Japan Geoscience Union Meeting 2013
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SEM36-P01 Room:Convention Hall Time:May 19 18:15-19:30

It was not switching global geo-magnetic fields that created the alternating anomalies over oceanic ridges

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[1]MAROSA

[1] Introduction

The global geo-magnetic field is said to have alternating polarity that switches every some 670 thousand years. However, such a periodically alternating global geo-magnetic field is supported only by observed local geo-magnetic anomalies. Nobody observed directly any global switching geo-magnetic field of the Earth.

The observed anomalies are not global but local. Therefore, it is not necessary to conclude that there is a switching global geo-magnetic field which has a periodically alternating polarity.

In this paper, we will present a mechanism to create the alternating geo-magnetic polarity patterns observed over the oceanic ridges. It will be clarified that it is no use to assume the hypothesis of periodically alternating polarity of the global geo-magnetic field.

[2] Periodically Alternating Global Geo-Magnetic Field and Geo-Magnetic Anomalies

It is said that the global geo-magnetic field of the Earth has periodically alternating polarities which switched its N-pole with S-pole every some 670 thousand years. This fact is derived from the observed data of geo-magnetic anomalies over oceanic ridges and also with the empirical estimations of the age of oceanic bottom.

However, it is not global data but only local data to be observed actually. Is it enough to conclude that there is a global fact which we observed only local evidences?

[3] Geo-Magnetic Anomalies over the Oceanic Ridges

Vine & Matthews(1963) observed actually the geo-magnetic anomalies over the oceanic ridges. They concluded that the oceanic bottom was created by lava flowed out from the oceanic ridges and the oceanic bottom was gladually extended.

According to their estimation, it takes less than 150 million years to build the oceanic bottom.

[4] Another Mechanism by local fields

However, it is promature to conclude the existence of periodically alternating polarity of the global geo-magnetic field of the Earth. Actually, the alternating polarities of lacal geo-magnetic fields was created by another utterly different mechanism (Cf. Figure).

This mechanism is based on a very simple physical phenomenon. We know very well the physical fact that a magnet has necessarily two different poles, namely S-pole and N-pole, and also that a S-pole attracts N-poles of other magnets, and that a N-pole attracts S-poles of other magnets, and that magnet poles with the same charge repel each other.

We know also that the magnetic polarity comes from the magnetic polarities of atoms. Here we call the tiny magnets, composed of each atom, micro magnets. When the magnetic symmetry was broken in the cooling down iron-rich lava, that flowed out from the oceanic ridge, obeying this physical law, micro N-poles point toward the S-pole of the peripheral magnetic field and micro S-poles point toward the N-pole of the peripheral magnetic field.

As a consequence of that, the newly cooled down lava will have the reverse magnetic field to the former peripheral magnetic field.

Therefore, the secondary flowed out lava, when it is cooled down, accepts the reverse local field created by the previously flowed out and cooled down lava. This magnetizing mechanism creates obviously the alternating polarities of the local anomalies. This is the real mechanism to create the observed local geo-magnetic anomalies. In this mechanism it is possible to make not only horizontal anomalies but also vertical anomalies. That fact fits well Vine & Matthews (1963).

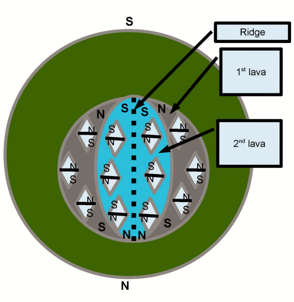
[5] Global Geo-Magnetic fields Doesn't Alternate Periodically

We reached the conclusion that the hypothesis of periodically alternating global geo-magnetic polarity of the Earth should be rejected because it has no use and no evidence. Instead, we should accept the newly devised mechanism to create the observed local geo-magnetic anomalies over oceanic ridges.

[References]

[1]F. I. Vine and Dr. D. Matthews, 'Magnetic Anomalies Over Oceanic Ridges', ***Nature***, September 7, 1963.

Keywords: Mechanisms of Alternating Geo-Magnetic Anomalies, Geo-Magnetic field, Geo-Magnetic Anomalies, Oceanic Ridges, Oceanic Bottom, Geo-Physics



SEM36-P02 Room:Convention Hall Time:May 19 18:15-19:30

A geomagnetic excursion found at around 2.3Ma from a marine sequence in the southernmost part of the Boso Peninsula

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The Chikura Group is distributed in the southernmost part of Boso Peninsula corresponding to the lower Pleistocene and the upper Pliocene. Since those intensities of magnetization are quite strong and stable, reliable paleomagnetic records can be obtained in the Chikura Group. We conducted a paleomagnetic study on the middle part of the Chikura group to recover a reliable record of geomagnetic excursions and/or short polarity events such as the period of the sub-normal polarity Reunion, during the Matuyama reversed polarity chron.

After detailed route map and a geologic column section were made for this study, we took 107 mini-cores for paleomagnetic measurements from 46 sites along the studied route.

As the results of thermomagnetic analysis, major magnetic carrier was estimated to be magnetite. The result of AMS (Anisotropy of magnetic susceptibility) measurements showed that the grains of those specimens were slightly rotated by the influence of a fold whose axis is just beside on the sampling route. But we decided to leave this result out of consideration, because this angle of rotation does not have much influence on identification for polarity events and excursions.

As the result of Paleomagnetic studies, VGP (Virtual Geomagnetic Pole) latitude indicated an excursion at the bottom part of the studied section.

According to an age model created in this study section, the excursion is calculate to have a duration for 8000 years centered at around 2.31Ma. There are no polarity reversal and excursion observed above that at this section.

Keywords: paleomagnetism, Reunion, excursion, Boso Peninsula

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Variance of magnetic properties of Hayachine ultramafic rock body in Tohoku District, Japan

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Serpentinite obtained crystallization remanent magnetization during serpentinization prior to uplifting crust, because of the random orientations from Mitsuishi serpentine belt, Hokkaido, Japan(Morijiri and Nakagawa, 2005). However, some examples of paleomagnetic directions aligned with rocks from the Kitakami Mountains, Japan has been reported. Inferred from geological studies might be suffered from contact metamorphism by intrusion of granite, after uplifting.

During study of the Geological map 1/50000 " Hayachine-San" (in printing), in the Hayachine ultramafic rocks, Kitakami Mountains, serpentinite samples for petrographic description were taken without orientation. Degree of serpentinization shows 30-80%, in southern than northern-central body, probably lower that percentage. Olivine is generally 1.2-2.0 mm in diameter which, replaced by serpentine along the cleavage and grain boundary. As well, the fine-grain containing beads of magnetite and fine metamorphic recrystallized olivine occur in the southern part. Serpentine occurs in the matrix of mesh-like texture, in fine vein with talc. Chromites are 0.3-1.0 mm in diameter and, been shown as a pseudomorph that subhedral in brown only internal or fully opaque. Often in the southern part, medium-grained (1.0-3.0 mm in length) tremolite with fascicular or tabular, and fibrous anthophyllite recrystallized, cut an original olivine texture. Appearances of metamorphic minerals are considered caused by thermal effect of Tono granodiorite body located in the South. Samples of the stuff in the same complex and slightly different distance from the Tono granodiorite think thermal metamorphic effects 13 more choice carried out various magnetization analysis of heat. In this case, not a paleomagnetic study, but can show examples of thermal magnetization curves of received heat contact metamorphic rocks.

Thirteen rock samples were collected without directions. Some pieces of these samples were measured. The natural remanent magnetizations(NRM) of pieces were measured using a pass-through cryogenic magnetometer (MODEL755R, 2G Enterprise). The alternating field demagnetization(AFD) of each piece was performed stepwisely starting from 0 to 100 mT at 5mT interval. The anhysteretic remanent magnetization(ARM) were also measured. The initial susceptibilities were measured using a susceptibility meter(KLY-3, AGICO). Hysteresis curve measurements at room temperature and thermo-magnetic analysis(Js-T curves) in a vacuum were done using the 0.1 to 0.2 g portion of each rock sample using a vibrating sample magnetometer(VSM, BHV-55L, RIKEN-Denshi).

Samples obtained from near granite were shown significantly different curves. This may be in effect of sulfide minerals, such as microscopic pentlandite in serpentinite, as described by Fujimaki and Yomogida(1986).

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Keywords: Thermomagnetic analysis, serpentinite, contact metamorphism, Hayachine, Kitakami

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Kelvin-Helmholtz wave texture in Nojima fault gouges and its rock magnetic constraint to temperature rise

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Nojima fault gouges exhibit a characteristic flow microtexture of a wavy boundary plane, a folding structure and a Kelvin-Helmholtz (KH) wave texture. The flow microtexture has been evident as a product of frictional melting slide (Otsuki et al. 2003) or of steady-state frictional non-melting slide (Mochizuki et al. 2009). It is important to constrain the formation mechanism (melting or non-melting) from these flow microtextures of a natural gouge sample. Ishikawa et al. (2008) proposed the coseismic presence of high temperature fluids during earthquake, resulting in dynamic fault weakening. Such high temperature fluid might liquefy a gouge or thermally pressurize a fault gouge to cause instability of friction. We found a distinct KH instability-promoted wave texture in a granular material of Nojima fault gouge. The well-known example of KH instability is a cloud that the cloud-atmosphere interface becomes an unstable vortex sheet that rolls up into a spiral. The instability occurs at the interface between two fluids of different densities shearing at different velocities (Thorpe 2005). The KH wave was found along a slip plane in a blackish cohesive gouge (pseudotachylyte-like gouge), resulting in the presence of instability at the slip interface during ancient earthquake or creep. The wave instability occurred at c.a. 1.5mm apart and c.a. 0.7mm height. Thin section observations showed the blackish cohesive gouge consisted of granular materials for both sides of the interface and the KH wave occurs in a denser granular material along an earthquake-originated sharp slip plane. Our scanning Magneto-impedance magnetic microscope observation shows the KH wave dense layer is only magnetized in isothermally-magnetized thin section, revealing the production of magnetic mineral in KH wave. Because the Nojima fault gouge contains iron-carbonate (siderite), the thermal decomposition of siderite produces magnetite more than 400 degree C. Therefore, we suggest that the KH wave is generated through KH instability in a high-temperature ($>$400C) granular dense layer with different densities and different slip velocities. This result constrains our understanding of earthquake slip dynamics.

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Magnetic minerals of a sediment core (IODP Site U1314) determined by low-temperature and high-temperature magnetism

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Magnetic minerals in the sediments from IODP Site U1314 in the North Atlantic have been investigated by low-temperature magnetometry and high-temperature magnetometry. Site U1314 is located in the southern Gardar Drift at 2820 m water depth. In the post-glacial Gardar Drift, the source area for the terrigenous material transported by the bottom current is the Iceland Faeroe Ridge and the Faeroe Bank Channel. Thermomagnetic curves of the sediments show reversible curves in heating and cooling with the Curie temperature of ˜580 degrees, indicating low Ti-content titanomagnetite (Kissel et al., 2009). In contrast, in the thermomagnetic curves of sediments of 2˜3 Ma, although magnetite is considered as the dominant magnetic mineral, contribution of an additional component is suggested from the small decrease during heating in magnetization at around 250 degrees, and higher magnetization (Js/J0) along the cooling curve than along the heating curve (Zhao et al., 2011). A possible explanation for this is the magnetite formation by heating from titanomagnetite, titanomaghemite, or pyrite. In the results of low-temperature magnetometry, magnetite is considered as the dominant magnetic mineral of the sediments (Zhao et al., 2011). The results also indicate that the magnetite suffers surface maghemization but that maghemization is not very severe because Verwey transition is observed at ˜110 K.

In the temporal variation in Mr/Ms and Hc during the period including marine isotope stage (MIS) 100, quick decrease associated with IRD events and succeeding gradual recover was observed in these parameters. In the thermomagnetic curves of these sediments, the dip around 250 degrees is observed more clearly for the periods without IRD events than for the periods with IRD events. Further, the dip is more apparent during the interglacial period (MIS99 and 101). The results suggest millennial-scale variability in the bottom current as well as the variability associated with glacial-interglacial cycles.

Keywords: rock magnetism, north atlantic

SEM36-P06 Room:Convention Hall Time:May 19 18:15-19:30

Tsunami and seasonal variation records of Sendai Bay sediments revealed by rock magnetic properties and geochemical anal

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The large amount of terrigenous substances is carried to coastal areas by natural disasters, which are Tsunamis and seasonal floods. Therefore coastal marine sediments along island arcs are possible to have information of past Tsunami and seasonal floods. In order to reconstruct those past events from the coastal marine sediments, we need to distinguish between Tsunami events and seasonal variations. Thus this study is aimed to sort both past events based on rock magnetic properties and geochemical analysis. Sediment samples were collected at five stations in Sendai Bay at every season during 2002-2011. For measurements of carbon, nitrogen and sulfur amounts in the sediments, CHNS analyses were conducted. Rock magnetic properties of the sediments were also measured. Results indicated that the amounts of those elements decrease toward offshore stations. The samples taken during spring and autumn show high values in those elements at all stations, suggesting the sediment supply increases in those seasons. These values are diffused at the near-shore stations, while the value ranges are narrow at the offshore stations under the Oyashio current. The sediment particle size is larger at the offshore stations. It suggests that fine sediment particles are transported by the Oyashio current. For discriminations between Tsunami events and seasonal variations, we focused on the samples taken in June 2008 and 2011. The amounts of carbon and sulfur are large in the 2011 samples after the Tsunami event. Thermo-magnetometric results indicate the presence of magnetite and iron sulfide in all samples. Especially, the 2011 samples at the offshore stations under the Oyashio current are found to contain iron sulfide as a dominant magnetic mineral. It may be implied that iron combines sulfur after deposition and that are prevented from the transportation of the Oyashio current.

Keywords: Tsunami sediments, geochemical analysis

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Regional and seasonal variations in magnetic properties of topmost sediments in the Northern Lake Biwa

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Rock-magnetic investigations have been performed on topmost sediments above about 30 cm below sediment surface (bss) cored in summer (June to July) and winter (November to December) at ten sites with different water depth, where dissolved oxygen (DO) content in bottom water and its seasonal variation are different, in the first depression at the North Basin of Lake Biwa in order to reveal early diagenetic effect on magnetic properties of the sediments. We will report results from the following three sites: N4 (91 m in depth), A (90m) and H70 (66m). The DO value becomes lower than 4 mg/L in winter at N4 and A.

Low-temperature magnetometric results indicate that a partially-maghemitized magnetite is a principal magnetic mineral in samples of the three sites. Warning curves from 6 to 300K of isothermal remanence (IRM) imparted at 6K in 1T after zero-field cooling show a remarkable decrease of IRM between 90 and 120K, which is regarded as a suppressed Verway transition of magnetite. The amount of IRM decrease between 90 and 120K increase downcore at all site, implying the dissolution of maghemite skin covering magnetite. The IRM decrease is slightly remarkable in H70 samples above about 18 cm-bss. The degree of maghemitization may be higher in N4 and A samples. The warning curves of N4 and A samples show another IRM decrease between 20 and 30K with the inflection point at about 29K. The IRM drop is detected in samples above about 18 cmbss, and the samples in two zones of 0-3 cm-bss and 6-12 cm-bss shows the IRM drop more clearly. It seems that the IRM drop is slightly remarkable in samples taken in winter and that the depth of the zone showing the IRM drop changes seasonally. The occurrence of the magnetic mineral with the characteristic low-temperature magnetic behavior may be influenced by the DO values and its seasonal change.

The downcore decrease of magnetic coercivity is observed in the uppermost sediments above about 10 cm-bss, and the amount and grain size of magnetic minerals subsequently decreases and increases downcore below 10cm-bss, respectively. These changes are considered to be associated with the dissolution of maghemitized magnetite by the early diagenetic effect. A seasonal change of magnetic coercivity is recognized in the samples above 10 cm-bss of N4: the samples taken in summer show lower magnetic coercivity, possibly implying a smaller contribution of fine magnetic minerals with higher coercivity.

Keywords: magnetic property, sediment, Lake Biwa

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Paleomagnetic and rock magnetic studies on non-marine and marine sediments in the Osaka Group cored at Kyoto Basin

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Rock magnetic analyses were performed on sediments of non-marine and marine clay in the Osaka Group cored at Kyoto Basin in order to investigate magnetic variations corresponding to environmental changes between freshwater and marine. The Osaka Group is the Pleistcene sequence formed related to sea-level changes in the glacial-interglacial cycles, and consists of alternating beds of non-marine sediment and marine clay.

KD-1 and KD-2 cores including the Osaka Group were drilled at Kyoto Basin. The Ma5 bed of marine clay had been observed between 150.00 and 141.35 m in depth on KD-1, between 190.37 and 182.21 m in depth on KD-2. The lower and upper boundaries of the Ma5 bed have been determined mainly based on the sediment facies and color.

Analyzed samples in this study were collected in 10 cm intervals from between 140.60 and 153.82 m in depth, including the Ma5 bed, and between 155.80 and 157.75 m in depth on KD-1, between 190.40 and 181.56 m in depth on KD-2.

We measured initial magnetic susceptibility, IRM intensity and hysteresis parameters, and performed progressive alternative field demagnetization (PAFD) of NRM for paleomagnetic analysis and progressive thermal demagnetizations (PThD) of IRM. Electristic conductivity (EC) and pH of clayey water stirring the sediment samples were also measured.

EC and pH value showed that the Ma5 beds lie from 151.21 to 142.40 m in depth on KD-1, from 188.60 to 182.19 m in depth on KD-2.

In variations of inclinations obtained from paleomagnetic analysis, a fluctuation corresponding to the Delta Event in the Marine Isotope Stage 17 was observed on both KD-1 and KD-2 cores. From variations in the magnetic parameters, a characteristic layer with high IRM intensity (High IRM layer) was observed on both cores. By using the High IRM layer and the zone of the Delta event as key layers for the age comparison between the two cores and by the duration of the Delta event observed in sediment cores from the North Atlantic ODP site 980, we estimated the formation age of marine clay bed Ma5. The results were 703-680 ka on KD-1, 704-696 ka on KD-2.

As characteristic magnetic properties in response to depositional environment changes, less variation in the amount of magnetic minerals, smaller particle size of magnetic mineral, and smaller amount of high coercivity magnetic minerals were recognized in the marine beds compared to the non-marine sediments.

In the marine beds, a clear correlation was observed between the particle size of magnetic minerals and EC values. Samples with higher EC value showed the presence of finer magnetic minerals. There was also a clear correlation between the abundance of high coercivity magnetic minerals and EC values. It is suggested that the difference in the amount of particle size and high coercivity magnetic minerals reflects the advanced dissolution of magnetic minerals associated with early diagenesis in marine under a reducing environment.

Keywords: Paleomagnetism, Rock magnetism, Environmental magnetism, Osaka Group, marine clay

SEM36-P09 Room:Convention Hall Time:May 19 18:15-19:30

Analyzing the early 19th century's geomagnetic declination in Japan from Tadataka Inoh's Santou-Houi-Ki The 7th report

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[1]Japan cartographers association, [2]San-in System Consultant, [3]Matsue municipal Comitee of culture property

Santou-Houi-Ki Japan national treasure is the survey data book comprised of 67 volumes consist of magnetic compass azimuth of approximately 200,000 data in 1800 to 1816, cover nearly whole of Japanese mainland cartographic survey, written by cartographer Tadataka Inoh. We continue the work of analysis that stopped after only analysis in 1917, which done about the survey data at Inoh retirement home Fukagawa in Edo (Tokyo) in 1802-1803.

(1)If we analyze the data of Santou-Houi-Ki, we can change Japan as one of the most concentrated area of accurate geomagnetic declination data in the world, back to early 19th century, from insufficient area of data, and supply new data to northeast Asia. The total Number of analyzed points is exceeded by 175, and the outline of the distribution of declination in Japan archipelago and the rough distribution of the declination in every15 minutes in western Japan coast in early 19th century, begun to appear.

(2)Comparison of Santou-Houi-Ki with Gauss and Weber isogonic Atlas which published in 1840, consisted of observational data roughly at the time of 1830(1828-1832), it foundational structure of isogonic lines in Japan archipelago is roughly similar to the result of analysis from Santou-Houi-Ki, But we can recognize the contradiction to reverse with secular variation in Northern Kyushuu area and Tsushima Island, or the local differences in eastern Hokkaido in Gauss and Weber isogonic Atlas, The observational data in Japan archipelago did not described in the table supplemented with Gauss isogonic Atlas. The described observational data in East Asia were from Pekin. Monggol, Baykal, Yakutsk Ohotsk Kamchatka etc. The isogonic line of declination in surrounding area of Japan in Gauss and weber's Atlas had to drawn by calculated estimates. The Gauss and Weber's Atlas was draw to understand the general conditions of geomagnetism of the entire world. The declination data in the table were calculated on a matrix of 5 degree of latitude and 10 degree of longitude, one cell of this matrix is 500km long. Therefore the analysis of Santou-Houi-Ki becomes very important as complement data.

(3)Advantage to use the data described in Santu-Houi-Ki.1.Huge number of survey data. 2. Minute standard of analysis. 3. The Data are concentrated in 1800 to 1816. 4. Data cover nearly whole of Japan Mainland. 5. It include the ability of local abnormality, if there is a remarkable differences between Gauss Atlas and the value of analysis from Santou-Houi-Ki. 6. We can restore the precise position of Tadataka Ino reference point in less than second unit in latitude and longitude from Santou-Houi-Ki.

(4)Analysis method of Santou-Houi-Ki needs the succession to future. 1.Calculate the average of remainder as the declination, to deduct the magnetic azimuth recorded in Santou-houi-Ki from the true azimuth. 2.The important point in deciding the precise position of the reference point should be adjusted to that all of the declination values are calculated from the azimuth to different target at the reference point are approximately equal to each other. 3, Use GPS transmitter at the reference point for investigation of longitude and latitude. 4. Consecutive formula use Excel for speed up and keep accuracy. 5.The result of analysis is useful for global model of geomagnetisism.6.It is available for the analysis of magnetic survey azimuth data in the world. 7.Restorated precise position of the survey reference points contribute to detail study of history. Keywords; 1. geomagnetic declination 2. Tadataka Inoh 3. Santou-Houi-Ki 4. Isogonic Atlas by Gauss and Weber 5. Secular variation of geomagnetic declination 6.Restoration of precise position of survey point

Keywords: geomagnetic declination, Tadataka Inoh, Santou-Houi-Ki, Isogonic Atlas by Gauss and Weber, Secular variation of geomagnetic declination, Resoration of precise position of survey point

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Hydromagnetic slow waves and geomagnetic westward drift

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It has been argued that the geomagnetic westward drift is caused or significantly influenced by hydromagnetic waves confined in the Earth's outer core, where balance between Coriolis and Lorentz forces makes it possible for a slow wave to exist with appropriate time scales. Here we investigate linear stability of an axisymmetric toroidal magnetic field in a rapidly rotating fluid sphere and discuss the magnetic instability and the resulting slow waves traveling eastward or westward. The basic magnetic field is equatorially antisymmetric, and we adopt the magnetostrophic approximation in which inertial and viscous forces are neglected. We assume that the mantle is insulating and the magnetic diffusivity is finite. As the basic field is more confined near the equator of the core surface, the basic field becomes unstable at a lower Elsasser number that measures the square of the basic field intensity, and the most unstable mode tends to exhibit faster westward drift with a larger azimuthal wavenumber. The result suggests that it is possible to interpret the recent geomagnetic westward drift seen under the Atlantic hemisphere as manifestation of magnetic instability of a strong toroidal field just below the core equator. We also investigate effects of existence of basic zonal flows, which are chosen so that the flow velocity satisfies either the equation of motion or the magnetic induction equation. The results indicate that the addition of the basic flow makes the dispersion relation so complex that the unstable modes move eastward too. We also discuss interpretation of our recent low-viscosity geodynamo simulations using the linear stability results.