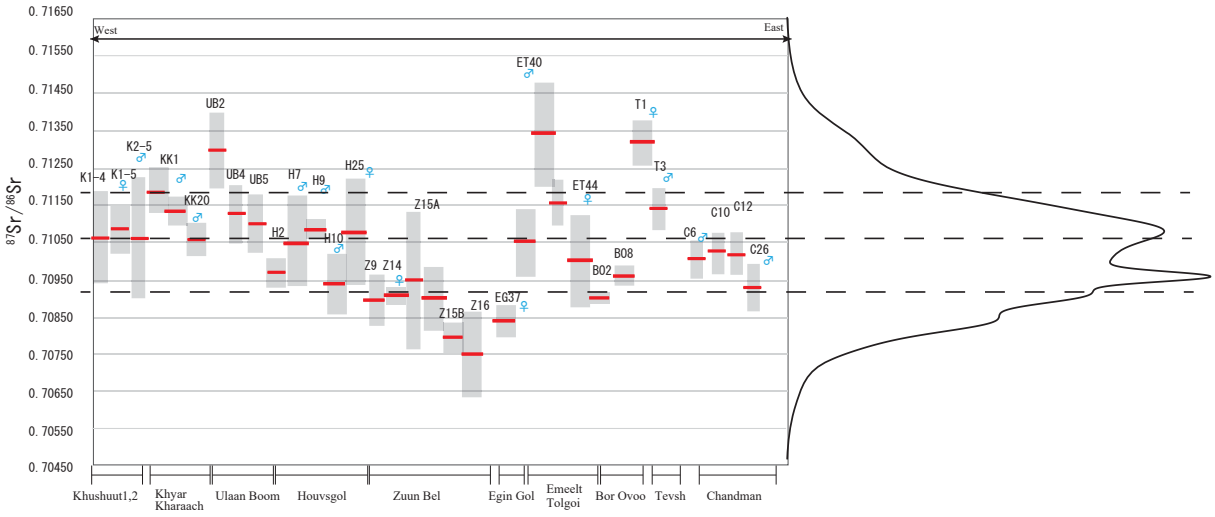


Fig.88 Diagram of $^{87}Sr/^{86}Sr$ ratio with probaility density

to different in sex, two human remains were basically same in burial styles. These burial styles same that of KK20. Moreover, ET 40 male were similar to KK 20 male in nasal root. Facial flatness and burial style of ET40 suggested the possibility of some influence from the west side. While $^{87}Sr/^{86}Sr$ ratios of ET40 and ET44 overlap with the value of KK 20, the dispersions are larger than KK20. It is the location of Emeelt Tolgoi Site to be important for interpret this result. In this area, geology with different types of rocks is distributed in narrow areas. It is therefore possible that the inhomogeneity of the $^{87}Sr/^{86}Sr$ value indicates not the magnitude of their travel distance, but the geological features of the place they grew up. We interpret the result as generally same in childhood habitat between ET40 and ET44. Probably, they were brought up near the place where their graves were made. Therefore, ET40 male and ET44 female who adopted the burial style influenced by west side may not be directly come from the west side.

As figure 88 shows, the $^{87}Sr/^{86}Sr$ ratios of three individuals from Bor Ovoo Site and Egin Gol Site are low. These low values are rare in Mongolia and are mainly found from ZuunBel Site. The specificity of the $^{87}Sr/^{86}Sr$ ratios of ZuunBel Site might result from Permian granite (Yonemoto et al., 2017). The location of Egin Gol Sites is close to ZuunBel Site (Fig.89). Although these sites are difference in the results of radiocarbon ages (Table5), the specificity of the $^{87}Sr/^{86}Sr$ ratios of ZuunBel and Egin Gol may come from Permian granite located on these sites (Fig.89). Also, the $^{87}Sr/^{86}Sr$ ratios of H2 and H10 in Houvsgol Sites cluster around the lowest point. Because Houvsgol Site is near to ZuunBel Site, the $^{87}Sr/^{86}Sr$ ratios of H2 and H10 may be affected by the human mobility from Permian granite in Northern Mongolia around ZuunBel Site and Egin Gol Site. However, it should be noted that there were greatly difference in period between Houvsgol site and Egin Gol Site, and ZuunBel Site (Table.5).

More noteworthy is the fact that the $^{87}Sr/^{86}Sr$ ratios of two individuals from Bor Ovoo Site were low (Fig.88). In respect of Bor Ovoo, it may be difficult to think that it was affected by human mobility from Permian granite in Northern Mongolia around ZuunBel Site, because the distance between the sites is too far. Permian granit also is slightly distributed in this Bor Ovoo area. Therefore, the low $^{87}Sr/^{86}Sr$ ratios of Bor Ovoo may related not to the fact that the population moved from Northern Mongolia but to the fact that Permian granite is distributed in this area. Moreover, BO2 was round grave with a burial pit and consist of a stone mound (Miyamoto et al., 2017). BO8 was figured grave with a burial pit (Miyamoto et al., 2017). Although these burial types are different, the $^{87}Sr/^{86}Sr$ ratios of two individuals were similar. From the result obtained in the $^{87}Sr/^{86}Sr$ ratios, we suggested that persons who were buried in Bor Ovoo Site, at least BO2 and BO8, may have been grew in similar place near burial site.

Here we have three types of the $^{87}Sr/^{86}Sr$ results in one graveyard: The first is that people who grew up in different areas are buried in different types of burial in the same graveyard, such as Khyar Kharaach Site (Miyamoto et al., 2017). The second is that person who grew up in a similar area were buried in different types of burials in the same graveyard, such as Bor Ovoo (Miyamoto et al., 2017). Viewed in the light of adopted burial types, we see a difference between first and second. For example the khereksurs is said to be

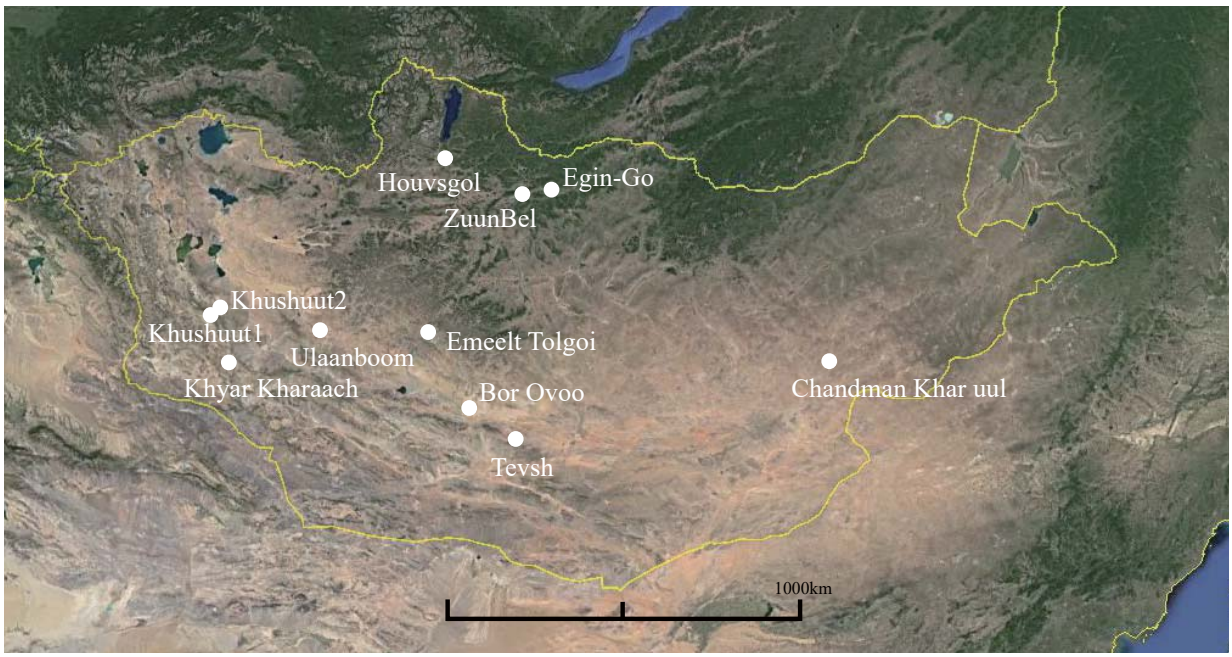


Fig.89 The locations of each site (Google earth)

the grave system which was particularly strongly affected by the west. In addition, the facial traits will be related to the person's origin. The burial type and facial traits in kk20 were in fluenced by the westside. The difference between first and second is whether it has some elements affected by the westside. There are many cases that people who clustered around middle point (0.710617±0.0001) have elements affected by the west.The third is that person who grew up in similar areas are buried in the same type of burial in the same graveyard, such as Emeelt Tolgoi and Tevsh Site (Miyamoto and Amgalantgus, 2016).

Moreover, except for the first case, in many cases of Mongolia, the geology of the grave site and the $^{87}Sr/^{86}Sr$ ratios can be explained without inconsistency. It is worth noting that many of them may be not moving longitudinally across Mongolia, namely we may reasonable conclude that there is no clear difference between the burial area and the area where individuals might have been grow up. One interpretation would be that the range of movement does not exceed the minimum range required for their lives, and that the extent of marriage was also basically limited. However, since people who grew up in different areas may form a group that shares the same graveyard as Khyar Kharaach, it can be said that there were various exceptions regarding the group composition principle in the cemetery.

Much work remains to be done in order to understand the group composition principle in the cemetery. Detailed studies should be made on the correlation among the $^{87}Sr/^{86}Sr$ ratios, burial types and anthropological traits.

Conclusions

We investigated the possibility of mobility and their origin in individuals who were buried in Bor Ovoo Sites and Emeelt Tolgoi Site using the $^{87}Sr/^{86}Sr$ ratios to research rules of group composition who shared same graveyard. The strontium isotopes result indicated that there is not differences in $^{87}Sr/^{86}Sr$ ratios between BO2 and BO8 and between ET40 and ET44. The results suggested that the geographic origins are each similar between BO2 and BO8 and between ET40 and ET44 who were buried in the same sites.

Table 5-1 Characters, $^{87}Sr/^{86}Sr$ ratio and $^{43}Ca/^{88}Sr$ ratio of human skeletal remains who were analyzed in this study.

Sitename	Burial No.	Individual skeleton No.	sex	age	Teeth type	Age estimated by Analysis point	Analysis No.	$^{87}Sr/^{86}Sr$	StdErr (2σ)	$^{43}Ca/^{88}Sr$	Weighted mean	SD	MSWD	Calibrated ^{14}C age (*Yoneda 2016, **Yoneda 2017, ***published in this book by Yoneda)
Emeelt Tolgoi	M40	ET40	Male	Young adult	LUI^1	2-4years old	1	0.7107	0.0009	3.2875	0.71049	0.0009	3.9	1266BC-1125BC***
							2	0.7109	0.0006	3.3025				
							3	0.7099	0.0008	3.0489				
							4	0.7116	0.0009	2.8438				
							5	0.7098	0.0006	3.0434				
					LLP_1 upper part	3-5years old	6	0.7131	0.0010	5.0661	0.7134	0.0014	3.4	
							7	0.7126	0.0008	5.0464				
							8	0.7142	0.0011	4.9620				
							9	0.7145	0.0011	4.7605				
							10	0.7087	0.0010	4.7382 *				
					LLP_1 lower part	5-6years old	11	0.7117	0.0009	4.1359	0.71153	0.00061	0.34	
							12	0.7114	0.0008	4.4635				
							13	0.7086	0.0013	4.5670 *				
	M44	ET44	Female?	Middle adult	RUI^1	2-4years old	1	0.7121	0.0007	2.3685 *	0.71	0.0012	2.8	1289BC-1112BC***
							2	0.7103	0.0008	2.6810				
							3	0.7101	0.0007	2.9906				
							4	0.7088	0.0009	3.0718				
							5	0.7107	0.0012	3.0693				
Bor-Ovoo	No.2	BO2	unknowen	Young adult	LUI^1	2-4years old	1	0.7092	0.0003	0.9682	0.709	0.00046	6.6	1316-1207BC**
							2	0.7091	0.0002	0.9216				
							3	0.7086	0.0003	0.9092				
							4	0.7086	0.0003	0.9028				
							5	0.7096	0.0003	0.9102				
	No.8	Bo8	unknowen	Juvenile	RLM_3	11-12years old	1	0.7095	0.0003	1.1905	0.7096	0.00014	1.19	1112-974BC**
							2	0.7098	0.0003	1.1895				
							3	0.7097	0.0003	1.1370				
							4	0.7096	0.0003	1.0660				
							5	0.7094	0.0003	1.1356				
Egin Gol-2015	No.37	EG37	Female	Young adult	RLC	3-5years old	1	0.7087	0.0008	3.5485	0.70837	0.00025	0.42	1216BC-1056BC***
							2	0.7085	0.0008	3.2589				
							3	0.7085	0.0006	3.0199				
							4	0.7082	0.0005	2.7832				
							5	0.7083	0.0005	2.6440				
Khyar Kharaach	No.1	KK1	Male	Middle adult	RLC	3-5years old	1	0.7111	0.0007	3.6125	0.71185	0.00063	3.3	1265BC-1108BC**
							2	0.7112	0.0008	3.2325				
							3	0.7126	0.0007	2.7859				
							4	0.7124	0.0008	2.7095				
							5	0.7118	0.0007	2.3282				
					RLI_1	1-4years old	6	0.7119	0.0010	4.7216	0.71135	0.00041	1.2	
							7	0.7115	0.0010	4.9333				
							8	0.7104	0.0011	4.7812				
							9	0.7112	0.0008	4.6864				
							10	0.7116	0.0009	4.3105				
	No.20	KK20	Male	Middle adult	RLI_2	1-4years old	1	0.7105	0.0006	2.5225	0.71057	0.00044	1.9	1306BC-1054BC**
							2	0.7103	0.0004	2.3801				
							3	0.7105	0.0006	2.4643				
							4	0.7108	0.0005	2.5467				
							5	0.7112	0.0006	2.7684				
Tevsh Uul	No.1	T1	Female	Middle adult	LLI_1	1-4years old	1	0.7131	0.0003	2.5910	0.71295	0.00040	1.5	901BC-812BC*
							2	0.7130	0.0005	2.8070				
							3	0.7138	0.0004	3.0216 *				
							4	0.7130	0.0005	3.0495				
							5	0.7126	0.0004	2.9097				
	No.3	T3	Male	Middle adult	LLI_1	1-4years old	1	0.7118	0.0007	4.0891	0.71140	0.00055	1.4	1392BC-1264BC*
							2	0.7118	0.0009	4.1888				
							3	0.7109	0.0009	4.2074				
							4	0.7115	0.0008	4.2166				
							5	0.7110	0.0006	4.1657				
Chandman	No.6	C6	Male	Middle adult	RUI^1	2-4years old	1	0.7113	0.0004	1.9792 *	0.71006	0.00049	2.4	406BC-367BC**
							2	0.7099	0.0004	1.9360				
							3	0.7100	0.0004	1.9327				
							4	0.7098	0.0005	1.9634				
							5	0.7105	0.0004	1.9116				
	No.10	C10			RUI^2	3-5years old	1	0.7106	0.0003	2.3285	0.71026	0.00053	5.2	51BC-52AD**
							2	0.7104	0.0003	2.2943				
							3	0.7103	0.0005	2.1983				
							4	0.7092	0.0005	2.2809				
							5	0.7102	0.0003	2.2327				
	No.12	C12			RUI^1	2-4years old	1	0.7108	0.0003	1.6230	0.71017	0.00058	8.6	-
							2	0.7096	0.0003	1.5867				
							3	0.7101	0.0003	1.5853				
							4	0.7104	0.0003	1.4713				
							5	0.7102	0.0004	1.6025				
	No.26	C26	Male	Young adult	RUI^1	2-4years old	1	0.7092	0.0008	2.4779	0.70928	0.00063	2.4	1493AD-1603AD**
							2	0.7084	0.0010	2.6863				
							3	0.7089	0.0006	2.7062				
							4	0.7092	0.0007	2.6572				
							5	0.7098	0.0005	2.5649				
Ulaan Boom	No.2	UB2			RUi^1	Birth-6month	1	0.7122	0.0004	4.3489	0.71300	0.00100	12	1266BC-1113BC**
							2	0.7132	0.0005	4.1848				
							3	0.7141	0.0004	4.2149				
							4	0.7130	0.0006	4.0884				
							5	0.7122	0.0006	4.1764				
	No.4	UB4			RUI^1	2-4years old	1	0.7109	0.0006	4.0048	0.71129	0.00076	8.2	1216BC-1052BC**
							2	0.7120	0.0004	3.9451				
							3	0.7120	0.0005	4.4232				
							4	0.7105	0.0004	2.1567				
							5	0.7112	0.0003	2.2738				
	No.5	UB5			LLI_1	1-4years old	1	0.7107	0.0006	3.6504	0.71100	0.00076	4.5	1133BC-976BC**
							2	0.7108	0.0006	3.8396				
							3	0.7118	0.0006	3.7979				
							4	0.7115	0.0006	3.6112				
							5	0.7103	0.0005	3.7092				

* indicate the outlier value

Table 5-2 Characters, $^{87}Sr/^{86}Sr$ ratio and $^{43}Ca/^{88}Sr$ ratio of human skeletal remains who were analyzed in this study.

Sitename	Burial No.	Individual skeleton No.	sex	age	Teeth type	Age estimated by Analysis point	Analysis No.	$^{87}Sr/^{86}Sr$	StdErr (2σ)	$^{43}Ca/^{88}Sr$	Weighted mean	SD	MSWD	Calibrated ^{14}C age (*Yoneda 2016, **unpublished data by Yoneda, HH is published in this book by Yoneda)
Khushuut1	No.4	K1-4			LLi_2	Birth-6month	1	0.7114	0.0006	2.1269	0.71060	0.00120	6.1	1214BC(92.7%)1041BC**
							2	0.7113	0.0008	2.7455				
							3	0.7110	0.0010	2.7415				
							4	0.7095	0.0011	2.9653				
							5	0.7096	0.0007	1.9671				
	No.5	K1-5	Female	Young adult	RLI_2	1-4years old	1	0.7104	0.0006	2.5735	0.71085	0.00062	3.4	1390BC(93.5%)1259BC**
							2	0.7112	0.0007	2.4092				
							3	0.7105	0.0008	2.3149				
							4	0.7109	0.0006	2.0136				
							5	0.7101	0.0007	1.9548				
							6	0.7117	0.0006	2.1673				
Khushuut2	No.5	K2-5	Male	Middle adult	LLI_2	1-5years old	1	0.7097	0.0008	3.5620	0.71060	0.00160	7.3	1386BC(85.5%)1251BC**
							2	0.7102	0.0008	3.4618				
							3	0.7118	0.0011	3.5490				
							4	0.7124	0.0010	4.0245				
							5	0.7090	0.0014	4.0962				
Houvsgoll2006	No.2	H2	Unknown	Child	LLI_2	1-4years old	1	0.7095	0.0004	2.0268	0.70969	0.00039	3.1	1010BC(95.4%)901BC**
							2	0.7098	0.0003	1.9021				
							3	0.7100	0.0003	1.9846				
							4	0.7092	0.0004	2.1759				
							5	0.7097	0.0004	2.2802				
	No.7	H7	Male	Old adult	RLI_2	1-4years old	1	0.7090	0.0008	2.9995	0.71050	0.00120	9.4	1126BC(95.4%)978BC**
							2	0.7098	0.0007	3.0027				
							3	0.7116	0.0006	3.0192				
							4	0.7103	0.0006	2.9961				
							5	0.7110	0.0005	2.9429				
Houvsgol2007	No.9	H9	Male	Young adult	LUI^2	3-5years old	1	0.7110	0.0008	3.0219	0.71088	0.00028	0.16	1262BC(95.4%)1122BC**
							2	0.7110	0.0007	2.7540				
							3	0.7107	0.0006	2.6365				
							4	0.7109	0.0006	2.5443				
							5	0.7109	0.0006	2.4784				
	No.10	H10	Male	Middle adult	RUI^2	3-5years old	1	0.7098	0.0004	2.2415	0.70939	0.00080	8.6	1316BC(73.7%)1213BC**
							2	0.7090	0.0005	2.4409				
							3	0.7084	0.0005	2.3815				
							4	0.7092	0.0005	2.4460				
							5	0.7100	0.0004	2.2480				
	No.25	H25	Female	Old adult	RLI_2	1-4years old	1	0.7116	0.0006	2.7547	0.71080	0.00140	9.4	1291BC(94.1%)1127BC**
							2	0.7111	0.0009	2.8698				
							3	0.7095	0.0006	3.1033				
							4	0.7105	0.0010	3.1293				
							5	0.7122	0.0008	3.0333				
Zuun Bel	No.9	Z9			RLI_2	1-4years old	1	0.7086	0.0007	2.0003	0.70896	0.00068	2.8	-
							2	0.7088	0.0006	2.2422				
							3	0.7083	0.0007	2.2697				
							4	0.7097	0.0007	2.1301				
							5	0.7093	0.0006	2.1364				
	No.14	Z14	Female	Young adult	LUI^1	2-4years old	1	0.7090	0.0006	1.6317	0.70907	0.00023	0.23	-
							2	0.7090	0.0004	1.6379				
							3	0.7092	0.0005	1.6641				
							4	0.7090	0.0007	1.6742				
							5	0.7092	0.0005	1.5636				
	No.15A	Z15A			RUc	Birth-9month old	1	0.7078	0.0012	2.6653	0.70950	0.00180	9.2	1299AD(75.0%)1370AD**
							2	0.7097	0.0009	2.7130				
							3	0.7110	0.0008	2.7104				
							4	0.7092	0.0008	2.7314				
							5	0.7071	0.0013	2.7695				
					LLM_1	1-3years old	6	0.7084	0.0009	2.7224	0.70901	0.00084	2.8	
							7	0.7089	0.0010	2.5930				
							8	0.7101	0.0008	2.4129				
							9	0.7085	0.0007	2.3844				
							10	0.7092	0.0008	2.3609				
	No.15B	Z15B	Unknown	Child	LUI^1	1-4years old	1	0.7079	0.0006	2.7036	0.70795	0.00041	1.3	1340AD(57.7%)1397AD**
							2	0.7075	0.0005	2.6803				
							3	0.7083	0.0006	2.6915				
							4	0.7079	0.0006	2.6353				
							5	0.7083	0.0006	2.6593				
	No.16	Z16			RUC	2-4years old	1	0.7057	0.0011	2.5101	0.70750	0.00110	4.3	-
							2	0.7069	0.0012	2.5673				
							3	0.7071	0.0011	2.2701				
							4	0.7080	0.0006	1.7373				
							5	0.7081	0.0008	1.9093				

* indicate the outlier value

4 Radiocarbon dating and stable carbon and nitrogen isotopic analyses on human and animal bones from the Emeelt Tolgoi Site

Minoru Yoneda, Hiromasa Ozaki, Takayuki Omori

In order determine the age of tombs at Emeelt Tolgoi, we measured radiocarbon abundance ($^{14}C/^{12}C$) in bone collagen samples extracted from human and animal remains. Additionally, the carbon and nitrogen stable isotope ratios ($\delta^{13}C$ and $\delta^{15}N$) in collagen were measured as well, which reflect their protein source for the last decade prior to their death. The dietary habits at the Emeelt Tolgoi Site is compared with other Mongolian Bronze Age sites.

Materials and Methods

Eleven bone pieces including 3 animals and 8 humans were submitted to Laboratory of Radiocarbon Dating at the University Museum, the University of Tokyo (Table 6). We applied gelatinization to extract collagen from bone (Longin 1971; Yoneda et al. 2002). First, bone surface was cleaned by sandblasting and ultrasonic washing in ultrapure water (Milli-Q water) for 10 min. Cleaned bone pieces was reacted with weak alkali (0.2 M NaOH) for 15-18 hours to remove humic and fluvic acids originated from soil. After washing with ultrapure water to neutral pH, dried bone piece was crushed into fine powder and sealed in a cellulose tube to react with hydrochloric acid (1.2 M) gently for 15-18 hours. After washing with ultrapure water to neutral, remaining portion was recovered by centrifuging. The precipitation was heated at the temperature of 90°C in acidified water (pH 4) for 12 hours to extract gelatin. Dissolved gelatin was purified by Whatman GF/F filter and lyophilized. The weigh of extracted gelatin was recorded, and fraction was applied for the following analyses.

The concentration of carbon and nitrogen in gelatin was measured by Flash 2000 Elemental Analyzer and produced gases were introduced to a ConFlo IV interface and measured for stable isotope ratios in carbon and nitrogen using a Delta V isotope ratio mass spectrometer (Thermo Fisher Scientific, Germany). About 0.4 mg of gelatin were weighed in a tin cup and measured with laboratory standards (e.g. alanine) which can be traced back to international standards (V-PDB for carbon and AIR for nitrogen). Typical uncertainties with carbon and nitrogen isotopic ratios were 0.2‰ in $\delta^{13}C$ and $\delta^{15}N$ notation.

Extracted samples were combusted and reduced into graphite crystal on iron catalyst in two different ways. For the first series, we combusted samples in an evacuated and sealed tube at 850°C for 3 hours in an electric furnace with copper oxide and sulfix (Tube method, according to Minagawa et al. 1984). For the second series of samples, a sample portion containing 1 mg of carbon was combusted into CO_2 using Vario ISOTOPE SELECT elemental analyzer (Omori et al. 2017). Produced CO_2 was introduced to a vacuum line and sealed in a reaction vessel with enough amount of H_2 (2.2 times of CO_2) and 2 mg of iron powder catalysis in an isolated grass vessel with a stop cock. The graphite was reduced on the surface of catalysis at the temperature of 650ºC for 6 hours (Kitagawa et al. 1993).

Reduced graphite was pressed in an aluminum holder for accelerator mass spectrometry (AMS; National Electrostatics Corp. Compact AMS System) at the University Museum, the University of Tokyo. A series of international standards were measured simultaneously, and $\delta^{13}C$ measured by AMS was applied to correct the isotopic fractionations during preparation and measurement to calculate conventional radiocarbon date (CRA, Stuiver and Polach 1977). CRA was shown with one standard deviation error. Calibration was conducted with IntCal13 dataset (Reimer et al. 2013) using a calibration software, OxCal4.3 (Bronk Ramsey 2009).

Results

The results obtained by elemental analyzer was shown in Table 7. Because the gelatin yield less than 1% empirically suggest the degradation of collagen (van Klinken 1999), a human rib from Tomb M30 (above burial pit) might be altered by diagenetic effect. Another criterium, atomic C/N ratio at 4.5 out of biological range between 2.9 and 3.6, also suggested the extracted gelatin from this sample with

C/N at 4.2 could be altered and/or contaminated through diagenetic effect during deposition (DeNiro 1985; van Klinken 1999). Hence, the radiocarbon age on this samples could not be reliable, and we omit this from discussion for the dietary habit at the site. Other ten samples kept collagen in good conditions.

The results of radiocarbon dating is shown in Table 9 and the calibrated dates were illustrated in Figure 90 after removing a significant outlier (208±19 BP on the horse skull from M18). While we expected that the dates on animal remains and human skeletons from the same tombs of M18 and M82 showed similar dates, animal remains generally showed younger dates in both cases. The dates of human showed a significant variability from ca. 1500 cal.BC on skeleton from M18 untill ca. 500 cal.BC on that from M82. Except for a limb fragments found above burial pit of M30 showing younger data round 900 cal.BC, the other 5 skeletons showed general agreement in the early 2nd Millennium cal.BC.

The results of IRMS for $\delta^{13}C$ and $\delta^{15}N$ in comparison with international standards (V-PDB for carbon and AIR for nitrogen) were shown in Table 8 and Figure 91.

The youngest human from M82 showed significantly lower isotopic ratios in both carbon and nitrogen, which is similar to animals identifies as sheep or goat, suggesting the diet based on C3 plants. On the other hands older humans between 900-1500 cal. BP showed significantly higher carbon and nitrogen isotopic ratios. One of possible interpretation for this is consumption of plant using C4 photosynthesis, such as foxtail and broomcorn millets, whose higher valued in $\delta^{15}N$ might affected by manuring or other human activity on cultigens.

In a previous study, we analyzed some human samples from Mongolian Bronze Culture (Yoneda et al. 2016). The Daram uul and the Tevsh uul sites showed radiocarbon ages between 500 to 1000 cal. BC and 1000 to 1500 cal. BC, respectively. Their stable isotopes were compared in Figure 92 with data from Emeelt Tolgoi. Even in the younger period (around 500 cal. BC) the human form Daram uul had C4 based diet, while the diet based on the C3 ecosystem was shown for the diet of M82 of Emeelt Tolgoi, which might not be temporal change in the region. For more detailed discussion, different investigations such a as provenance research using enamel and other morphological features will be required.

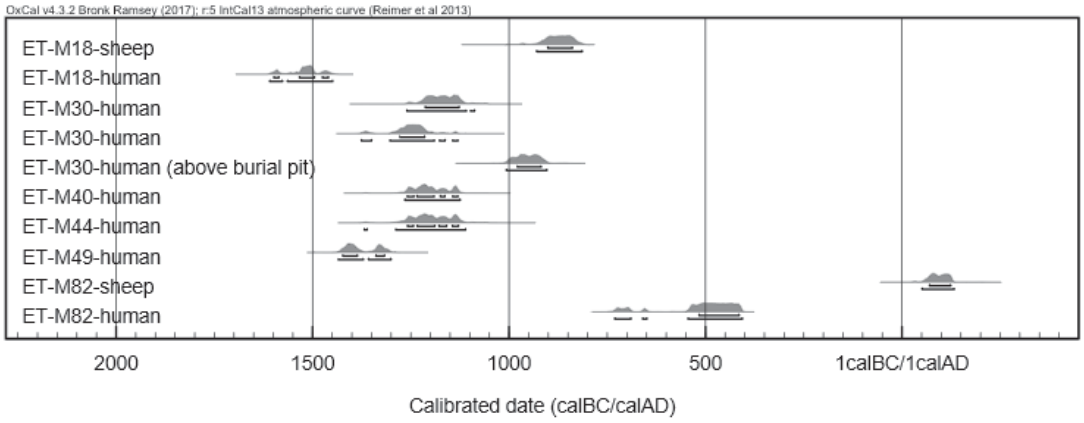


Fig.90 Calibrated radiocarbon ages on the bones from Emeelt Tolgoi.

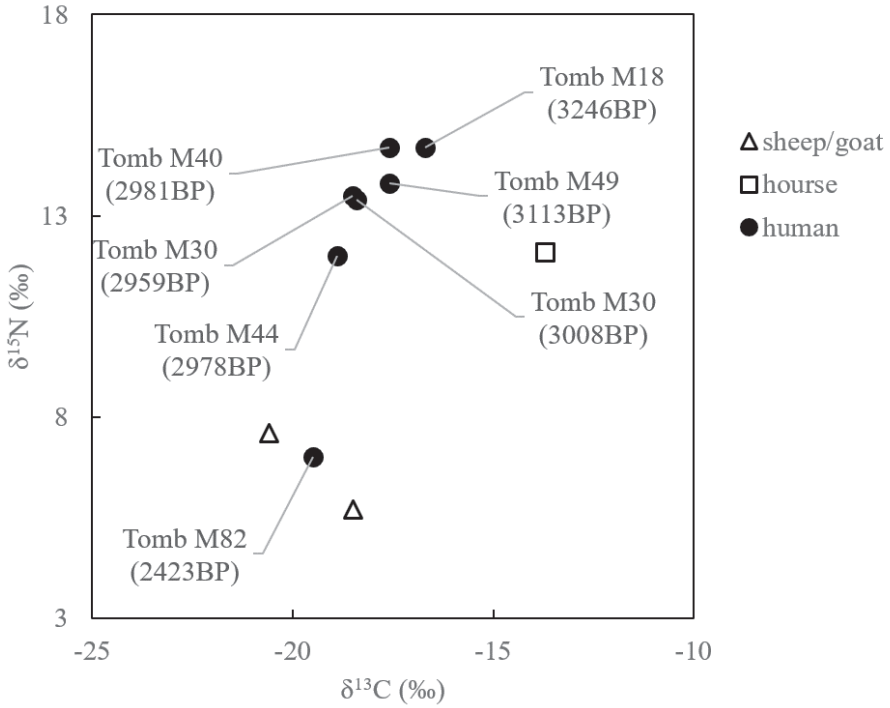


Fig.91 Carbon and nitrogen isotopic ratios in bone collagen. The tomb number and conventional radiocarbon ages (years BP) were shown for human remains.

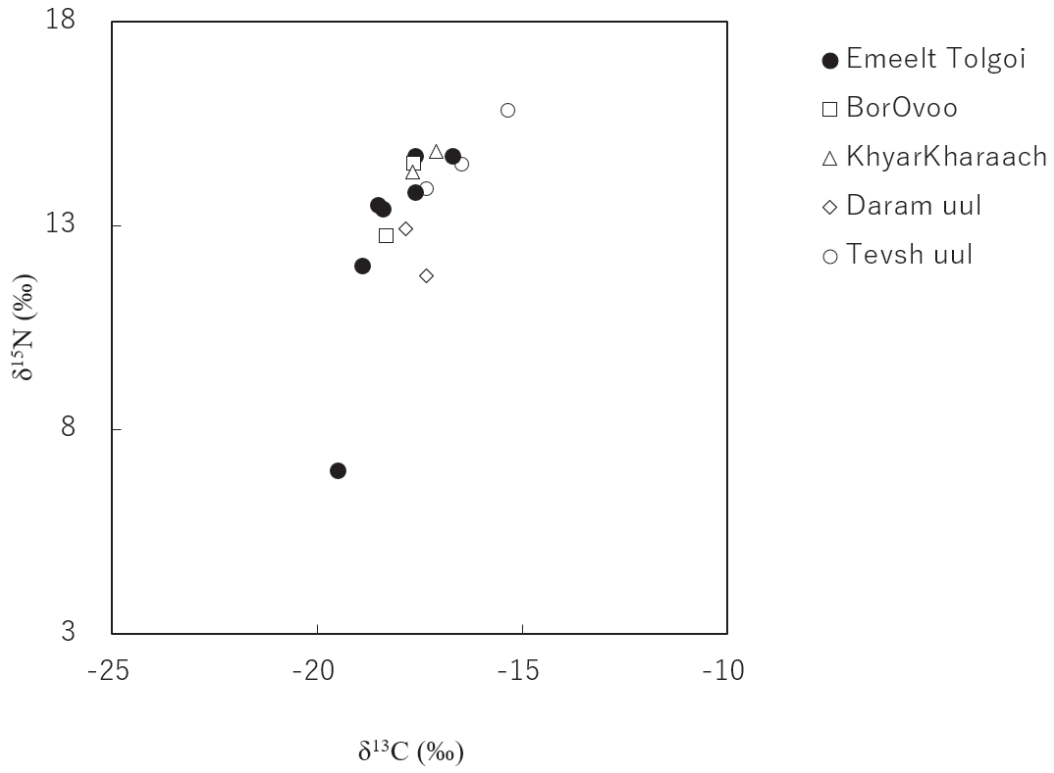


Fig.92 Carbon and nitrogen isotopic rations in Bronze-age human collagen from Mongolia.

Table 6 List o sample analyzed in this study and the yields of extracted gelatin.

Site	Location	Sample	species	skeletal element	Gelatin %
Emeelt Tolgoi	Tomb M18	No.4	horse	skull	9.9%
Emeelt Tolgoi	Tomb M18	No.5	sheep/goat	rib	11.0%
Emeelt Tolgoi	Tomb M18	No.8	human	fragmental piece	9.7%
Emeelt Tolgoi	Tomb M30	No.1	human	phalanx	7.5%
Emeelt Tolgoi	Tomb M30	No.2	human	femur	9.3%
Emeelt Tolgoi	Tomb M30 above burial pit	sample-1	human	limb fragment	**0.8%**
Emeelt Tolgoi	Tomb M40	sample-2	human	rib	3.2%
Emeelt Tolgoi	Tomb M44	No.7	human	rib	5.2%
Emeelt Tolgoi	Tomb M49	No.9	human	fragmental piece	14.0%
Emeelt Tolgoi	Tomb M82	No.6	sheep/goat	rib	7.2%
Emeelt Tolgoi	Tomb M82	No.10	human	fragmental piece	4.0%

Table 7 Carbon and nitrogen contents and atomic C/N rations in extracted gelatin.

Location	Sample	species	%C	%N	atomic C/N ratio	Remarks
Tomb M18	No.4	horse	45.3%	16.6%	3.2	
Tomb M18	No.5	sheep/goat	46.8%	16.7%	3.3	
Tomb M18	No.8	human	45.7%	16.3%	3.3	
Tomb M30	No.1	human	46.0%	16.3%	3.3	
Tomb M30	No.2	human	46.0%	16.5%	3.2	
Tomb M30 above burial pit	sample-1	human	37.6%	9.7%	**4.5**	altered C/N ratios
Tomb M40	sample-2	human	42.0%	14.8%	3.3	
Tomb M44	No.7	human	44.9%	14.7%	3.6	
Tomb M49	No.9	human	46.1%	16.6%	3.2	
Tomb M82	No.6	sheep/goat	46.0%	15.9%	3.4	
Tomb M82	No.10	human	44.7%	14.5%	3.6	

Table 8 Carbon and nitrogen isotopic ratios in gelatin.

Location	Sample	$\delta^{13}C$	$\delta^{15}N$	atomic C/N ratio	Remarks
Tomb M18	No.4	-13.7‰	12.1‰	3.2	
Tomb M18	No.5	-18.5‰	5.7‰	3.3	
Tomb M18	No.8	-16.7‰	14.7‰	3.3	
Tomb M30	No.1	-18.5‰	13.5‰	3.3	
Tomb M30	No.2	-18.4‰	13.4‰	3.2	
Tomb M30 above burial pit	sample-1	-19.2‰	13.8‰	**4.5**	altered C/N ratios
Tomb M40	sample-2	-17.6‰	14.7‰	3.3	
Tomb M44	No.7	-18.9‰	12.0‰	3.6	
Tomb M49	No.9	-17.6‰	13.8‰	3.2	
Tomb M82	No.6	-20.6‰	7.6‰	3.4	
Tomb M82	No.10	-19.5‰	7.0‰	3.6	

Table 9 Conventional and calibrated radiocarbon ages.

Location	Sample	Species	Lab-ID	Conventional radiocarbon age (uncalibrated)	Calibrated age (1 s.d.)	Calibrated age (2 s.d.)	Calibrated age (1 s.d.)	Calibrated age (2 s.d.)	Calibration curve	Remarks
Tomb M18	No.4	horse	TKA-19014	**208 ± 19 BP**	292 cal BP(18.5%)280 cal BP 172 cal BP(38.3%)152 cal BP 8 cal BP(11.4%)-1 cal BP	301 cal BP(30.2%)268 cal BP 212 cal BP(1.7%)205 cal BP 189 cal BP(47.5%)147 cal BP 14 cal BP(16.0%)-5 cal BP	1659AD(18.5%)1670AD 1779AD(38.3%)1799AD 1943AD(11.4%)1951AD	1650AD(30.2%)1682AD 1738AD(1.7%)1745AD 1762AD(47.5%)1803AD 1937AD(16.0%)1955AD	IntCal13, Bomb13 NH2	
Tomb M18	No.5	sheep/goat	TKA-19015	2734 ± 29 BP	2851 cal BP(68.2%)2789 cal BP	2879 cal BP(95.4%)2764 cal BP	902BC(68.2%)840BC	930BC(95.4%)815BC	IntCal13	
Tomb M18	No.8	human	TKA-19018	3246 ± 22 BP	3548 cal BP(8.4%)3536 cal BP 3483 cal BP(50.8%)3445 cal BP 3424 cal BP(9.0%)3410 cal BP	3559 cal BP(15.2%)3526 cal BP 3514 cal BP(80.2%)3399 cal BP	1599BC(8.4%)1587BC 1534BC(50.8%)1496BC 1475BC(9.0%)1461BC	1610BC(15.2%)1577BC 1565BC(80.2%)1450BC	IntCal13	
Tomb M30	No.1	human	TKA-19011	2959 ± 22 BP	3163 cal BP(68.2%)3077 cal BP	3209 cal BP(94.4%)3059 cal BP 3047 cal BP(1.0%)3038 cal BP	1214BC(68.2%)1128BC	1260BC(94.4%)1110BC 1098BC(1.0%)1089BC	IntCal13	
Tomb M30	No.2	human	TKA-19012	3008 ± 22 BP	3227 cal BP(68.2%)3165 cal BP	3325 cal BP(5.9%)3300 cal BP 3252 cal BP(85.2%)3140 cal BP 3126 cal BP(1.7%)3113 cal BP 3093 cal BP(2.6%)3080 cal BP	1278BC(68.2%)1216BC	1376BC(5.9%)1351BC 1303BC(85.2%)1191BC 1177BC(1.7%)1164BC 1144BC(2.6%)1131BC	IntCal13	
Tomb M30 above burial pit	sample-1	human	TKA-17500	2802 ± 21 BP	2928 cal BP(68.2%)2868 cal BP	2956 cal BP(95.4%)2854 cal BP	979BC(68.2%)919BC	1007BC(95.4%)905BC	IntCal13	altered C/N ratios
Tomb M40	sample-2	human	TKA-17501	2981 ± 21 BP	3208 cal BP(11.7%)3192 cal BP 3184 cal BP(39.6%)3141 cal BP 3124 cal BP(6.7%)3113 cal BP 3093 cal BP(10.2%)3080 cal BP	3215 cal BP(95.4%)3074 cal BP	1259BC(11.7%)1243BC 1235BC(39.6%)1192BC 1175BC(6.7%)1164BC 1144BC(10.2%)1131BC	1266BC(95.4%)1125BC	IntCal13	
Tomb M44	No.7	human	TKA-19017	2978 ± 28 BP	3208 cal BP(9.4%)3193 cal BP 3183 cal BP(35.2%)3139 cal BP 3128 cal BP(12.2%)3109 cal BP 3094 cal BP(11.4%)3079 cal BP	3318 cal BP(0.4%)3311 cal BP 3238 cal BP(95.0%)3061 cal BP	1259BC(9.4%)1244BC 1234BC(35.2%)1190BC 1179BC(12.2%)1160BC 1145BC(11.4%)1130BC	1369BC(0.4%)1362BC 1289BC(95.0%)1112BC	IntCal13	
Tomb M49	No.9	human	TKA-19019	3113 ± 22 BP	3373 cal BP(44.8%)3336 cal BP 3288 cal BP(23.4%)3267 cal BP	3384 cal BP(57.4%)3321 cal BP 3307 cal BP(38.0%)3250 cal BP	1424BC(44.8%)1387BC 1339BC(23.4%)1318BC	1435BC(57.4%)1372BC 1358BC(38.0%)1301BC	IntCal13	
Tomb M82	No.6	sheep/goat	TKA-19016	1909 ± 21 BP	1879 cal BP(68.2%)1826 cal BP	1898 cal BP(95.4%)1817 cal BP	71AD(68.2%)125AD	52AD(95.4%)133AD	IntCal13	
Tomb M82	No.10	human	TKA-19020	2423 ± 21 BP	2466 cal BP(68.2%)2364 cal BP	2680 cal BP(11.0%)2640 cal BP 2609 cal BP(2.1%)2599 cal BP 2494 cal BP(82.3%)2356 cal BP	517BC(68.2%)415BC	731BC(11.0%)691BC 660BC(2.1%)650BC 545BC(82.3%)407BC	IntCal13	

5 Bronze Age Khirigsuur and Stone-slab Burial Cultures on the Mongolian Plateau

Kazuo Miyamoto

Introduction

Two distinct burial customs existed on the Mongolian Plateau during the Bronze Age: Khirigsuur and stone-slab graves. Khirigsuur are distributed in the western part of Mongolia; on the other hand, stone-slab graves are distributed in the eastern part of Mongolia. In central Mongolia, there is a mixed distribution of both burial customs (Цыбиктаров, 1998). Khirigsuur date to a relatively earlier period than stone-slab graves (Fitzhugh ed., 2005). Khirigsuur do not usually contain grave goods like bronze weapons. In some cases, pits containing the remains of sacrificed horses are present under the cairns outside the enclosure of Khirigsuur. The size of Khirigsuur is indicative of the scale of social units or social cohesion at that time (Wright, 2014). On the other hand, some stone-slab graves contain grave goods such as bronzeware, beads and pottery. The kinds of grave goods found in stone-slab graves differ greatly depending on the social status of the individual buried there, much more than with Khirigsuur. In this case, it is assumed that much more esteem was given to the personality of the social group in the stone-slab burial culture than that of Khirigsuur.

In this paper, I would like to classify stone-slab graves based on the development process of the burial structure and functional meaning of the burial construction in reference to Sosnovskii's classification (Цыбиктаров, 1998). I will also attempt to construct a chronology of stone-slab graves based on the typologies of classifications which have been proven through the carbon dating of human skeletons from the stone-slab burial culture. In particular, this analysis is based on the results of joint Mongolian-Japanese excavations conducted at Daram and Tevsh Sites (Miyamoto & Obata ed., 2016).

On the other hand, Khirigsuur can be roughly divided into two types: those with a round enclosure and those with a square enclosure. Graveyards containing Khirigsuur sometimes include round graves and square graves. I would like to call these graves "Khirigsuur culture." The joint Mongolian Japanese excavations on Khirigsuur culture graves were conducted at Bor Ovoo, Khyar Khyaraach (Miyamoto ed., 2017) and Emeelt Tolgoi Sites. Classifications in terms of the typology and chronology of Khirigsuur culture have been analyzed based on the results of these excavations.

I would also like to chronologically arrange the types of Khirigsuur and stone-slab graves in three dimensional spaces based on the distribution of the type of Khirigsuur and stone-slab graves. Doing this will enable me to elucidate the historical background of the Khirigsuur culture and stone-slab burial culture through the chronology of burials during the Bronze Age on the Mongolian Plateau.

1. Classification and chronology of burial structures in the stone-slab burial culture

Through excavations at Daram Site and Tevsh Site (Miyamoto & Obata ed., 2016), we can re-classify burial structures in the stone-slab burial culture based on the classifications by Sosnovsky and Cybiktarov (Цыбиктаров, 1998). There are three categories of burial structure in the stone-slab burial culture (Fig. 93): rectangular stone construction graves (Type 1), figured graves (Type 3) and stone-slab graves (Type 2).

Type 1 consists of a stone structure with a square or rectangular stone fence, inside of which is piled up with stones. Type 1 can be divided into two sub-types depending on whether or not stones have been piled up outside the stone fence: Type 1a and Type 1b (Fig. 94). In the case of Type 1a, no stones have been piled up outside the stone fence; in the case of Type 1b, however, stones have been piled up outside the stone fence. Because stones have been piled up outside as a means of supporting the stone fence, it is believed that stone fences in Type 1b enabled stone structures to be constructed much more easily than those of Type 1a.

Type 3 refers to figured graves. Type 3 can be divided into three sub-types: Type 3a, Type 3b and

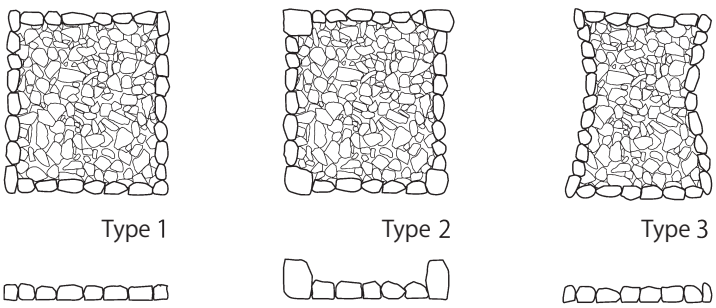


Fig.93 Classification by Sosnovski of stone-slab graves

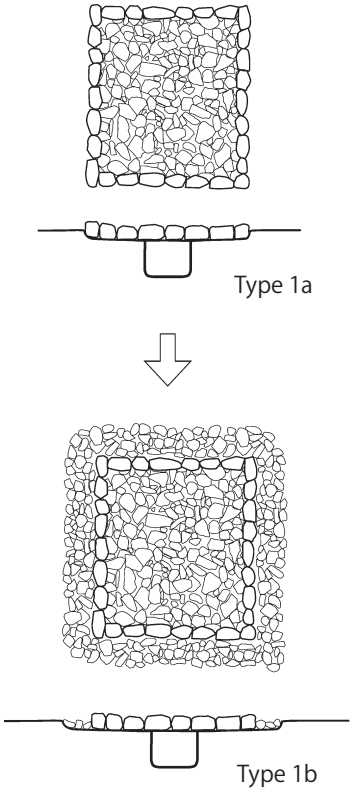


Fig.94 Classification of stone square construction graves: schematic models of Type 1 graves

Type 3c (Fig. 95). The classification of sub-types is based on the degree of curbing of the stone fence. Type 3a does not exhibit a significant curved line of the stone fence, which does not extend to any significant degree to the corners. Type 3b has a significant curved line of the figured stone fence, which extends to the corners. Type 3a would subsequently change into Type 3b. Type 3c is a stone fence in the shape of a horse's hoof. Type 3c would eventually be modified from Type 3a or Type 3b.

Type 2 has a rectangular stone fence with four corners. Burial structures such as a stone construction are typical of stone-slab graves. Type 2 can also be divided into three types: Type 2a, Type 2b and Type 2c (Fig. 96). Type 2a has a rectangular stone fence, outside of which is not piled up with stones. Type 2a has a rectangular stone fence, outside of which has been piled up with stones to support the stone fence. It is probable that double pit burial structure of Type 2c means the existence of wood trunk coffin. Type 2c has the same stone structure as that of Type 2b, but the stone fence of Type 2c is much higher than that of Type 2a and Type 2b. The function of the pile of stones outside the stone fence is to allow for a bigger stone fence for Type 2c. Therefore, it is supposed that Type 2a gradually changed into Type 2b and then changed into Type 2c. This process of change also indicates the development of stone structures for Type 2.

Additional mention must be made of burial customs. All types of stone-slab burial cultures usually utilized pit burials. However, the location of these pit burials differs among the three types. In the case of Type 1, pit burials are not located in the center of the stone construction; however, those of Type 3 and Type 2 are located in the center. Among these, only Type 2 has cover stones over the pit burials, with a different number of cover stones according to the sub-type of Type 2. Type 2a also has only one cover stone, but Type 2b and Type 2c have multiple cover stones, such as three stones. Only Type 2c has a double pit burial structure, the construction of which would have required much labor; other types have only one pit burial. Type 2c, which has a bigger stone fence and double pit burial, indicates a much higher social status, given the amount of intensive labor required for the construction of the grave.

When discussing these graves, the combination between the classification of the stone construction and that of the pit burial should be made clear in order to constitute the sub-types. Table 10 shows combinations of the classifications of several attributes. Combinations of the attributes clearly indicate the particularity of the sub-types and the typological shifted line. Therefore, we can understand the process of change of the types as follows: from Type1a to Type 1b, from Type 3a to Type 3b, and from Type 2a to Type 2b and then to Type 2c. In addition, it is supposed that Type 1a changed to Type 3a.

The dating of the graves can prove this chronological hypothesis. Table 11 shows the dating of the types based on the AMS data for human bones or sacrificed animal bones. According to this table, the dating of Type 1a covers the period from 1530 - 1187 cal. BC, and is relatively earlier than those of Type 1b, which covers the period from 1440 - 804 cal. BC. And the dating of Type 3a, which covers the period from 1500 - 1110 cal. BC, is also earlier than that of Type 3b

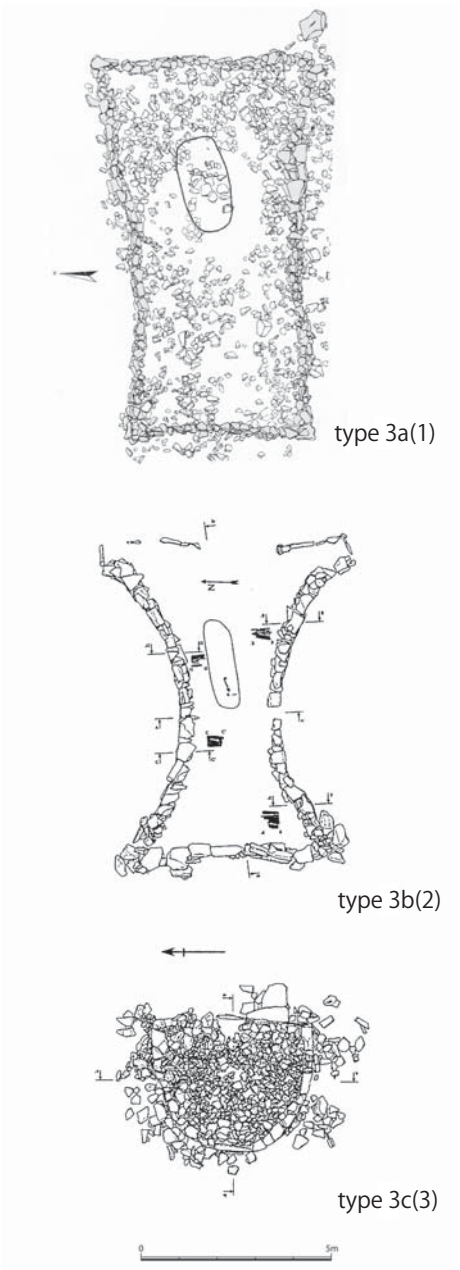


Fig.95 Classification of figured graves: Type 3 (1 Chandomani Khar Uul Grave No.31, 2 Baruun Gyalaat Grave No. 2, 3 Baruun Gyalaat Grave No. 1)

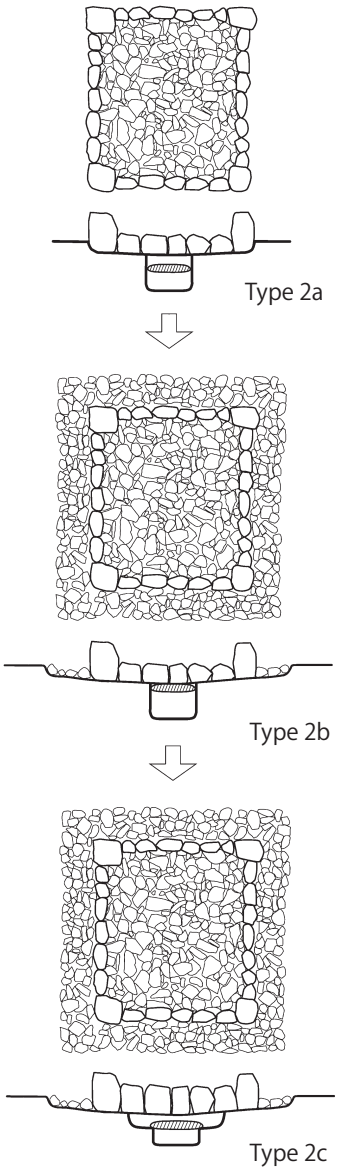


Fig.96 Classification of stone-slab graves: schematic models of Type 2 graves

and Type 3c, which covers the period from 1270 - 812BC. Based on the dating of Daram Site, we can infer that Type 2a dates to an earlier period than Type 2b and Type 2c. In addition, the rectangular stone construction grave (Type 1) and the figured grave (Type 3) are relatively earlier than the stone-slab grave (Type 2).

Figure 97 shows the chronology of grave structures in the stone-slab burial culture. Based on the distribution and dating of square stone construction graves, it is believed that Type 1a rectangular stone construction graves originated from the eastern Mongolian Plateau and spread westward to the central Mongolian Plateau, where they changed into Type 1b. Recently Type 1a rectangular stone construction graves at Ar Khavstal Site of Khotont sum in Arhangai province dating 12th to 10th century BC are reported (Enkhtör et al. 2018). This discovery is the proof that Type 1a rectangular stone construction graves lately spread to Central Mongolian Plateau from Eastern Mongolian Plateau. Also, Type 1a rectangular stone construction graves changed into Type 3a figured graves in the central Mongolian Plateau. Type 3a then changed into Type 3b and Type 3c in the central Mongolian Plateau. These rectangular stone construction graves and figured graves were distributed in the eastern and central Mongolian plateau from the 15th to 9th centuries

Table 10 Combinations of attributes in the typology

Rectangular stone fence	Figured stone fence	Corner stone	Outer paved stone	Cover stone	Pit burial	Type name
○	×	×	×	×	○	1a
○	×	×	○	×	○	1b
×	○	×	×	×	○	3a
×	○	×	○	×	○	3b
○	×	○	×	single	○	2a
○	×	○	○	double	○	2b
○	×	○	○	double	doubled	2c

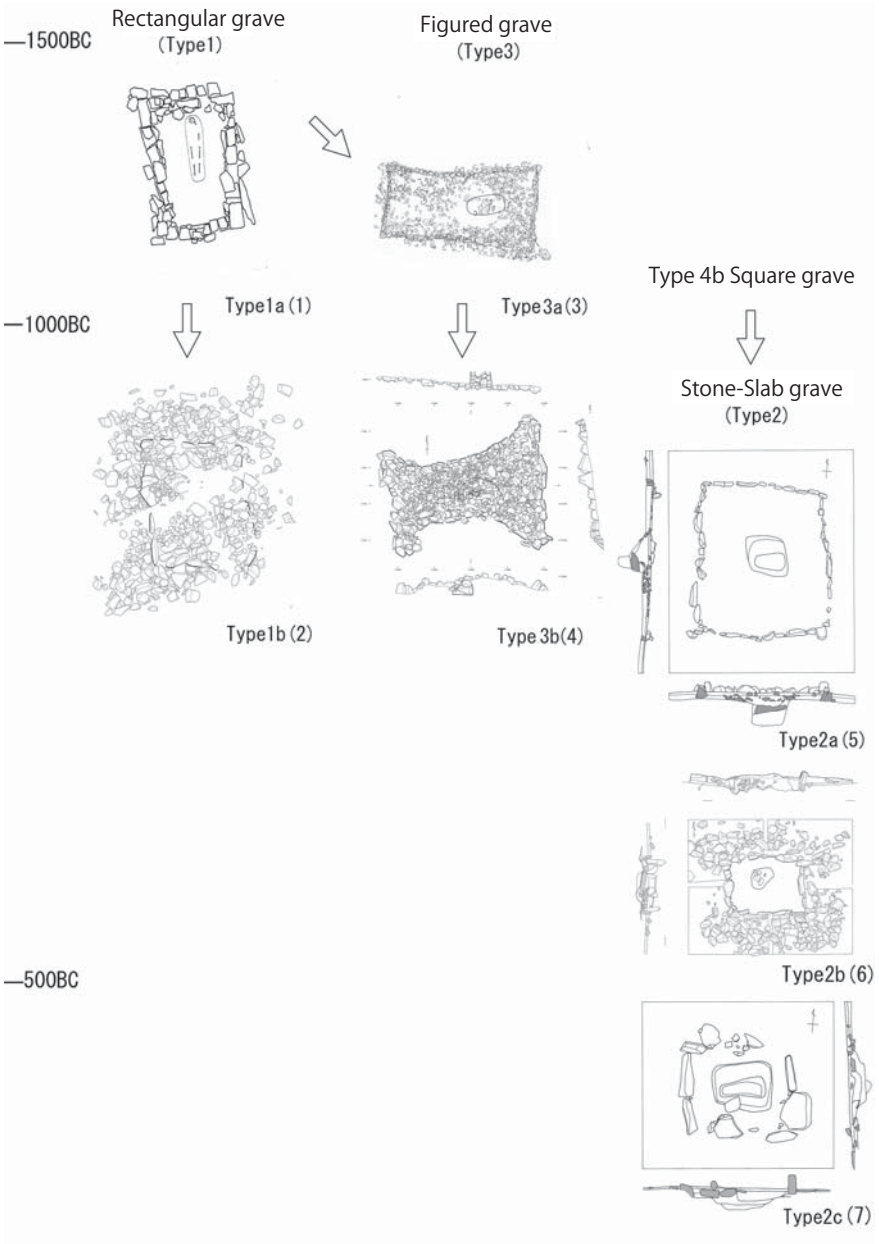


Fig.97 Changes of the grave structure in the stone-slab burial culture (1 Bulgiin Ekh, 2 Daram Grave No. 9, 3 Chandomani Khar Uul Grave No.31, 4 Tevsh Grave No. 1, 5 Daram Grave No. 4, 6 Daram Grave No. 8, 7 Daram Grave No. 1)

BC. On the other hand, stone-slab graves (Type 2) were distributed in this same region from the 8th to 3rd centuries BC. The stone-slab grave replaced the rectangular stone construction grave and figured grave in the eastern and central Mongolian Plateau.

This process of change poses questions regarding

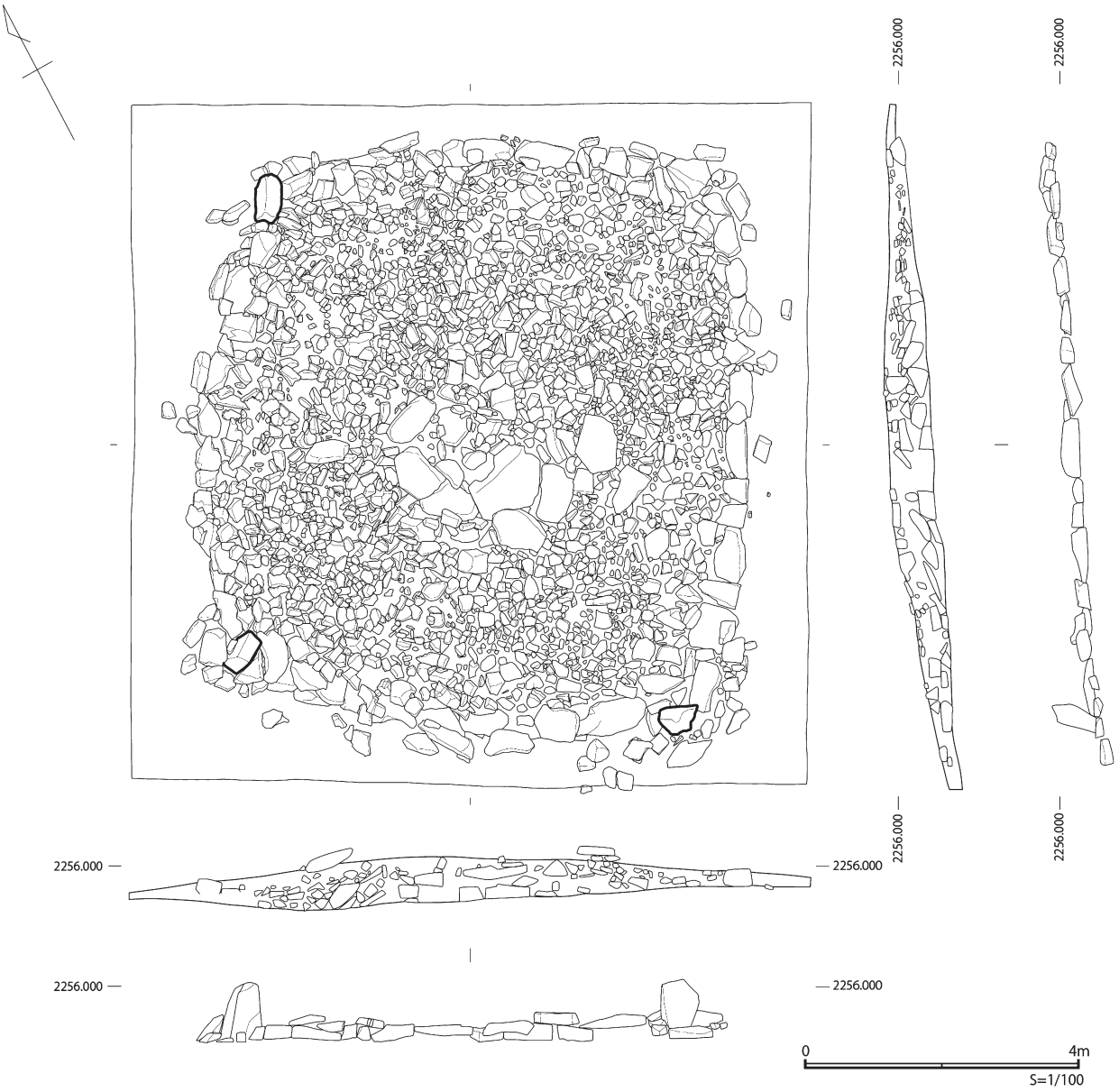


Fig.98 The prototype of the stone-slab grave (Type2: Khyar Kharaach Grave No.1)

the origin of Type 2a, as well as why the stone-slab grave came about. We do not know how the four corner stones in Type 2 originated; all we can say is that the rectangular stone construction grave and figured grave do not have these four corner stones. A square stone fence with four corner stones, which is believed to have originated from Khirigsuur, was found at Grave No.1 (Fig. 98) at Khyar Kharaach Site, Gobi Altai Aimag (Miyamoto ed., 2017). This grave dates to 1306 - 1054cal. BC (90.1%, 2 sigma) and 1325 - 1209 cal. BC (68.8%, 2 sigma), which correspond to the dating of the rectangular stone construction grave and the figured grave (Table 11). Grave No. 82 at Emeelt Tolgoi Site is also the same type as that of Grave No.1 at Khyar Kharaach Site. If this type of Khirigsuur is indeed the origin of the stone-slab grave (Type 2), we would name the prototype of the stone-slab grave after this type of Khirigsuur. The prototype of the stone-slab grave is found in western and central Mongolia. The prototype of the stone-slab grave spread from the western Mongolia Plateau to the central Mongolian Plateau in the same way the Khirigsuur spread, leading to the supposition that this is the origin of Type 2a stone-slab graves.

2. Chronology of the Khirigsuur culture

Khirigsuur are distributed throughout western and central Mongolia. Khirigsuur consist of a stone mound enclosed by a round or square enclosure in which there is a cairn containing the remains of sacrificed horses outside the enclosure. According to the plan of the enclosure, Khirigsuur are divided into

Table 11 Dating of graves by typology in the stone-slab burial culture

Grave	Aimag	Site	Type	Scale (m.)	Burial type	Orientation	Cover stone	Grave goods	Dating(cal BC)	Reference
Ulaanzuukh Row 1A (3)	Sukhbaatar	Adgiin Gol	1a	4.1×4.0	pit	NE	0		1423-1288	Tumen et al. 2010, Tumen et al. 2014
Ulaanzuukh Row 1D (5)	Sukhbaatar	Adgiin Gol	1a	4.6×3.4	pit	NE	0		1325-1192	Tumen et al. 2010, Tumen et al. 2014
Ulaanzuuk Row 2-6	Sukhbaatar	Adgiin Gol	1a						1456-1369	Tumen et al. 2014
Ulaanzuuk Row 2-3	Sukhbaatar	Adgiin Gol	1a						1322-1187	Tumen et al. 2014
Ulaanzuuk Row 2-2	Sukhbaatar	Adgiin Gol	1a						1443-1313	Tumen et al. 2014
Chandomani Khar Uul 2-p	Dornogovi	Delgerekh	1a	4.2×2.8	pit	NE	0		1530-1380	Amartuvshin et al. 2015
Chandomani Khar Uul 5-p	Dornogovi	Delgerekh	1a	6.7×5.7	pit	NE	0	motor stone	1440-1250	Amartuvshin et al. 2015
Chandomani Khar Uul 33	Dornogovi	Delgerekh	1a	4.3×3.1	pit	NE	0	stone beads	(1500-1250)	Amartuvshin et al. 2015
Bitoogiin Tsagaan 2-p	Bylgan	Xytag-Undur	1a	6.5×6.5	pit, face down		0		(1116-906)	Törbat et al. 2003
Chandomani Khar Uul 41	Dornogovi	Delgerekh	1b	5.4×4.3	pit	NE	0	tripod pottery	1440-1190	Amartuvshin et al. 2015
Chandomani Khar Uul 130	Dornogovi	Delgerekh	1b	3.0×2.1	pit	E	0		1400-1120	Amartuvshin et al. 2015
Tavan Khailaast 3-No.1	Hentiy	Delgerhaan	1b	3.8×3.2	pit, face up	E	0	bronze ornament18	835-804	Shiraishi ed. 2013
Daram No.9	Henty	Delgerhaan	1b	4.7×3.8	pit	E	0		896-806	Miyamoto & Obata 2016
Daram No.2	Henty	Delgerhaan	1b	4.0×2.5	pit	E	0		769-407	Miyamoto & Obata 2016
Orog Hyyp 85-p	Baiankhongol	Bogd	1b	3.2×2.5	pit,face up	NE	0		1220-900	GyhChincuren et al. 2010
Maikhan Tolgoi No.3	Baiankhongol	Khyjilt	3a	8.45×5.54	pit				1737-1526	Yeröol-Erdene et. al 2015
Chandomani Khar Uul 31	Dornogovi	Delgerekh	3a	11.5×7.7	pit	E	0		1500-1250	Amartuvshin et al. 2015
Baga Gazaryn Chuluu 1	Dundgovi	Adaatsag	3a	4.8×3.2	pit	NE	0	bronze knife, bronze arrow head, polished stone,pottery	1390-1110	Amartuvshin & Jargalan 2008, Nelson et al. 2009
Tevsh No.3	Uvuruhangai	Bogd	3a	6.5×6.0	pit, face down	E	0		1392-1264	Miyamoto & Obata 2016
Tevsh No.1	Uvuruhangai	Bogd	3b	8.5×7.5	stone cist, face up	W	0		901-812	Miyamoto & Obata 2016
Baruun Gyalaat 2	Baiankhongol	Baianlig	3b		pit	E	0		1270-970, 960-930	Kovalev & Erdenebaatar 2009
Bor Ovo No.8	Baiankhongol	Bogd	3b		pit	E	0		1112-974	Miyamoto 2017
Ulaanboom 16	Gobi-Altai	Taishir	3b	10×4			0		1270-970	Amartuvshin & Aldamönkh 2010
Baruun Gyalaat 1	Baiankhongol	Baianlig	3c		pit	E	0		1020-760	Kovalev & Erdenebaatar 2009
Daram No.4	Henty	Delgerhaan	2a	8.5×7.5	pit	E	1	bronze ornaments3, stone beads1000	786-429	Miyamoto & Obata 2016
Daram No.2	Henty	Delgerhaan	2b	4.0×2.5	pit		2or3		769-415	Miyamoto & Obata 2016
Maikhan Tolgoi No.13	Baiankhongol	Kujilt	2b	6.67×5.8	pit	E		pottery sheards	752-403	Yeröol-Erdene et. al 2015
Daram No. 41	Henty	Delgerhaan	2b	4.6×3.6	pit		3	pottery sheards	404-205	Miyamoto & Obata 2016
Daram No.1	Henty	Delgerhaan	2c	4.3×4.2	pit	E	3	pottery sheards	479-381	Miyamoto & Obata 2016

two types: round type and square type. Amgalantugs believed that the two types dated to different periods, with the round type being relatively earlier than the square type (Амгалантөгс, 2015). But it is probable that the difference in the plan is based on the different customs of groups or different clan symbols of the groups.

According to Amgalantugs (Fig. 99), the round type and square type can be classified into subgroups (Амгалантөгс, 2015). The round group is divided into five groups. His 1A, 1B, 1E types have an enclosure. The others are merely round graves with no enclosure. These types with no enclosure are round graves. Amgalantugs proposed the round grave separately. But it is difficult to distinguish between these types and Amgalantugs's round type (Fig. 99) in the definition. In this paper, Khirigsuur and the round grave should be distinguished in the definition. In this case, we need to take into consideration another attribute of Khirigsuur and round graves. This is whether or not four erected corner stones are present. In the case of Khirigsuur, there are four corner stones on the round enclosure or on the square enclosure. In the case of round graves, there are four corner stones on the round rimmed stones. In addition, some square graves of Khirigssur also have four corner stones on the square rimmed stones. Amgalantugs classified some Khirigsuur which were modified and were not major types to other his types. These types are very few irregular types for Khirigsuur, so this paper considers them to be unrelated.

Therefore, I would like to modify Amgalandugus' definition of Khirigsuur. Khirigsuur Type 1 consists of a round enclosure. Khirigsuur Type 3 consists of a square enclosure. Khirigsuur Type 1 is divided into two subtypes depending on whether or not four corner stones are present: Type 1a and Type 1b (Fig. 100). Type 1a is a round enclosure without four corner stones, and Type 1b is a round enclosure with four corner stones. Khirigsuur Type 3 consists of a square enclosure. Type 3 is also divided into two subtypes depending on whether or not four corner stones are present: Type 3a and Type 3b (Fig. 102). Type 3a is a square enclosure without four corner stones, and Type 3b is a square enclosure with four corner stones. Round graves have a round line with rimmed stones. These stone mounds are thought to be connected with rimmed stones and round enclosures in Khirigsuur Type 1. Because of this formation process, round graves can be included within the Khirigsuur burial system. Therefore, round graves can be called Khirigsuur Type 2. Type 2 is also divided into two subtypes depending on whether or not four corner stones are present: Type 2a and Type 2b (Fig. 101). Type 2a is a round grave without four corner stones, and Type 2b is round grave with four corner stones. I would like to call this burial system "Khirigsuur culture."

In addition, Khirigsuur culture graveyards often contain square graves with four corner stones. These are not same as those rectangular graves of the stone-slab grave culture. This fact is exemplified by Grave No. 1 at Khyar Kharaach Site (Miyamoto ed., 2017). Grave No. 1 at Khyar Kharaach Site (Fig. 98) is

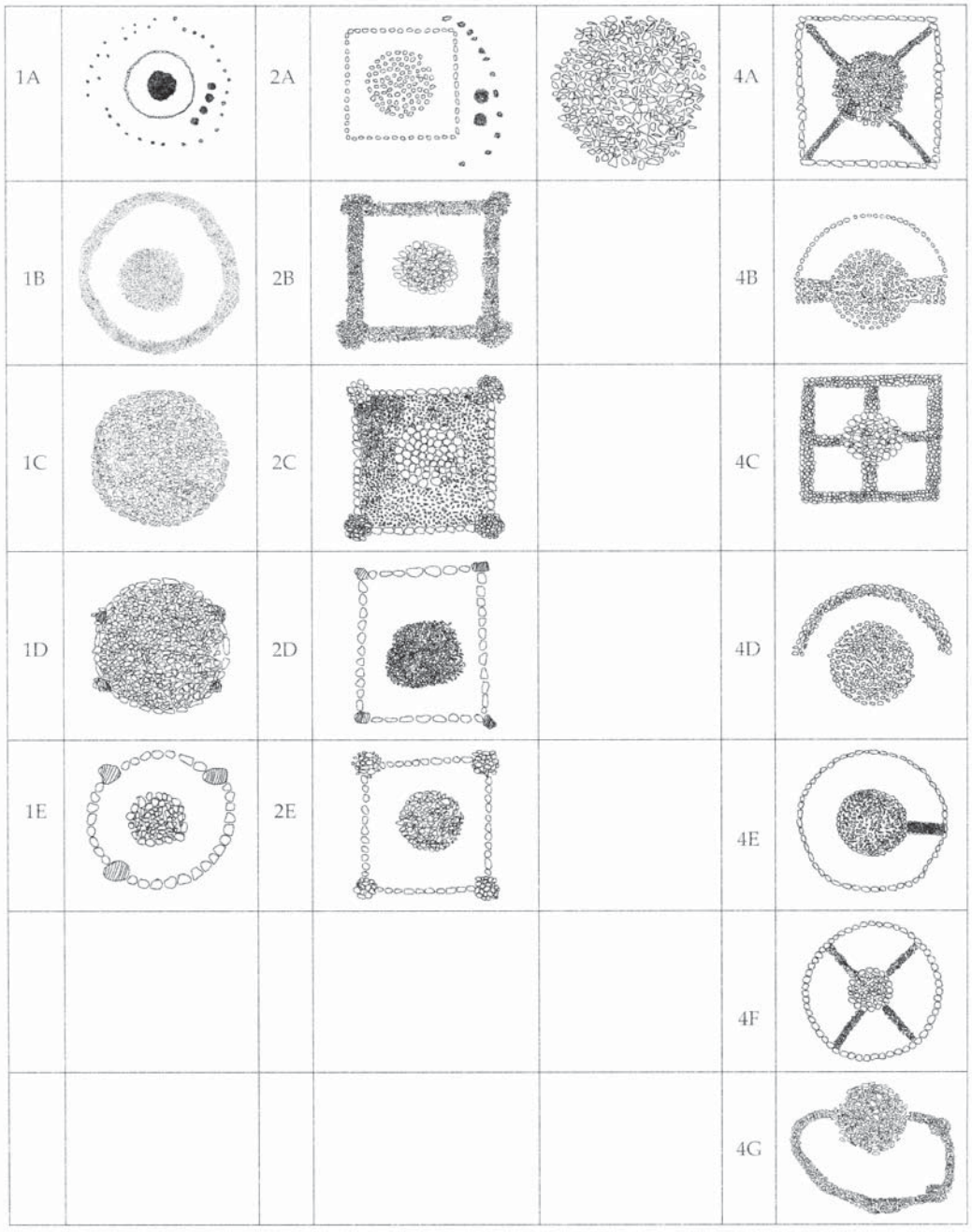


Fig.99 Classification of Khirigsuur by Amgalantugus Tsend (Amgalantugus 2015)

composed of a square plan, but there is small cairn in the center, something which is not found with slab-stone graves. It is supposed that Khirigsuur Type 3b developed to be connected between the cairn and square enclosure with four corner stones and then became a square grave. A particular feature of square graves is the existence of pavement stones between the small cairn in the center and the square rimmed stones with four corner stones. Therefore, it is believed that the square grave belongs to the Khirigsuur culture. Square graves can be called Khirigsuur Type 4. Furthermore Type 3b and Type 4 have recently been called the Sagsai type (Гантулга, 2016). The Sagsai type is distributed in western and central Mongolia.

Khyar Kharaach Site has four cemetery units, from Unit 1 to Unit 4 according to the grave distribution (Fig. 103). Khyar Kharaach's graveyard belongs to the Khirigsuur culture and includes Type 1, Type 2, Type 3 and Type 4. Type 1 and Type 3 are the main types in this graveyard (Miyamoto ed. 2017). Figure 103 indicates the distribution of every type at Khyar Kharaach Site. According to these figures relating to grave type distribution, Type 1 and Type 3 are the main grave types at this site. Grave No. 20, which is Type 2b at Khyar Kharaach Site, dates to 1397 - 1259 cal. BC. Emeelt Tolgoi Site, excavated by a joint Mongolian-Japanese research team in 2016 and

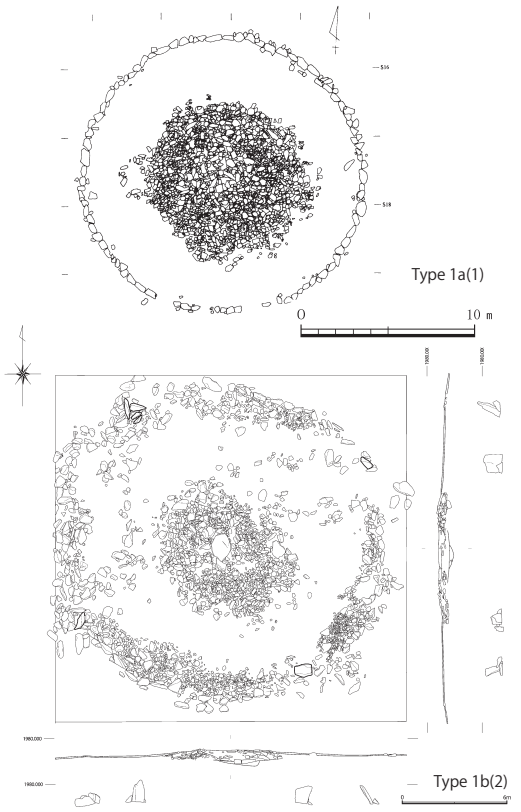


Fig.100 Khirigsuur Type1 (1 Ulaan Uushig Grave No.4, 2 Emeelt Tolgoi Grave No. 30)

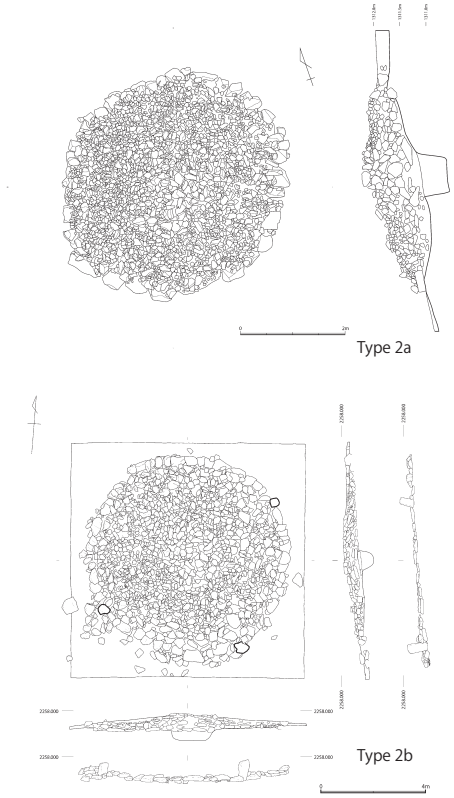
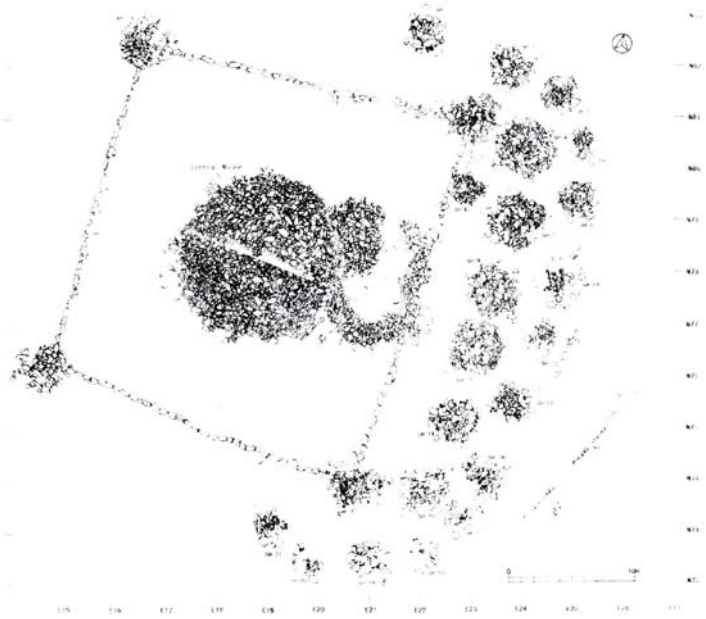


Fig.101 Khirigusuur Type2 (1 Bor Ovoo Grave No.11, 2 Khyar Kharaach Grave No. 20)

2017, also has mainly Type 1b and Type 2b in the same graveyards (Fig. 25). Type 1b Grave No. 30 and Type 2b Grave No. 40 and No. 44 at Emeelt Tolgoi Site date to approximately the same time, and the dating of these is roughly the same as that of Grave No. 20 at Khyar Kharaach Site. According to dating of Type 1b and Type 2b, these two types are believed to have existed simultaneously. The differences between Type 1b and Type 2b are conjectured to indicate differences in the social status of the buried individuals or of social cohesion of the groups included with the buried individuals. If true, we can conceive that the relationship between Type 1b and Type 2b is the same kind of relationship as between Type 3b and Type 4 (Fig. 104).

Figure 103 shows that the number of Type 1 graves is much larger than that of Type 2, and that these two types are clearly divided in location. According to Amgalantugs's research, Type 1 dates to a relatively earlier period than Type 3 in the chronological scheme (Амгалантөгс, 2015). If true, we can assume that Type 1a and Type 2a were distributed first at Khyar Khraach Site, Type 1b and Type 2b were distributed at the next stage, and Type 3a and Type 4 spread to this site during the third stage. And it is probable that differences between Type 1 and Type 2 are reflected not only by differences in period but also by differences in the social group's identity or social group customs.

Type 4 graves are also present at Khyar Kharach Site. The particular features of Type 4 graves with four corner stones are the same as those of Type 1b and Type 3b. It is probable that those groups with four corner stones indicate the same cultural identities. However, there are very few Type 4 graves at Khyar Kharach Site compared with other types - Type 1b and Type 2b - and graves of this type are located in a peripheral area of this graveyard (Fig. 103). The dating of Type 4 Grave No. 1 at Khyar Kharaach Site is 1306 - 1054 cal. BC and 1325 - 1209 cal. BC. Grave No. 1 dates to a relatively the same period as that of Type 2b Grave No. 20 at Khyar Kharaach Site and Grave No. 40, No. 44 at Emeelt Tolgoi Site. In addition, the results of physical anthropological research show that the individual buried in Grave No. 1 is genetically from the Mongolian line, while the individual buried in Grave No. 20 is genetically from the Caucasian line. This means that these two types of burial custom indicated different clan groups. Therefore, it is thought that people of Type 4 moved to this district from eastward district. Furthermore, people of the main burial customs of Type 1b and



Type 3a(1)

Type 3b(2)

Fig.102 Khiriguur Type3 (1 Ulaan Uushig No. 4, 2 Emeelt Tolgoi Grave No. 4)

Type 2b spread from a westerly direction with the migration of people to Khyar Kharaach Site.

In addition, square grave with four corner stones dating to 15th to 14th century BC was found Grave No. 49 at Emeelt Tolgoi Site. This grave is also belonging in Type 4 grave. But the scale and plan form of this grave are different from those of Grave No. 1 at Khyar Kharaach Site and Grave No. 82 at Emeelt Tolgoi Site. Type 4 can be divided into two subtypes: Type 4a and Type 4b. Grave No. 49 at Emeelt Tolgoi Site is called Type 4a and Grave No. 1 at Khyar Kharaach Site and Grave No. 82 at Emeelt Tolgoi Site are Type 4b. However, Type 4a square graves differ to Type 1 rectangular stone construction graves in southwestern Mongolia in terms of burial structure. The origin of Type 4a is unknown. On the other hand, Type 4b square graves developed from square Khirigsuur Type 3b with four corner stones on the enclosure. Square Khirigsuur Type 3b and Type 4a and Type 4b square graves of the Khirigsuur culture emerged in northern Mongolia and spread to western and middle Mongolia during migrations with round Khirigsuur and round grave. The Sagsai-type, particular in that it has four oval stones, is also assumed to have been established in northern Mongolia and spread to the western and middle Mongolian Plateau.

3.Development process of the stone-slab burial and Khirigsuur culture

The stone-slab burial culture has three distinct burial customs: the rectangular stone construction grave (Type 1), the figured grave (Type 3) and the stone-slab

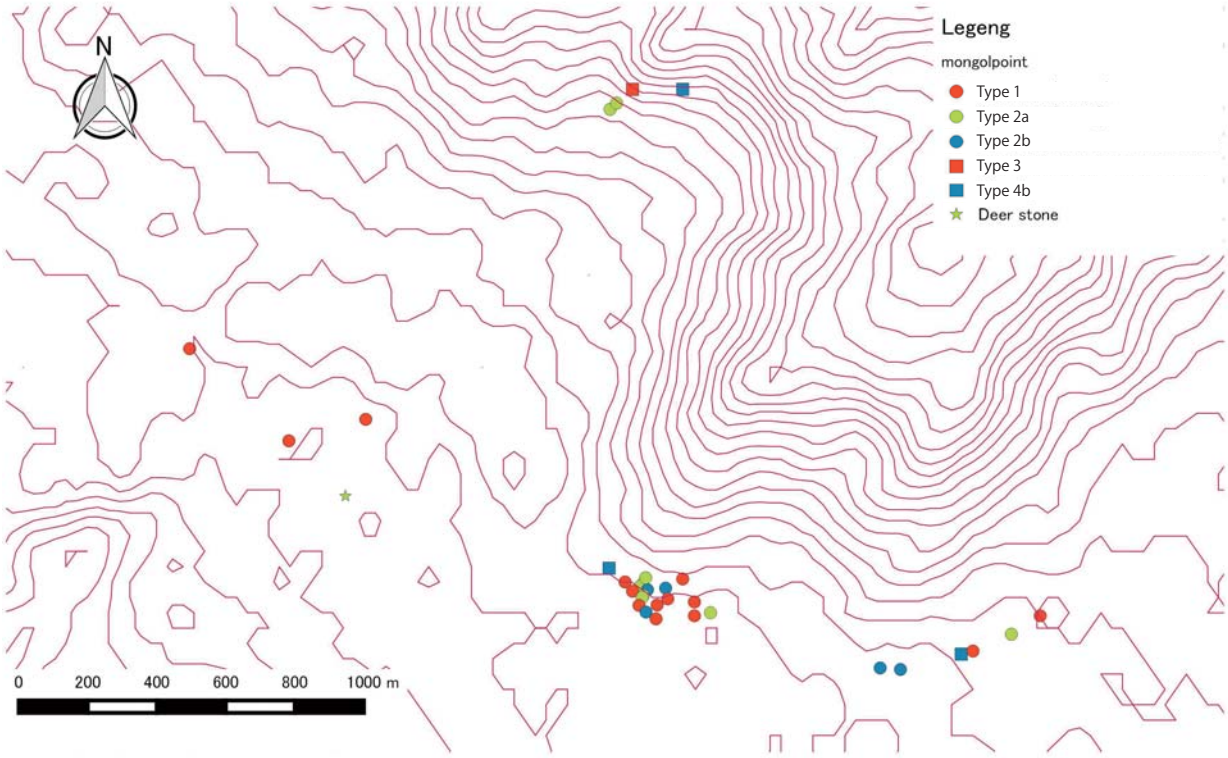


Fig.103 Distribution map of cemeteries at Khyar Kharaach Site

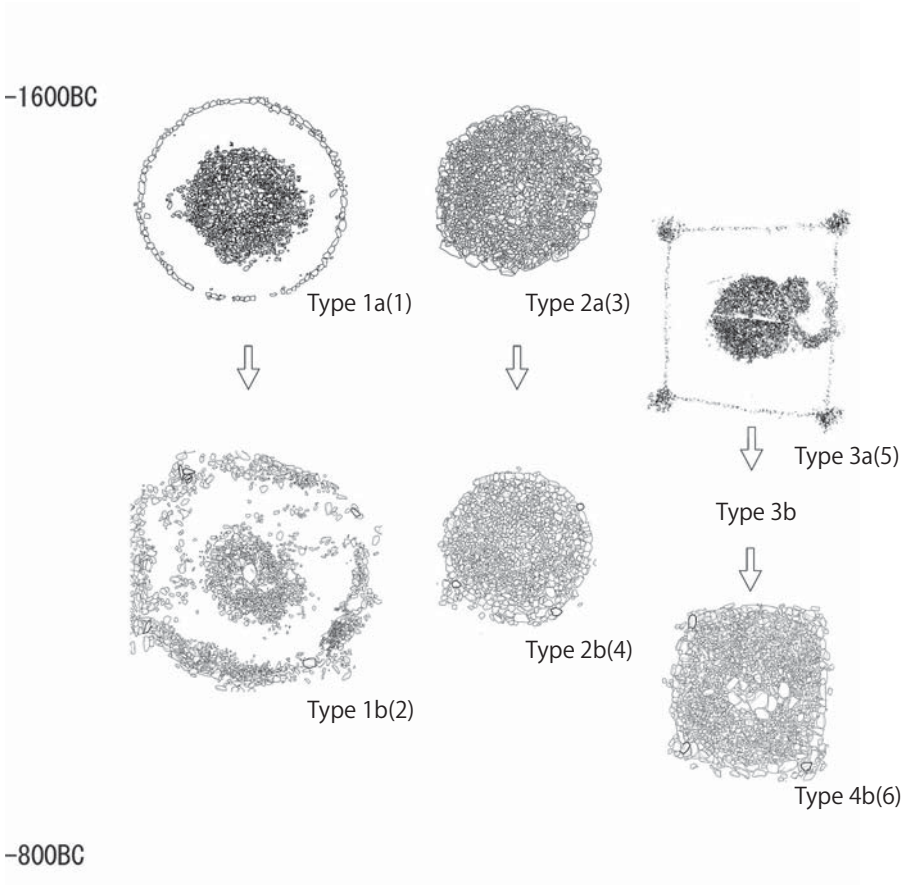


Fig.104 Changes of the grave structure in the Khirigsuur culture (1 Ulaan Uushig Grave No.4, 2 Emeelt Tolgoi Grave No. 30, 3 Bor Ovoo Grave No.11, 4 Khyar Kharaach Grave No. 20, 5 Ulaan Uushig No. 4, 6 Khyar Kharaach Grave No. 1)

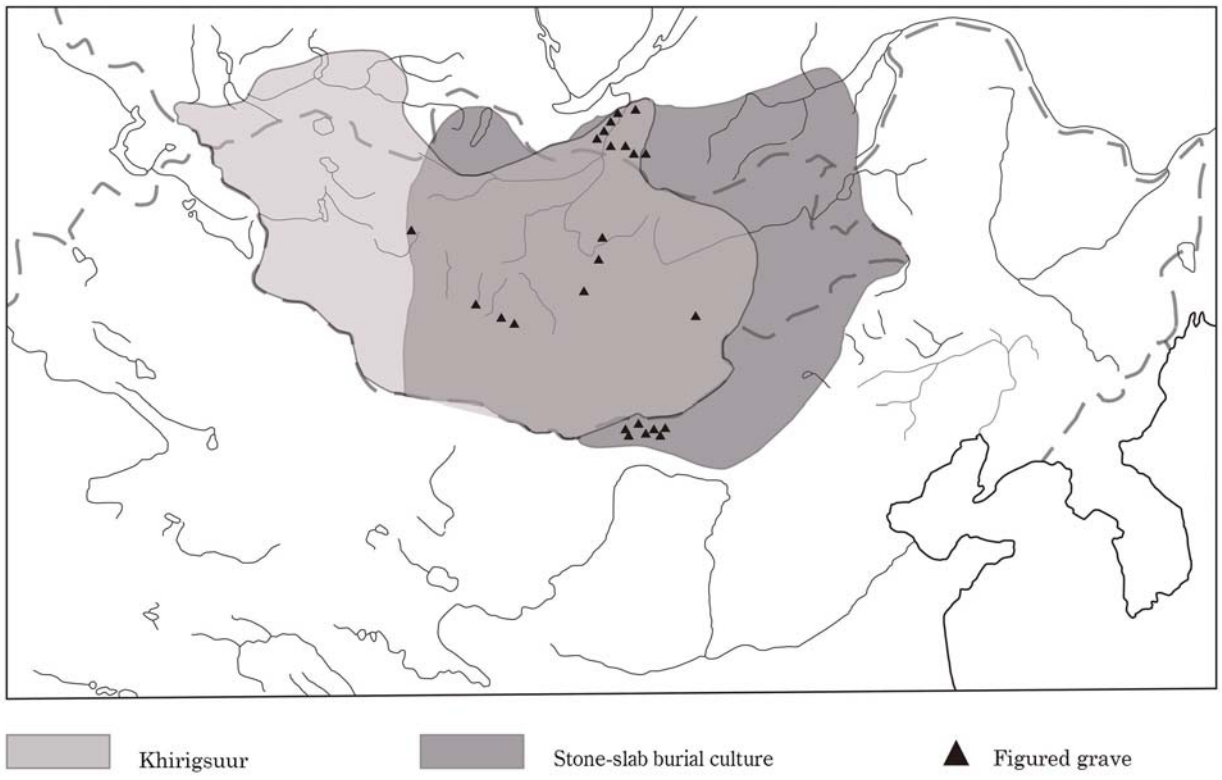


Fig.105 Distribution map of Khirigsuur and stone-slab burial culture (figured grave) in the Mongolian Plateau

grave (Type 2). The former two burial customs, which date to between the 15th and 9th centuries BC, are of a relatively earlier period than the last one, which dates to between the 8th and 3rd centuries BC. The stone-slab burial culture is distributed in the eastern and middle Mongolian Plateau based on the Cybiktarov's grave distribution map (Цыбиктаров А. Д., 1998) with recent excavation data (Fig. 105). The original location of rectangular stone construction graves (Type 1) is probably southeastern Mongolia according to the AMS dating (Table 11). This is because the dating of Type 1a of Chandomani Khar at Dornogovi and of Ulaanzuuk at Adgiin Gol, which are located in eastern Mongolia, covers the 15th to 12th centuries BC. rectangular stone construction graves (Type 1) then spread to the central Mongolian Plateau and changed to figured graves (Type 3). Figured graves are mainly distributed in Central Mongolia (Fig. 105). Many figured graves are found south of the Yinshan Mountains in Inner Mongolia, which is the south of central Mongolia (Ma, 2015). On the other hand, figured graves in the Baikal area, which is in the north of middle Mongolia, are also concentrated here (Fig. 105). It is supposed that the rectangular stone construction graves of southeastern Mongolia spread to middle Mongolia and changed to figured graves. It is also possible to explain how the long edge line of the Type 1a square stone construction graves changed to be curved on the long edge lines to be the Type 3a figured graves in the typological changes (Fig. 97)

On the other hand, Khirigsuur culture which corresponds to the rectangular stone construction graves and figured graves of the stone-slab burial culture in this period were distributed in western and central Mongolia (Fig. 105). In most cases, as with Khirigsuur, graves belonging to the former two burial customs do not contain grave goods. The whole Khirigsuur culture graves does not possess a grave goods. The nature of Khirigsuur culture is suggestive of an egalitarian society, although the scale of graves is different. However, Baga Gazaryn Chuluu1, Dundgovi Aimag, a Type 3a figured grave dating to 1390 - 1110 cal. BC, contains relatively large quantities of grave goods. For example, its contents include a Karasuk style bronze knife, bronze arrow heads, a ground stone crucible with handles, and pottery (Nelson et al., 2009). Another figured grave at Tevsh Site, Bayankhongol Aimag, contains a Karasuk style golden earing (Волков, 1972). And the square stone construction grave at Emgent Hoshuu Site, Bulgan Aimag, contains bronze helmets (Erdenebaatar, 2004). Therefore, several rectangular stone construction graves and figured graves contain fine grave goods like bronzes. In addition, the profile on the pit burial at Tevsh Grave No. 3 indicates the likelihood that there was a wooden coffin or body wrapped in

textiles or feathers in the burial pit. The presence of pit burial facilities under the stone construction at figured graves means that those graves were invested with special labor. On the basis of this evidence, we believe social classification gradually started as early as the beginning of the stone-slab burial culture. On the other hand, Khirigsuur culture which originated in western Mongolia exhibits differences in grave scale. The differences between Type 1, Type 2 and Type 3 in the Khirigsuur culture corresponds to the scale difference of graves. These scale differences are supposed to indicate differences in social cohesion between the groups or clan systems of the buried individuals. Another interpretation is that differences in grave scale represent differences in group scale to which the buried individuals belonged.

On the other hand, such social differences improved during the phase of typical stone-slab graves. Daram Grave No. 4, a Type 2a stone-slab grave, has a pit burial with a cover stone under the stone construction. It is probable that there was a wooden coffin or body wrapped in textiles or feathers in the burial pit because of the distribution of grave goods. This stone-slab grave contains many grave goods, such as bronze ornaments and stone beads. Differences in grave goods in terms of quantity and quality show that there were social differences between individuals at that time. It is also very interesting that the individual buried in Daram Grave No. 4 is female. No social differences between the sexes have been confirmed so far, but the social differences between individuals are much more pronounced than those seen in Khirigsuur. In addition, Daram Grave No. 1, a Type 2c stone-slab grave, also has a wooden coffin in a burial pit with double pit graves. The wooden coffin in Daram Grave No. 1 was much larger than that of Daram Grave No. 4. Depending on the time period and stage of social development, not only the stone-slab grave structure itself but also burial facilities like wooden coffins under the stone construction were much bigger. This shows that social complexity based on the individual in social groups was gradually increasing.

Khirigsuur culture probably changed to Chandmani culture, which includes a wooden chamber or wooden coffin. Chandmani culture with iron tools was also established through the influence of the early Iron Age of Altai and the Minusinsk Basin, west of Mongolia. These cultures also indicate social complexity based on the individual.

Conclusion

Khirigsuur culture, in which the grave scale indicates the group scale of the buried individuals, corresponds to the Karask culture and is distributed in western Mongolia. Khirigsuur culture spread from western Mongolia to central Mongolia with the movement of people from central Eurasia (Fig. 105). A Caucasian genetic line of people of the Khirigsuur culture has been identified at Khar Kharaach Site (Miyamoto ed., 2017). Therefore, Khirigsuur culture is believed to have been influenced by the Altai or the Minusinsuk Basin with the cultural attributes and immigration of people. The Khirigsuur in western Mongolia gradually changed in a horizontal space from westward to eastward in central Mongolia. The Khirigsuur symbolized the social unit or social group rather than a particular individual.

Figure 97 shows the changing processes of rectangular stone construction graves, figured graves and stone-slab graves in the stone-slab burial culture of central and eastern Mongolia. Two burial customs, the rectangular stone construction grave and the figured grave, gradually changed along a shifting line in the chronological framework from the 15th to 9th centuries BC, corresponding to the Karask culture of bronzeware. Rectangular stone construction graves originated in eastern Mongolia and spread to central Mongolia, where they changed into figured graves. The figured grave is mainly distributed in central Mongolia from the Bikal area in the north to the Yinshan Mountains in central Inner Mongolia in the south (Fig. 105).

Typical stone-slab graves gradually changed from Type 2a to Type 2b and Type 2c in central and eastern Mongolia, dating from the 9th to 3rd centuries BC, thus corresponding with the Tagar culture of bronzeware. This process of change also led to the social development of herding societies in the eastern steppe area. In particular, certain individuals gained esteem within the social stratification. This social particularity is seen in the stone-slab burial culture of central and eastern Mongolia. On the other hand, Chandmani culture, which consists of wooden chambers coffins, spread at the same time throughout western Mongolia under the influence of the Pazyryc culture of Altai. These social particularities and esteem for the individual in the social stratification is also seen in Chandmani culture.

Closing Remarks

Kazuo Miyamoto

Through excavations at Emeelt Tolgoi Site along with the results of previous excavations at Bor Ovoo Site and Khyar Kharaach Site, we were able to construct a chronology for Bronze Age graves in western Mongolia. Round Khirigsuur and round graves were distributed mainly in western Mongolia and spread eastward to the middle Mongolian Plateau in the latter half of the second millennium BC. At the same time, square Khirigsuur and Type 4 square graves were also distributed mainly in northern Mongolia and spread southward to western and middle Mongolia. Round Khirigsuur and round graves can be classified into two types according to whether or not four corner stones are present. Square Khirigsuur can be also classified into two types according to whether or not four corner stones are present on square enclosure. The presence of four corner stones, the same as with Type 4 square graves, indicates stylistic similarities with Sagsai shaped-graves (Гантулга 2017), a situation identical with that encountered at Khyar Kharaaach Site (Miyamoto ed. 2017).

On the other hand, Type 1 rectangular stone construction graves emerged in the southeastern Mongolian Plateau and spread westward in the latter half of the second millennium BC (Miyamoto 2016). However, Type 4a square graves differ to Type 1 rectangular stone construction graves in southwestern Mongolia in terms of burial structure. Type 1 rectangular stone construction graves in southeastern Mongolia developed simultaneously into figured graves, mainly in the middle Mongolian Plateau. On the other hand, Type 4b square graves developed from square Khirigsuur with four corner stones on the enclosure. Square Khirigsuur and Type 4a and Type 4b square graves of the Khirigsuur culture emerged in northern Mongolia and spread to western and middle Mongolia during migrations with round Khirigsuur and round grave. The Sagsai-type, particular in that it has four oval stones, is also assumed to have been established in northern Mongolia and spread to the western and middle Mongolian Plateau. These are thought to be included in Khirigsuur Culture. In the latter half of the second millennium BC, during the Karask period, there were two separate burial customs in the east and west of the Mongolian Plateau: a stone-slab burial culture and Khirigsuur culture. Two separate social groups were a part of the same bronze culture in the Mongolian Plateau. The Type 3b figured graves of the stone-slab burial culture spread to Bor Ovoo Site from the 12th to 10th centuries BC. And Type 3b figured graves spread to Emeelt Tolgoi Site from the 10th to 9th centuries BC.

According to physical anthropological research, the individuals buried at Emeelt Tolgoi Site are, like at Khyar Kharaach Site, Bor Ovoo Site and Tevsh Site, taller in height compared with other prehistoric peoples in East Asia (Okazaki et al. 2016). The peoples found at Emeelt Tolgoi Site, like at Khyar Kharaach Site, Bor Ovoo Site and Tevsh Site, sustained far more injuries than other hunter-gatherers or farmers as a result of accidents related to riding horses (Okazaki & Yonemoto 2017). Herding societies would have been based on a more nomadic lifestyle than other peoples. And the individuals found at Grave No. 40 and No. 44 of Emeelt Tolgoi Site are identified as a Mongolian people based on physical anthropological analysis.

Strontium analysis on teeth was also conducted at Emeelt Tolgoi Site, like at Khyar Kharaach Site, Bor Ovoo Site and Tevsh Site. Strontium figures on teeth indicate local geological differences in Mongolia. According to these results, differences in Strontium ratios at Khyar Kharaach Site indicate different birthplaces between different Strontium figures. On the other hand, there are no differences in Strontium ratios between round graves and figured graves at Bor Ovoo Site, thought to be due to the fact that people who built figured graves moved westward from the eastern Mongolian Plateau to cemeteries originally established by people who built round graves. Nor are there differences in Strontium ratios between both round graves at Emeelt Tolgoi Site: Grave No. 40 and Grave No. 44. These results indicate similar geographical origins for both types of graves at Bor Ovoo and Emeelt Tolgoi Sites.

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