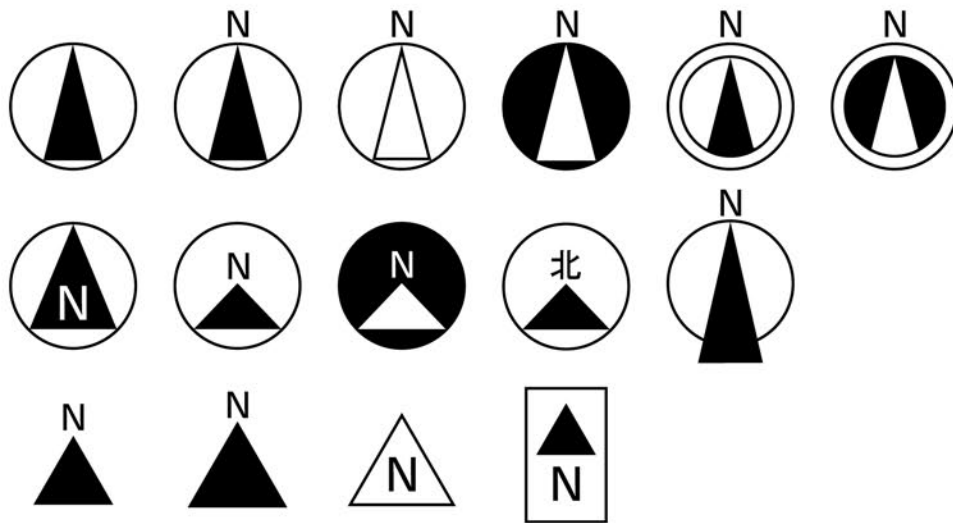
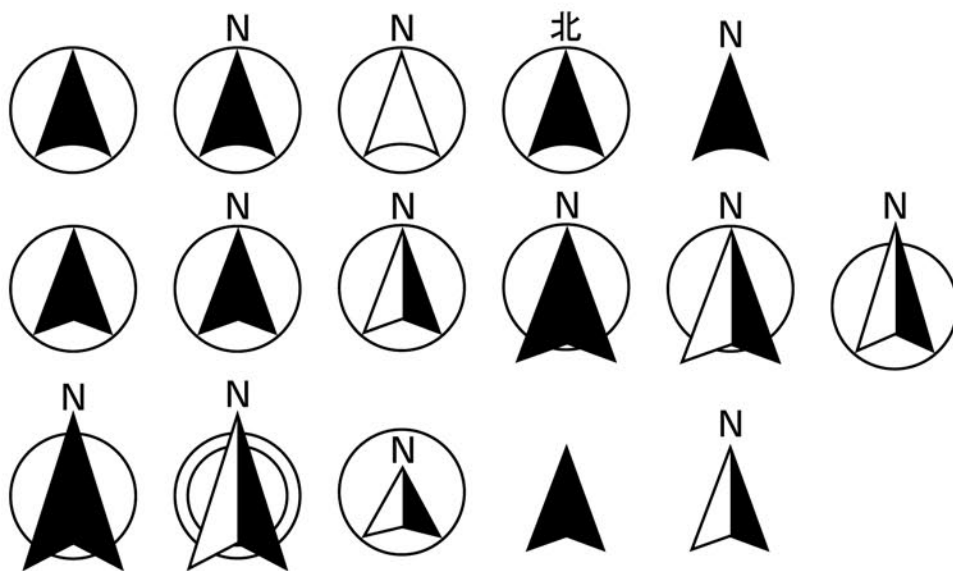


A. triangle type

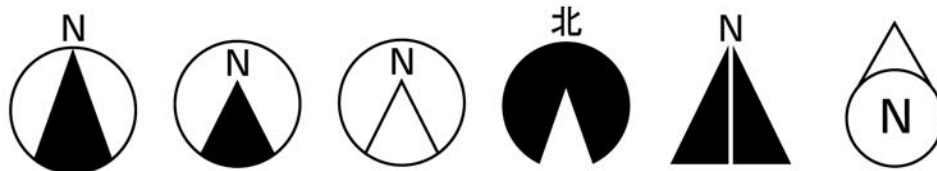
A-1. simple triangle type



A-2. triangle tower type

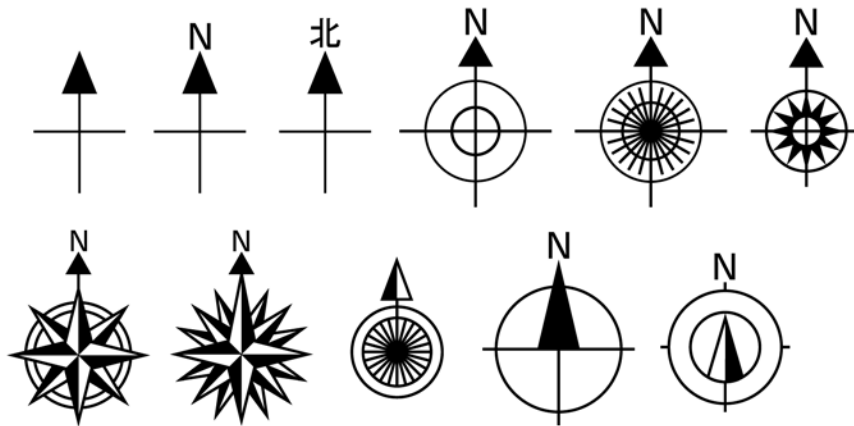


A-3. other triangle type

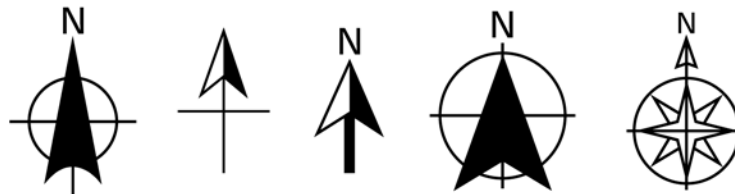


B. arrow type

B-1. simple triangle arrow type



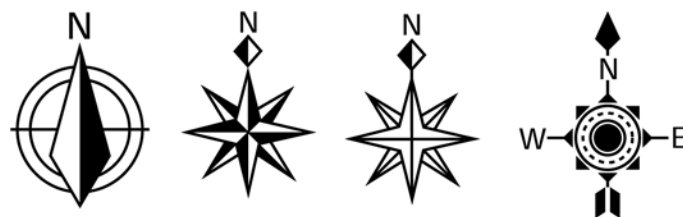
B-2. triangle tower arrow type



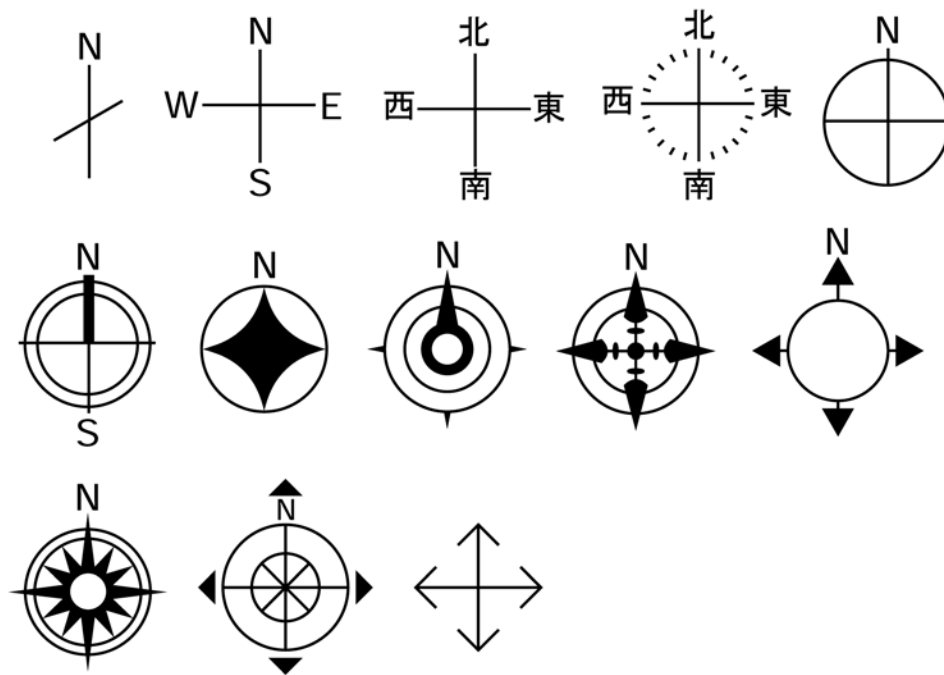
B-3. simple arrow type



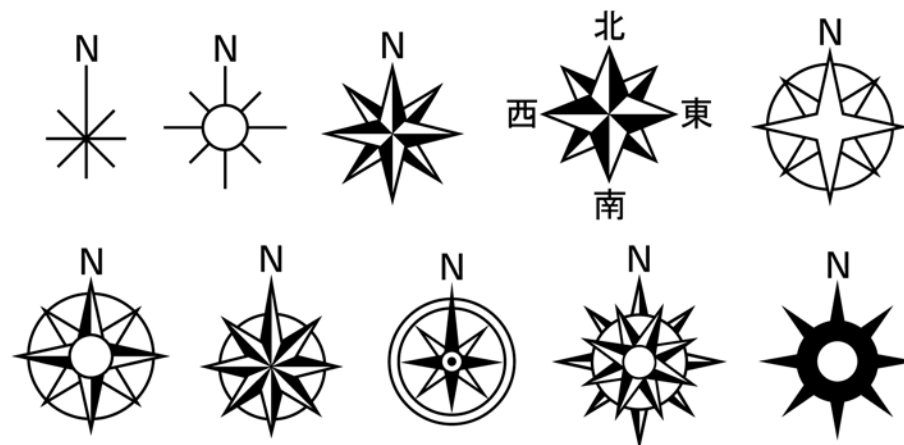
C. diamond type



D. cross type



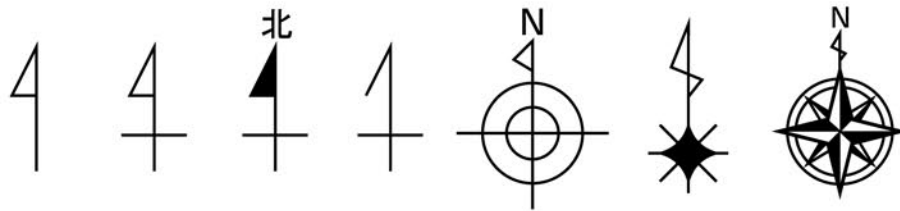
E. eight directions type



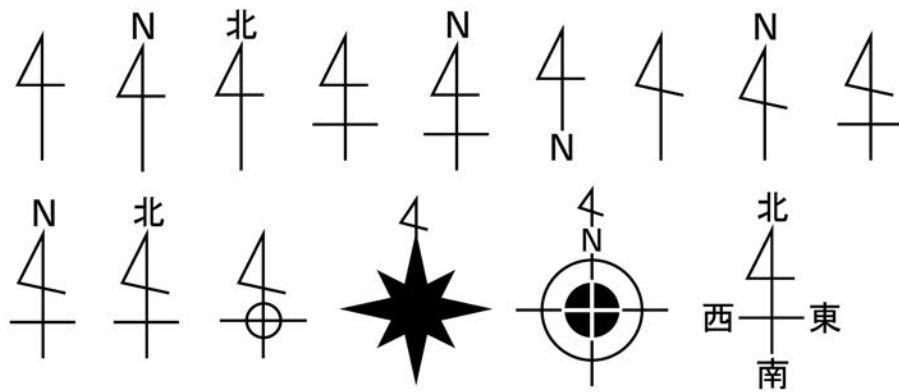
Hiroki, Fig.A1-3 (continued)

F. half arrow type

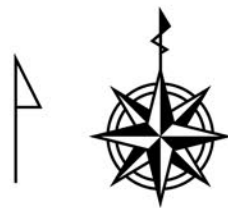
F-1. left half arrow type



F-2. figure-four arrow type



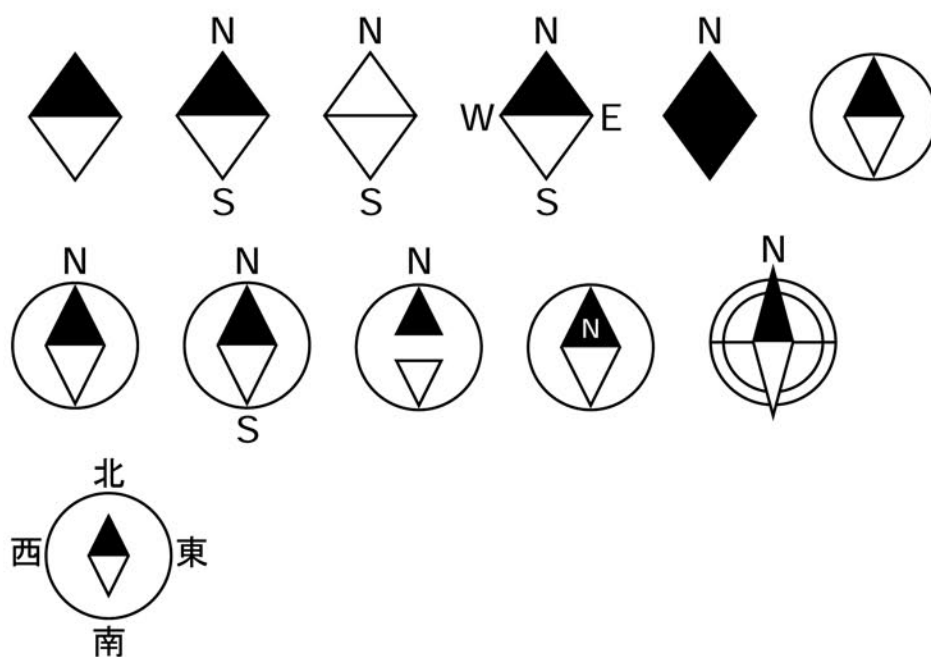
F-3. right half arrow type



F-4. reverse figure-four arrow type



G. compass type



H. letter type



Hiroki, Fig.A1-5 (continued)

Table A1. Summary of the types of the north symbols found on maps and the numbers of their occurrence in answers by university students to the questionnaire, on signboards, in newspaper flyers, in textbooks of social studies and science in elementary and junior high schools, and in study material on geography and earth science in high school.

Type	University students		JR signboards	Newspaper flyers	Textbook of science or earth science			Textbook of social studies or geography		
	<i>Bun-kei</i> *	<i>Ri-kei</i> **			Elementary school	Junior high school	High school	Elementary school	Junior high school	High school
A: Triangle type										
A-1: Simple triangle type	0 (0.0)	1 (0.9)	43 (32.6)	290 (46.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
A-2: Triangle tower type	2 (1.8)	4 (3.6)	27 (20.5)	130 (20.8)	0 (0.0)	4 (10.5)	0 (0.0)	41 (11.5)	0 (0.0)	0 (0.0)
A-3: Other triangle type	0 (0.0)	0 (0.0)	32 (24.2)	26 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	8 (18.2)	0 (0.0)
B: Arrow type										
B-1: Simple triangle arrow type	1 (0.9)	0 (0.0)	0 (0.0)	14 (2.2)	0 (0.0)	3 (7.9)	28 (38.9)	0 (0.0)	0 (0.0)	0 (0.0)
B-2: Triangle tower arrow type	0 (0.0)	0 (0.0)	0 (0.0)	5 (0.8)	0 (0.0)	2 (5.3)	3 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)
B-3: Simple arrow type	7 (6.4)	2 (1.8)	1 (0.8)	1 (0.2)	0 (0.0)	0 (0.0)	40 (55.6)	0 (0.0)	1 (2.3)	0 (0.0)
C: Diamond type	0 (0.0)	0 (0.0)	0 (0.0)	15 (2.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
D: Cross type	8 (7.3)	1 (0.9)	1 (0.8)	27 (4.3)	0 (0.0)	0 (0.0)	1 (1.4)	0 (0.0)	0 (0.0)	0 (0.0)
E: Eight directions type	0 (0.0)	2 (1.8)	3 (2.3)	23 (3.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
F: Half arrow type										
F-1: Left half arrow type	1 (0.9)	3 (2.7)	0 (0.0)	3 (0.5)	0 (0.0)	5 (13.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
F-2: Figure-four arrow type	41 (37.3)	52 (46.8)	19 (14.4)	86 (13.7)	1 (100.0)	24 (63.2)	0 (0.0)	315 (88.5)	35 (79.5)	16 (94.1)
F-3: Right half arrow type	3 (2.7)	0 (0.0)	0 (0.0)	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
F-4: Reverse figure-four arrow type	16 (14.5)	14 (12.6)	3 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (5.9)
G: Compass type	16 (14.5)	17 (15.3)	3 (2.3)	5 (0.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
H: Letter type	15 (13.6)	15 (13.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total	110 (99.9)	111 (99.9)	132 (100.2)	626 (100.1)	1 (100.0)	38 (100.1)	72 (100.1)	356 (100.0)	44 (100.0)	17 (100.0)

* social science course during high school

** science course during high school

Table A2-1. Examples of descriptions of north on maps in elementary, junior high, and high school textbooks.

School year	Subject	Descriptions (in Japanese)	Descriptions (English translation by author)
3rd and 4th grades of elementary school	Social study ¹⁾	<ul style="list-style-type: none"> • 四つの方位のことを、合わせて「東西南北」といいます。 • 方位じしん（方位をたしかめるためのじしゃく）を平らなところへおいたとき、色のついたはりがさす方位が北です。 • 方位じしんをまわして、色のついたはりを北に合わせると、東西南北がわかります。 • 地図は、ふつう北を上にしてつくる。* • 八方位を使えば、東西南北よりくわしく方位をあらわすことができます。 	<ul style="list-style-type: none"> • The four cardinal directions are east, west, south, and north. • The colored needlepoint of a compass placed on a horizontal surface points north. • Adjusting a compass so that its colored needlepoint points north clarifies the directions of east, west, south, and north. • Maps are usually made with north at the top.* • Using the eight cardinal directions can show directions more accurately than using the four directions of east, west, south, and north.
3rd grade of elementary school	Science ²⁾	<ul style="list-style-type: none"> • 方位じしんを使うと、東西南北などの方位を調べることができます。 • 方位じしんのはりがじしゃくになっていて、N極（色のついた方の極）が北をさすようになっています。 • じしゃくのN極が北をさし、S極が南をさすのは、どうしてでしょうか。それは、地球が「大きなじしゃく」だからです。地球の北極がS極に、南極がN極になっているのです。方位じしんのはりが、いつも北と南をさすのは、はりのN極と地球の北極（S極）が引き合い、はりのS極と地球の南極（N極）が引き合うためなのです。 	<ul style="list-style-type: none"> • You can examine the directions of east, west, south, and north with a compass. • Since the needle in a compass is magnetized, the colored needlepoint points north. • Why do a magnet's N pole and S pole point north and south, respectively? The reason is because Earth is like a huge magnet. Earth's North Pole and South Pole are equivalent to the magnet's S pole and N pole. The needlepoints of a compass always point north or south because the N pole of the compass and the S pole of the Earth's South Pole are attracted to each other.
4th grade of elementary school	Science ³⁾	<ul style="list-style-type: none"> • 夏の三大角やカシオペアの星は、時間がたつと動きますが、北極星とよばれる星だけは、ほぼ真北にあって、時間がたってもほとんど動きません。このため、北極星は、北の位置を知る手がかりとして、古くから利用されてきました。 	<ul style="list-style-type: none"> • The stars of the big triangle of summer and Queen Cassiopeia move with time. But the North Star, or Polaris, is located in the direction of true north and does not move. Thus, Polaris has been used to find north since ancient times.
5th grade of elementary school	Science ⁴⁾	<ul style="list-style-type: none"> • 方位磁針の使い方。①文字ばんの「北」を、色のぬってあるはりの先（北を指す）に合わせる。②方位を読み取る。南を向いたとき、左手の方位は東、右手の方位は西になる。 	<ul style="list-style-type: none"> • How to use the compass: (1) Align the letter representing north on the dial to the colored needlepoint, which points to the north. (2) Read the directions. If you face south, the east is on your left side, and the west is on your right side.

¹⁾ Nihon Bunkyo Shuppan: Ikeno et al. (2015a), ²⁾ Tokyo Shoseki: Mori et al. (2015a), ³⁾ Kyoiku Shuppan: Yoro et al. (2015b),⁴⁾ Gakko Toshō: Shimoda et al. (2015c).

* The map symbol of the figure-four arrow type (F-2) is explained in the textbook.

Table A2-2. Examples of descriptions of north on maps in elementary, junior high, and high school textbooks (continued).

School year	Subject	Descriptions (in Japanese)	Descriptions (English translation by author)
Junior high school	Geography ⁵⁾	<ul style="list-style-type: none"> ・原則として、地図の真上が北になり、16方位（16種類のよび方）で表します。ただし、真上を北にできない場合は右のような方位記号（矢印）を用いて北を示します。 ** ・赤道と平行に引かれた線を緯線といい、北極点と南極点を結んだ線を経線（子午線）といいます。 ・ある地点を緯度と経度で示すことで、そこが地球上のどこなのかを知ることができます。 	<ul style="list-style-type: none"> ・As a principle, a map's top represents north, and the sixteen cardinal directions each express a direction. However, when you cannot make a map with north at the top, a symbol, usually an arrow, should point to the map's north. ** ・Lines drawn parallel to the equator are latitude lines, while lines connecting the North Pole and South Pole are meridians. ・You can show a location on Earth by latitude and longitude.
2nd grade of Junior high school	Science ⁶⁾	<ul style="list-style-type: none"> ・方位磁針が北を指すのは、地球が大きな磁石になっているからである。図のように、北極に磁石のS極、南極にN極があると考えるとわかりやすい。正確には、方位磁針が指す北の向きは、北極の向きからわずかにずれている。 	<ul style="list-style-type: none"> ・A needlepoint of a compass points north because Earth is a huge magnet. As shown in the figure, there is the S pole of a magnet on the North Pole and the N pole of a magnet on the South Pole. However, the north to which the needle points is not true north.
3rd grade of Junior high school	Science ⁷⁾	<ul style="list-style-type: none"> ・地上の方位は、北極から観測者の地点を通り、南極までを結ぶ子午線（経線）の方向が南北となり、それに垂直に交わる緯線の方向が東西となる。 	<ul style="list-style-type: none"> ・On the ground, a south-north line is a meridian connected from the North Pole to the South Pole through a point on which the observer is standing. The east-west line is the latitude line that crosses at right angles to the meridian.
High school	Geography B ⁸⁾	<ul style="list-style-type: none"> ・地球上の任意の地点の位置は、すべて緯度と経度を用いて表すことができる。 ・同じ緯度の地点を結んだ線が緯線であり、赤道に平行な線である。 ・同じ経度の地点を結んだ線が経線であり、すべて北極点と南極点を結ぶ線である。 ・地球上の任意の地点の方位は、その地点を通る経線の北極点の側が北、南極点の側が南となる。 	<ul style="list-style-type: none"> ・A location on the Earth can be expressed by latitude and longitude. ・Latitude is a line connected between locations parallel to the equator. ・A meridian is a line between locations of the same longitude, that is, the line connecting the North Pole and the South Pole. ・Directions at a location on Earth are so that north is the direction to the North Pole and south is the direction to the South Pole on a meridian.
High school	Earth science ⁹⁾	<ul style="list-style-type: none"> ・地球上のある地点での地磁気の強さ（大きさ）を全磁力、水平分力、鉛直分力で表され、向きは、偏角、伏角で表される。 ・偏角 水平分力が真北（地理上の北）からずれている角度。 ・偏角は、真北の方向を0°として、東へずれた場合を＋、西へずれた場合を－で表す。 	<ul style="list-style-type: none"> ・Geomagnetism's strength at a location on Earth is indicated by an all magnetic force, represented by a horizontal force component, a normal force component, and the direction by declination and inclination. ・Declination: The angle at which direction of the horizontal component of a magnetic force component shifts from true north (the north of geography). ・Declination is zero to the direction of true north and is expressed by a plus sign for eastern declination and a minus sign for western declination.

⁵⁾ Kyoiku Shuppan: Takeuchi et al. (2016), ⁶⁾ Dainippon Tosho: Arima et al. (2016b),⁷⁾ Shinko Shuppan-sha Keirin-kan: Tsukada et al. (2016c), ⁸⁾ Tokyo Shoseki: Kaneda et al. (2018),⁹⁾ Shinko Shuppan-sha Keirin-kan: Isozaki et al. (2017).

** The map symbol of the simple arrow type (B-3) is explained in the textbook.