

*Report on DELP 1989 Cruise in the TTT Junction Areas  
Part 3: Geomagnetic Anomalies over the Triple Junction Area  
off the Boso Peninsula, Japan*

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Abstract

The three components and total intensity of the geomagnetic field were measured using STCM and a proton precession magnetometer during the DELP 1989 triple junction cruise. The magnetic anomaly lineation located at 34°N, 142° 30'E, which may be the M7 (129Ma) Mesozoic anomaly, crosses over the Japan Trench, with the trend N45°E. Lineations in the north western Pacific basin east of this region is N70°E. Therefore, the N45°E trend over the triple junction area means anticlockwise rotation of the triple junction area by 25° relative to the northwestern Pacific basin.

I. Introduction

In the triple (TTT-type) junction area off the Boso Peninsula many investigations including geomagnetic studies have been conducted to reveal the geological and geophysical structure beneath the junction (e.g. Kato *et al.*, 1985; Kinsohita *et al.*, 1986; Renard *et al.*, 1987; Nakamura *et al.*, 1987; Iwabuchi *et al.*, 1990).

The geomagnetic surveys, however, have been conducted only by using a proton magnetometer which measures the total intensity of the geomagnetic field. In this cruise we used the STCM (Shipboard Three Component Magnetometer; e.g. Isezaki *et al.*, 1981) to measure the vector geomagnetic field. From three component geomagnetic anomalies we can determine the position and the strike of the boundary of two dimensional normal/reverse magnetic moment of the magnetic anomaly lineations whose strike and dip give us those of the subducting plate beneath the junction, and we can also determine the position and the strike of the fracture zone or the strike slip fault structure (e.g. Isezaki, 1986).

Nakanishi *et al.* (1989) reported the Mesozoic M5 (128Ma)–M9 (130Ma) anomalies in the area although they are not clear (Fig. 3). In this report we will present the three component and total intensity geomagnetic anomalies and confirm the trend of M5–M9 anomaly lineations using vector geomagnetic anomalies.

## 2. Methods of Measurement and Analysis

The three components and total intensity of the geomagnetic field were measured by STCM and proton precession magnetometer. The STCM system was controlled by a personal computer which also collected the position of the ship obtained by the GPS/LORAN-C navigation system, as well as geomagnetic field data and the ship roll and pitch angles (Isezaki, 1986).

The flux-gate sensors were set up on the deck during the entire period of the cruise. The field around the sensors may have been affected by the additional magnetic field produced by the metallic vessel body. The true geomagnetic field was calculated by subtracting this field from the observed one. The main assumption of the method of Isezaki (1986) is that the induced magnetic moment of a vessel body is proportional to the ambient geomagnetic field. For instance, the fore component of the induced magnetic moment of a vessel ( $M_p$ ) is directly proportional to the fore component of true geomagnetic field ( $P$ ). Then  $M_p/P$  where  $P=X\cos\theta+Y\sin\theta$  ( $X$ ,  $Y$  and  $\theta$  are the north and the east components of the geomagnetic field and the angle of ship's heading respectively).

In this paper, however, I assumed the induced magnetic quadrupole moment as well as the above mentioned  $M_p$  (induced magnetic dipole moment). In this case the fore component of the resultant induced magnetic moment is proportional to  $P+Pq$  where  $Pq=X\cos(2\theta)+Y\sin(2\theta)$ . This assumption improves the method of Isezaki (1986). Fig. 1 shows the result of analysis using the fore component magnetic field ( $H_p$ ) observed during a  $360^\circ$  turn of a ship at a point and the difference ( $\Delta H$ ) between the observed  $H_p$  and the IGRF-85 field (IAGA Division 1, WG1, 1985).

$\Delta H$  is distributed over a finite band, mainly due to ship's rolling and pitching. The  $2\theta$  component in  $\Delta H$  can be seen in Fig. 1-a, which shows the result under the assumption

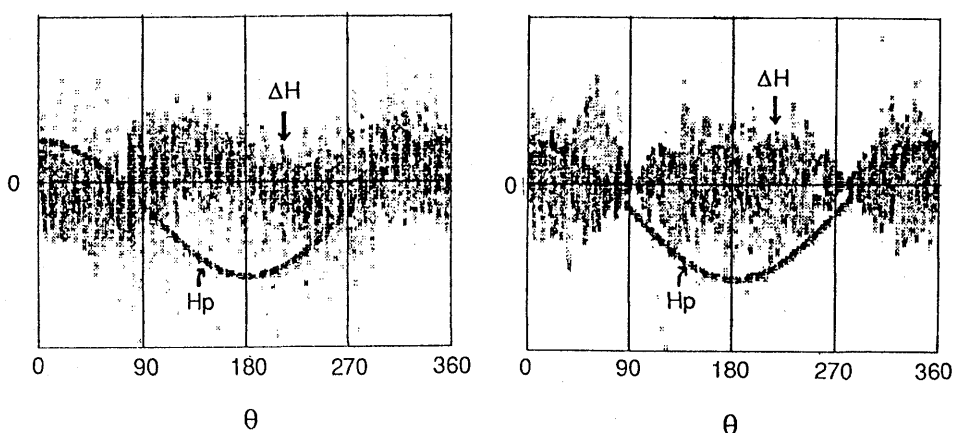


Fig. 1 The fore component ( $H_p$ ) of geomagnetic field and the residual field ( $\Delta H$ ) from IGRF-85 field observed during ship's  $360^\circ$  turn at a point. The scale of the vertical axis is  $\pm 50000$  nT for  $H_p$  and  $\pm 2000$  nT for  $\Delta H$ . The abscissa  $\theta$  is the angle (in degree) of ship's heading measured clockwise from the true north.

1-a:  $H_p$  and  $\Delta H$  for P field model (see the text).

1-b:  $H_p$  and  $\Delta H$  for P+ $Pq$  field model (see the text).

of P field only. Fig. 1-b shows the result under the assumption of P+Pq field. The standard deviation of  $\Delta H$  is 450nT for Fig. 1-a and 420nT for Fig. 1-b, and  $\Delta H$  is distributed almost symmetrically around the zero line, which means that the unbiased value can be obtained by stacking and averaging an appropriate number of data for the constant  $\theta$  (ship's heading).

Geomagnetic three component values obtained through the method above as well as the total intensity value were compared with those of IGRF-85 by subtracting both the regional field and the artificial field.

### 3. Results

The magnetic data obtained from the morning of the 14th to the morning of the 18th of July, 1989 were analyzed. The results are listed in Table 1 and shown in Fig. 2.

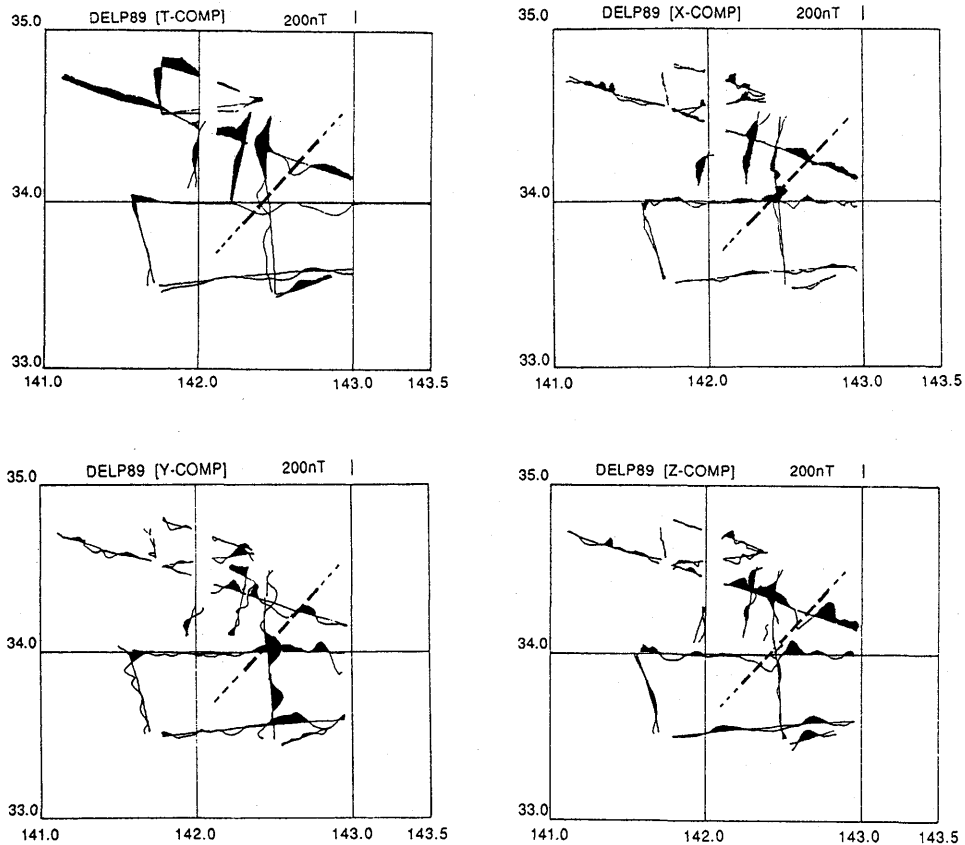


Fig. 2 Geomagnetic anomaly profiles. A broken line indicates the anomaly lineation M7.

- 2-a: total intensity anomaly profile.
- 2-b: north component anomaly profile.
- 2-c: east component anomaly profile.
- 2-d: downward component anomaly profile.

Table I. (1-a~1-g)

The list includes, from left to right:

1. Sample Time (year/month/day/hour/minute: e.g. 89 714 610 = 10 minutes past 6 o'clock on 14th July, 1989)
2. Latitude and longitude of ship's position in degree (e.g. 3406350 14303416 = 34.06350°N. 143.03416°E)
3. Sea water depth in m (9999 indicates data not available)
4. T, X, Y, Z (total intensity, north, east, and downward component anomalies) in nano Tesla (99999 indicates data not available)

89 714 610	3406350	14303416	5272	-75	999999	999999	999999
89 714 620	3403917	14302133	5257	-112	999999	999999	999999
89 714 630	3401583	14300717	5232	-88	999999	999999	999999
89 714 640	3399633	14298967	5196	-50	999999	999999	999999
89 714 650	3399667	14295833	5140	-106	999999	999999	999999
89 714 7 0	3399783	14292667	5158	-156	-14	-325	75
89 714 710	3399900	14289467	5237	-184	-15	-200	49
89 714 720	3400067	14286316	5308	-179	-44	-28	-49
89 714 730	3400200	14283167	5368	-164	0	94	-65
89 714 740	3400333	14280099	5444	-142	-2	152	-32
89 714 750	3400483	14276967	5561	-118	-37	94	24
89 714 8 0	3400583	14273900	5790	-93	-41	-7	47
89 714 810	3400617	14270683	5780	-73	-29	-16	57
89 714 820	3400600	14267517	5871	-53	49	46	10
89 714 830	3400600	14264284	5906	-24	86	56	8
89 714 840	3400533	14261084	5906	7	45	99	85
89 714 850	3400483	14257899	5830	12	-58	116	186
89 714 9 0	3400450	14254750	5924	-16	-119	127	203
89 714 910	3400383	14251584	6212	-62	-63	169	84
89 714 920	3400317	14248466	6197	-113	-27	172	-25
89 714 930	3400217	14245200	6536	-156	45	132	-162
89 714 940	3400067	14241966	6717	-179	108	86	-263
89 714 950	3399900	14238583	6439	-173	102	71	-252
89 71410 0	3399750	14235300	6975	-132	74	17	-188
89 7141010	3399567	14231883	7295	-90	32	-4	-100
89 7141020	3399400	14228467	7639	-54	63	-15	-85
89 7141030	3399233	14224950	7648	-19	73	-42	-55
89 7141040	3399067	14221483	7342	9	75	-24	-17
89 71411 0	3398850	14214667	7111	33	60	-15	11
89 7141110	3398783	14211301	9999	27	12	-45	54
89 7141120	3398767	14207883	9999	24	8	-54	46
89 7141130	3398783	14204550	9061	25	35	-20	18
89 7141140	3398850	14201300	9063	23	57	-26	-13
89 7141150	3398933	14197951	9062	14	-2	-15	27
89 71412 0	3399050	14194667	9063	3	-51	20	55
89 7141210	3399233	14191451	9059	-11	-78	20	61
89 7141220	3399467	14188133	9002	-9	-58	-15	26
89 7141230	3399700	14184967	8951	-16	-10	-44	-32
89 7141240	3399900	14181750	9125	-21	52	-37	-98
89 7141250	3400083	14178616	9025	-8	70	-22	-109
89 71413 0	3400283	14175417	9999	5	39	-48	-66
89 7141310	3400517	14172284	9999	26	49	-50	-57
89 7141320	3400733	14169067	8739	43	-0	-27	10
89 7141330	3400933	14166034	8539	56	-82	-29	101
89 7141340	3401183	14162984	8602	69	-41	-33	71

Table 1-a

89	7141350	3401433	14159950	8654	73	-77	-14	109
89	71414 0	3401717	14156883	8723	73	99999	99999	99999
89	7141410	3401150	14155167	8875	68	99999	99999	99999
89	7141420	3399083	14155983	8906	61	97	190	-52
89	7141430	3396983	14156833	8889	50	75	215	-37
89	7141440	3394900	14157634	9999	38	26	93	-15
89	7141450	3392800	14158467	9999	23	-11	-49	-8
89	71415 0	3390700	14159267	9999	9	-27	-132	-14
89	7141510	3388567	14160017	9999	-2	-39	-115	-10
89	7141520	3386417	14160750	9999	-10	-58	-64	9
89	7141530	3384250	14161484	7858	-13	-68	-44	21
89	7141540	3382084	14162199	7903	-12	-62	-84	21
89	7141550	3380000	14162817	7816	-5	-46	-77	21
89	71416 0	3377917	14163383	7719	4	-40	-38	35
89	7141610	3375817	14164067	7839	8	-25	1	37
89	7141620	3373734	14164633	7901	13	-25	6	50
89	7141630	3371617	14165134	7888	16	-24	-23	55
89	7141640	3369500	14165700	7868	16	-11	-33	49
89	7141650	3367417	14166150	7836	15	8	-41	35
89	71417 0	3365333	14166684	7799	10	21	-52	23
89	7141710	3363267	14167250	7741	3	24	-36	17
89	7141720	3361200	14167751	7699	-11	30	-28	-1
89	7141730	3359117	14168333	7622	-28	31	-27	-20
89	7141740	3357050	14168817	7489	-48	26	-47	-39
89	7141750	3354967	14169366	7349	-68	32	-87	-71
89	71418 0	3352817	14169901	7281	-85	25	-90	-81
89	7141810	3350667	14170383	7135	-98	99999	99999	99999
89	71419 0	3349500	14175050	7193	-88	99999	99999	99999
89	7141910	3349917	14177783	7191	-76	-20	68	-4
89	7141920	3350317	14180533	7374	-65	10	53	-24
89	7141930	3350667	14183299	7647	-64	15	11	-28
89	7141940	3351017	14186133	8125	-62	11	-40	-30
89	7141950	3351367	14189017	9999	-63	6	-51	-30
89	71420 0	3351700	14191933	9999	-68	0	-49	-29
89	7142010	3352000	14194901	9999	-67	6	-43	-37
89	7142020	3352250	14197749	9999	-65	-10	-33	-18
89	7142030	3352533	14200734	9999	-58	-17	22	2
89	7142040	3352817	14203616	8546	-45	-38	26	40
89	7142050	3353117	14206551	8245	-30	-58	-21	75
89	71421 0	3353433	14209500	8339	-12	-33	-18	73
89	7142110	3353767	14212450	8424	6	-12	8	77
89	7142120	3354083	14215334	8422	19	27	-25	53
89	7142130	3354400	14218317	7919	26	28	-87	54
89	7142140	3354700	14221217	7643	25	33	-108	45
89	7142150	3354984	14224283	7796	13	40	-100	24
89	71422 0	3355267	14227283	7619	-1	68	-53	-22
89	7142210	3355517	14230333	7672	-21	54	-1	-29
89	7142220	3355767	14233267	7267	-39	22	19	-23
89	7142250	3356533	14241983	6944	-75	22	23	-66
89	71423 0	3356783	14244783	7045	-75	7	19	-67
89	7142310	3357033	14247617	6912	-83	-5	58	-64
89	7142320	3357267	14250467	6790	-96	-28	95	-55
89	7142330	3357533	14253334	6590	-105	-60	126	-34
89	7142340	3357817	14256267	6446	-104	-57	134	-36
89	7142350	3358100	14259166	6420	-93	-40	130	-40
89	715 0 0	3358317	14262050	6131	-73	-34	141	-14

Table 1-b

89 715 010 3358550 14264883 5926	-34	-51	148	55
89 715 020 3358717 14267767 5851	16	-41	110	102
89 715 030 3358850 14270633 5790	56	-3	15	111
89 715 040 3358950 14273483 5817	64	37	-46	77
89 715 050 3359033 14276334 5854	48	43	-80	51
89 715 1 0 3359134 14279201 5799	33	65	-106	2
89 715 110 3359233 14282117 5496	20	82	-120	-37
89 715 120 3359367 14284866 5455	4	47	-120	-28
89 715 130 3359533 14287801 5467	-22	37	-95	-51
89 715 140 3359733 14290717 5486	-48	29	-32	-73
89 715 150 3359967 14293634 5425	-62	-18	45	-40
89 715 2 0 3360266 14296384 5380	-68	99999	99999	99999
89 715 210 3360534 14299234 5377	-79	99999	99999	99999
89 715 310 3354900 14284683 5478	44	99999	99999	99999
89 715 320 3353783 14281599 5483	63	21	-51	-65
89 715 330 3352617 14278500 5653	58	13	-43	-48
89 715 340 3351467 14275301 5897	64	27	13	-33
89 715 350 3350317 14272084 5995	100	-5	51	61
89 715 4 0 3349183 14269000 5948	138	-33	45	141
89 715 410 3348250 14265834 6023	129	-44	29	143
89 715 420 3347617 14262700 6088	79	-22	49	74
89 715 430 3347000 14259517 9999	28	-4	35	-5
89 715 440 3346433 14256233 6486	-9	27	-27	-81
89 715 450 3345800 14252933 6868	-30	99999	99999	99999
89 715 5 0 3345217 14249834 6952	-51	99999	99999	99999
89 715 510 3347717 14249667 6797	-59	99999	99999	99999
89 715 520 3350250 14249516 6793	-73	-1	-211	48
89 715 530 3352717 14249384 6825	-83	-4	-226	25
89 715 540 3355200 14249283 6862	-94	1	-135	6
89 715 550 3357700 14249117 6853	-101	10	-69	-16
89 715 6 0 3360217 14249017 6945	-104	21	-48	-38
89 715 620 3365250 14248599 7043	-96	1	-1	-21
89 715 640 3370300 14248183 6801	-104	-31	139	-2
89 715 650 3372917 14248016 6763	-117	-38	163	-19
89 715 7 0 3375617 14247783 6856	-123	-41	147	-31
89 715 710 3378383 14247501 6795	-117	-36	95	-36
89 715 720 3381150 14247250 6810	-93	-39	46	-21
89 715 730 3383900 14247017 6775	-59	-49	21	24
89 715 740 3386700 14246783 6746	-28	-36	21	43
89 715 750 3389467 14246533 6862	-11	-32	-2	50
89 715 8 0 3392250 14246266 6691	-15	-43	20	47
89 715 810 3395050 14245984 6628	-45	-61	108	26
89 715 820 3397850 14245633 6623	-81	-74	165	-17
89 715 830 3400617 14245367 6405	-117	-74	142	-78
89 715 840 3403350 14244917 6481	-140	116	159	56
89 715 850 3406033 14244467 9999	-144	221	170	111
89 715 9 0 3408717 14243950 9999	-99	82	121	-71
89 715 910 3411417 14243500 9999	-44	1	51	-102
89 715 920 3414183 14243117 6312	-1	41	-31	-97
89 715 930 3416967 14243167 6288	27	89	-40	-115
89 715 940 3419767 14243300 6407	49	70	-1	-73

Table 1-c

89 715 950	3422583	14243449	6446	84	68	-5	-36
89 71510 0	3425417	14243617	6443	118	60	-28	1
89 7151010	3428217	14243933	6128	137	38	-92	36
89 7151020	3430950	14244167	6115	158	26	-131	64
89 7151030	3433717	14244501	6017	189	15	-150	95
89 7151040	3436483	14244733	6228	193	-3	-150	112
89 7151050	3439250	14245100	6193	174	-23	-95	96
89 71511 0	3442083	14245416	6251	131	-41	-10	53
89 7151110	3444900	14245734	6477	90	-47	26	-4
89 7151120	3447733	14246100	6600	60	-78	-16	-33
89 7151130	3450200	14246533	6603	35	99999	99999	99999
89 7151250	3453967	14233116	6624	12	99999	99999	99999
89 71513 0	3451750	14232716	6684	31	-149	229	-72
89 7151310	3449567	14232317	6798	66	-130	260	8
89 7151320	3447367	14231866	6797	101	-89	147	53
89 7151330	3445150	14231416	6891	126	-44	-64	69
89 7151340	3442900	14231017	7098	134	12	-161	53
89 7151350	3440633	14230499	7258	120	50	-172	19
89 71514 0	3438383	14230026	7141	86	77	-165	-40
89 7151410	3436133	14229533	7307	49	77	-110	-70
89 7151420	3433900	14229134	7393	33	70	-88	-67
89 7151430	3431683	14228633	7293	38	67	-96	-33
89 7151440	3429483	14228133	7312	55	70	-107	19
89 7151450	3427234	14227634	7444	77	81	-42	56
89 71515 0	3424983	14227150	7504	92	95	27	58
89 7151510	3422700	14226633	7864	97	100	6	44
89 7151520	3420417	14226184	7761	91	93	-17	5
89 7151530	3418150	14225667	7599	79	69	-45	-2
89 7151540	3415867	14225166	7632	69	39	-28	11
89 7151550	3413600	14224600	7444	66	8	51	24
89 71516 0	3411317	14224049	7281	63	-22	78	12
89 7151610	34 8975	14223450	7109	59	-60	66	-16
89 7151620	34 6572	14222844	6855	46	-110	72	-56
89 7151630	34 4133	14222234	6884	34	-166	57	-90
89 7151640	34 1650	14221600	6985	28	99999	99999	99999
89 7151650	3399850	14220192	7295	27	99999	99999	99999
89 71517 0	3399850	14216917	7155	126	-13	-78	6
89 7151710	3399950	14213533	7265	219	99999	99999	99999
89 7151810	34 1016	14194489	9060	-8	99999	99999	99999
89 7151820	34 1391	14191600	9056	-47	99999	99999	99999
89 7151830	34 4450	14191833	9038	-66	99999	99999	99999
89 7151840	34 7600	14192700	9037	-81	-50	-78	-30
89 7151850	3410767	14193584	9031	-84	4	-37	-78
89 71519 0	3413880	14194441	9015	-76	56	45	-94
89 7151910	3416977	14195355	9014	-48	95	78	-91
89 7151920	3420077	14196199	9026	-9	103	19	-51
89 7151930	3423183	14197151	9039	30	78	-72	-16
89 7151940	3426200	14198117	9047	58	-2	-134	27
89 7151950	3429217	14199078	9049	71	99999	99999	99999
89 7152020	3438338	142 1761	9053	23	99999	99999	99999
89 7152030	3441333	142 2592	9059	-16	99999	99999	99999

Table 1-d

89	7152040	3444350	142	3300	9058	-54	229	199	-44		
89	7152050	3447300	142	4100	8991	-84	99999	99999	99999		
89	71521	0	3449158	142	4733	8868	-105	99999	99999		
89	7152110	3448483	142	1861	9058	-84	99999	99999	99999		
89	7152120	3447833	141	98584	9059	-61	99999	99999	99999		
89	7152130	3447183	141	95267	9060	-35	99999	99999	99999		
89	7152240	3446463	141	93990	9064	-12	99999	99999	99999		
89	716	010	3441150	1421	1366	8966	-22	-13	-113	-11	
89	716	020	3440683	1421	3217	8933	4	1	-142	-1	
89	716	030	3440183	1421	5199	9227	27	5	-100	28	
89	716	040	3439633	1421	7216	9175	43	20	-29	41	
89	716	050	3439034	1421	9034	9053	52	-25	77	106	
89	716	110	3437750	1422	2783	8955	46	-24	156	98	
89	716	120	3437175	1422	4650	8949	32	-53	99	100	
89	716	130	3436600	1422	6517	8923	21	-101	62	124	
89	716	140	3436067	1422	8334	9177	9	-108	68	118	
89	716	150	3435534	1423	0234	9137	12	-89	99	101	
89	716	220	3433700	1423	5483	8938	64	-100	199	172	
89	716	230	3433083	1423	7367	8909	100	-95	114	226	
89	716	340	3429033	1425	1500	5515	51	30	-79	-61	
89	716	350	3428467	1425	3400	5721	-7	55	-131	-99	
89	716	4	0	3427817	1425	5417	5899	-17	86	-147	
89	716	410	3427133	1425	7434	5843	-52	109	-146	-218	
89	716	420	3426467	1425	9399	5765	-109	125	-158	-312	
89	716	430	3425834	1426	1400	5724	-174	111	-147	-387	
89	716	440	3425225	1426	3359	5651	-221	72	-106	-408	
89	716	450	3424617	1426	5334	5654	-224	45	-41	-382	
89	716	5	0	3424050	1426	7216	5741	-187	3	57	-285
89	716	510	3423441	1426	9226	5696	-124	-11	140	-183	
89	716	520	3422817	1427	1083	5682	-55	-3	134	-99	
89	716	530	3422167	1427	3067	5607	13	-5	119	-7	
89	716	540	3421516	1427	4975	5578	66	14	70	40	
89	716	550	3420900	1427	6833	5593	97	51	-18	37	
89	716	6	0	3420333	1427	8850	5550	110	83	-83	17
89	716	610	3419800	1428	0958	5497	113	77	-66	27	
89	716	620	3419333	1428	3099	5440	114	41	-12	65	
89	716	630	3418817	1428	5184	5441	108	30	9	72	
89	716	640	3418583	1428	6366	5404	112	29	-42	64	
89	716	650	3418000	1428	8350	5397	100	-33	-27	112	
89	716	7	0	3417283	1429	0350	5331	85	-44	20	106
89	716	710	3416567	1429	2300	5258	76	-43	32	91	
89	716	720	3415783	1429	4250	5196	73	-44	32	146	
89	716	730	3415033	1429	6217	5229	70	-81	35	108	
89	716	740	3414367	1429	8199	5214	59	99999	99999	99999	
89	716	8	0	3413033	143	2217	5204	36	99999	99999	
89	716	810	3412366	143	4117	5231	32	99999	99999	99999	
89	71619	0	3437750	1422	5450	7423	136	197	21	325	
89	7161910	3438550	1422	2667	7434	145	-20	33	194		
89	7161920	3439300	1421	9817	7506	134	-92	27	108		
89	7161940	3440833	1421	4349	9999	106	-62	-39	36		
89	7161950	3441683	1421	1417	8173	73	-38	-23	-27		

Table 1-e



89	71620	0	3442550	142	8467	9999	36	-66	-1	-50	
89	7162010		3443383	142	5650	9999	0	-54	-10	-100	
89	7162020		3444233	142	2699	9056	-21	99999	99999	99999	
89	7162030		3445150	14199750	9058		-47	99999	99999	99999	
89	7162040		3446083	14196967	9058		-36	99999	99999	99999	
89	7162050		3447117	14194099	9059		-20	-29	1	1	
89	71621	0	3448133	14191299	9999		-4	21	-11	62	
89	7162110		3449183	14188434	9999		5	13	-16	66	
89	7162120		3450217	14185651	9999		10	-25	-16	-8	
89	7162130		3451233	14182867	9999		13	-26	1	-4	
89	71622	0	3454267	14174533	9999		58	99999	99999	99999	
89	7162210		3454933	14171666	6517		77	99999	99999	99999	
89	7162220		3455567	14168700	6380		87	9	17	-53	
89	7162230		3456133	14165666	9999		102	23	24	-47	
89	7162240		3456717	14162601	9999		113	-11	25	-1	
89	7162250		3457250	14159517	5361		120	-39	39	34	
89	71623	0	3457817	14156450	5542		117	-46	60	40	
89	7162310		3458450	14153467	5775		115	-35	57	23	
89	7162320		3459117	14150484	5679		108	-35	28	15	
89	7162330		3459800	14147549	5949		108	-50	-37	24	
89	7162340		3460583	14144867	5582		112	-70	-96	46	
89	7162350		3461367	14142250	5327		118	-57	-77	40	
89	717	0	0	3462100	14139667	5088		117	-8	-25	-2
89	717	010		3462867	14137083	4955		113	121	-71	143
89	717	020		3463650	14134500	4953		104	130	-94	124
89	717	030		3464417	14131917	4919		97	95	-63	-4
89	717	040		3465283	14128984	4955		96	117	-34	-21
89	717	050		3466233	14125999	5087		96	44	30	-69
89	717	1	0	3467233	14123117	5099		98	54	80	-78
89	717	110		3468217	14120233	5095		97	41	45	-52
89	717	120		3469217	14117566	4742		95	-11	5	-25
89	717	130		3470167	14115016	4488		91	-50	-16	5
89	717	140		3471117	14112534	4450		86	-50	3	-2
89	717	150		3472100	14110083	4420		79	-90	13	25
89	717	2	0	3473233	141	7617	4223	71	99999	99999	99999
89	717	210		3474350	141	5350	3791	58	99999	99999	99999
89	717	220		3475117	141	3149	3336	49	99999	99999	99999
89	717	240		3476233	14098816	3709		0	99999	99999	99999
89	717	250		3476650	14096617	3179		-13	12	14	-25
89	717	3	0	3477083	14094299	3056		-28	-16	-28	37
89	717	310		3477567	14091750	3073		-42	99999	99999	99999
89	717	320		3478033	14089267	2728		-52	99999	99999	99999
89	717	330		3478400	14086884	2379		-53	99999	99999	99999
89	717	340		3479016	14084567	2277		-54	99999	99999	99999
89	717	350		3479917	14082050	2222		-48	-35	-56	-49
89	717	4	0	3480817	14079567	1931		-60	12	-47	3
89	717	410		3481633	14077150	1878		-62	47	-39	-23
89	717	420		3482417	14074850	1923		-73	40	-40	-100
89	717	430		3483167	14072417	1846		-76	-13	-48	-43
89	717	440		3483917	14070117	1874		-81	-52	-70	-3
89	717	450		3484667	14067950	1808		-89	-97	45	59

Table 1-f

89	7171930	3452483	14174867	6228	33	99999	99999	99999
89	7171940	3455100	14174133	6378	25	99999	99999	99999
89	7171950	3457767	14173183	6566	28	-20	-17	-22
89	71720	0	3460350	14172267	6454	39	17	-102
89	7172010	3462883	14171283	6444	54	99999	99999	99999
89	7172020	3465550	14170650	6142	68	99999	99999	99999
89	7172030	3468400	14170583	5856	84	3	31	-2
89	7172040	3471300	14170317	5578	95	-7	-24	8
89	7172050	3474217	14170233	5373	101	-1	-92	-7
89	71721	0	3477150	14170134	5314	100	99999	99999
89	7172150	3479150	14176184	5493	154	99999	99999	99999
89	71722	0	3478450	14179367	5693	171	-43	37
89	7172210	3477733	14182401	5948	176	-25	-58	4
89	7172220	3476967	14185516	6236	178	7	-103	-1
89	7172240	3475433	14191550	9999	128	-1	18	-5
89	7172250	3474633	14194633	9999	98	6	42	-20
89	71723	0	3473817	14197633	9999	470	99999	99999
89	7172320	3472033	142	3616	9999	27	99999	99999
89	7172330	3471100	142	6567	9999	17	-65	30
89	7172340	3470133	142	9483	9999	20	-38	-17
89	7172350	3469167	14212466	9999	24	113	-50	96
89	718	0	0	3468167	14215625	9999	25	153
89	718	010	3467133	14218767	9999	21	0	-18
89	718	020	3466083	14221834	9999	13	56	-10
89	718	030	3465083	14224933	7489	3	68	-22
89	718	040	3464100	14228101	7410	-6	-59	30
89	718	050	3463083	14231433	7026	-9	-62	67
89	718	1	0	3462117	14234650	6761	9	-37
89	718	110	3461133	14237767	6900	38	99999	99999
89	718	120	3460033	14240666	6941	52	99999	99999
89	718	130	3459633	14237616	6683	44	99999	99999
89	718	140	3459283	14234616	6627	23	-42	-53
89	718	150	3458917	14231900	6766	-4	-27	93
89	718	2	0	3458583	14229050	7222	-43	-5
89	718	210	3458250	14226350	7293	-79	52	130
89	718	230	3457533	14220667	9999	-108	13	13
89	718	240	3457183	14217934	9999	-101	20	-51
89	718	250	3456883	14215150	9999	-92	14	-91
89	718	3	0	3456617	14212317	9999	-73	6
89	718	310	3456367	142	9599	8883	-73	-3
89	718	320	3456100	142	7033	8886	-66	-34
89	718	330	3455833	142	4466	8881	-57	-78
89	718	340	3455550	142	1984	9999	-52	99999
89	718	350	3455233	14199384	9999	-76	99999	99999
89	718	4	0	3454917	14196851	9999	-65	95
89	718	410	3454617	14194284	9999	-53	26	-0
89	718	420	3454300	14191850	9999	-47	-23	16
89	718	430	3453933	14189549	9999	-35	-64	33
89	718	440	3453550	14187117	9999	-29	-83	13
89	718	450	3453133	14184700	9999	-20	-95	-20
89	718	5	0	3452717	14182167	9999	-6	-81

Table 1-g

Fig. 2-a shows T (total intensity anomaly) profiles along the track lines. The prominent negative T anomalies can be traced crossing over the three tracks as indicated by the thick broken line which connects the positions of the minimum of anomaly. This lineation can be identified as M7 (129Ma) anomaly (e.g. Nakanishi *et al.*, 1989). In Figs. 2-b and c (X and Y component anomaly profiles), the thick broken line on the same position as in Fig. 2-a does not cross over the bottom/peak but the steepest portion of the profile. On the other hand, as seen in Fig. 2-d, the positions of the bottom/peak of Z (downward component anomaly) profile is almost the same as those of the T profile (Fig. 2-a). The amplitude of Z is, however, larger than that of T due to the 46° inclination of the regional geomagnetic field.

The strike of lineation is N45°E, as seen in Fig. 2.

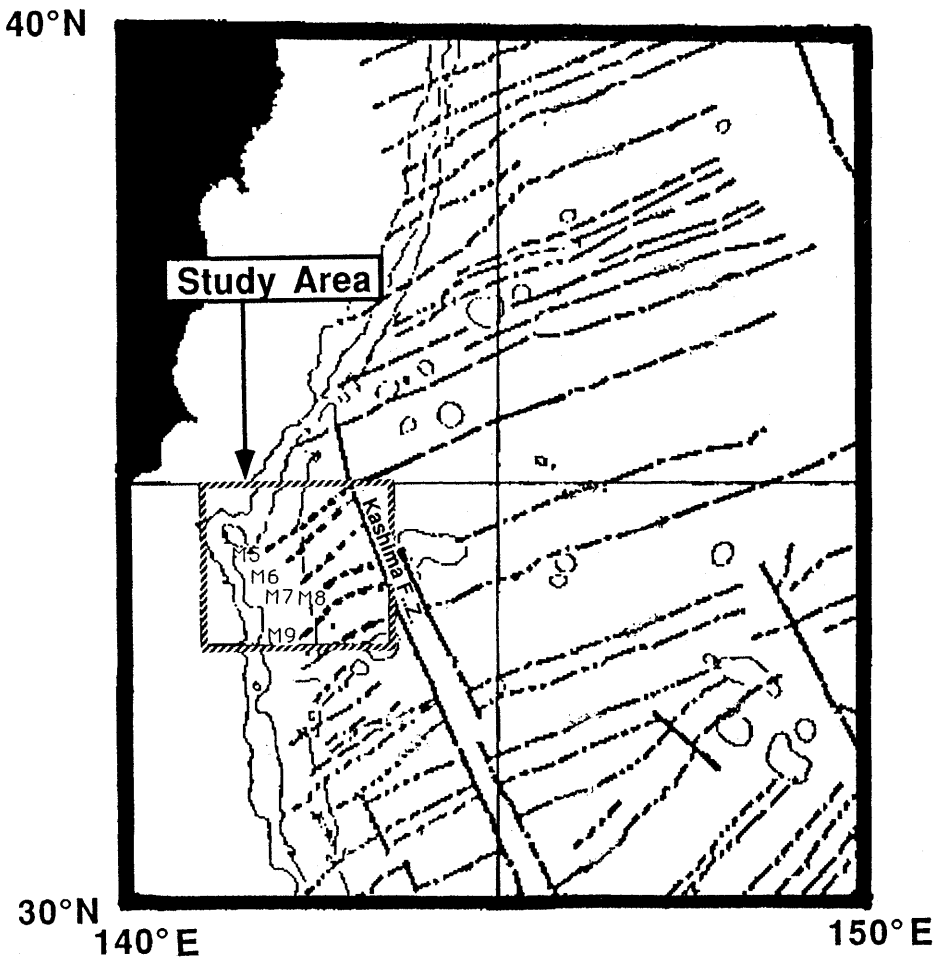


Fig. 3 Geomagnetic anomaly lineations in the north western Pacific Basin. Modified from Fig. 6 of Nakanishi *et al.* (1989).

#### 4. Discussion

As M5–M9 anomaly lineations are represented by dotted lines in Fig. 3, Nakanishi *et al.* (1989) could not definitely identify magnetic lineations in this area. The M7 anomaly lineation, however, is clearly identified using the magnetic data obtained in this cruise as shown in Fig. 2. It is an obvious lineation because the horizontal component anomalies (X and Y) shift their phases by 90° relative to the phase of Z, as mentioned above (Isezaki, 1986). The M6 and M8 anomaly lineations can be seen in the southernmost two tracks in Fig. 2.

The trend of M7 anomaly lineation is N45°E, and that of M9 may be nearly N30°E as seen in Fig. 2-a and d. The N30°E trend of M9 anomaly lineation is also inferred from the amplitude difference between X and Y anomalies (Figs. 2-a and c). Note that as the trend becomes closer to the NS direction, the amplitude of X decreases and that of Y increases (Isezaki, 1986). The X anomaly profile (Fig. 2-b) suggests that the trend of lineations over the trench is between NS and N45°E because the X anomaly amplitude is generally smaller than the Y anomaly amplitude.

The trend of magnetic anomaly lineations in the northwestern Pacific basin to the east of the Kashima fracture zone (e.g. Nakanishi *et al.*, 1989) is N70°E as seen in Fig. 3. The trend difference between the triple junction area and the northwestern Pacific basin area is more than 25°, which implies that the Pacific Plate subducting beneath the triple junction suffers interference with in its movement due to its complex structure and dynamics, which may cause the 25° anticlockwise rotation of the block around the triple junction.

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## 1989年度 DELP 海溝三重会合点海域調査研究航海報告 第三部：海溝三重会合点海域における地磁気異常

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1989年に DELP 航海により、海溝三重点海域での地磁気調査がなされた。測定にはフラックスゲート船上三成分磁力計とプロトン磁力計を用いて、地磁気三成分異常と全磁力異常分布を明らかにすることが目的であった。

調査海域には M5～M9 の地磁気異常縞模様があると考えられていたが、M7 の縞模様が顕著に観測され、その方式は N45°E と決定された。これは、この海域より東側の海盆にある縞模様の走向、N70°E と 25°異なるものであり、海溝三重点付近の海底地塊の北西太平洋海盆に対して 25°の反時計回りの回転運動を示すものである。