IN THE KNOW

Grid references and map symbols

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Accurate and reliable background information to underpin your geography lessons

Introduction

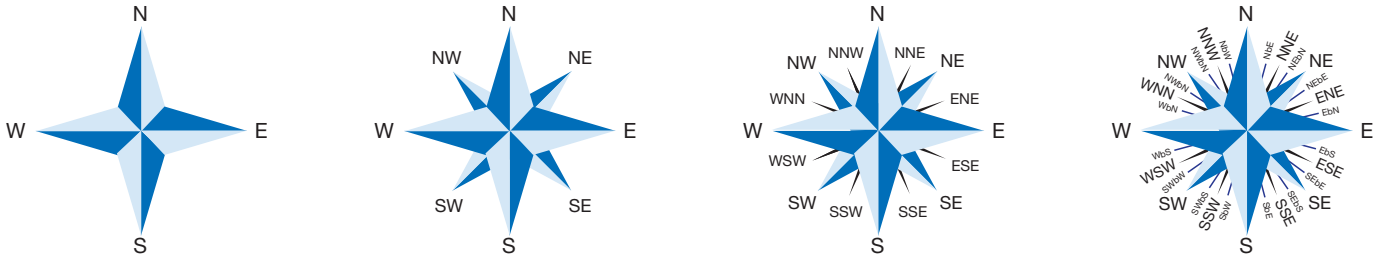
Maps are works of art. There are many types of maps, but they all communicate information, spatially and pictorially, about a particular area, from a theme park to a country to the world. Understanding maps is an important geographical and life skill, which can be improved with good knowledge of directions and compass points, distance and scale, features, symbols and grid references. The essential subject information provided here should give you the confidence to use maps in any appropriate context across the curriculum, in a way that is meaningful and that will encourage your pupils to develop a love of, and enthusiasm for, using and making maps of all sorts.

Compass points

The eight points of the compass are North, East, South and West at 90° to each other, with the additional points of North East, South East, South West and North West falling between them. (Figure 1).

Invented by the Chinese over 2000 years ago, the compass is an instrument with a free-moving magnetic needle that always settles to point north, the direction of the North Pole. The needle is mounted in the centre of a compass rose that shows 4, 8, 16 or 32 points of the compass (see Figure 1), or equal divisions of 360°. The eight points are used to describe the direction of travel or a location; for example, 'the park is SW of school'. *The Shipping Forecast,* broadcast on radio across the UK, uses the 32 compass points to provide information on wind direction; wind direction is described by where it is coming from, not the direction it is blowing towards.

Compasses are used to indicate direction for navigation and orientation purposes, including maps, which are usually printed to have N at to the top. Compasses are complemented by Global Positioning Systems (GPS), which use satellites to determine location. A Satellite Navigation System (or 'Sat Nav') combines GPS with maps.



A 4-point compass rose | An 8-point compass rose | A 16-point compass rose | A 32-point compass rose

Figure 1: The compass rose shows the directions of North, East, South and West and increasingly detailed directions between these points.

Grids and grid references

To make it easier for us to locate a particular place on a map, maps frequently have grids superimposed on them with grid codes used to index an exact location. Atlases may contain maps that have arbitrary straight-line grids superimposed on them, or the grids used may be based on lines of latitude and longitude and may be straight or curved depending on the map projection used. The alphanumeric grid codes that refer to places on maps are derived from the labelled grid lines; columns (between vertical grid lines) are labelled alphabetically and rows (between horizontal grid lines) are labelled numerically. The grid code (for example, A3 or B7) gives the column and row grid position of a particular place on a map.

Ordnance Survey (OS) maps don't use an alphanumerical grid system, but instead incorporate a superimposed numerical grid, which enables the use of a four-figure or six-figure grid reference system to locate places. The numerical grid references of OS maps are based on the repeated division of grid squares into 10x10 smaller squares. With each smaller grid section, a location can be viewed in greater detail and with increased accuracy (Figure 2).

Reading a grid reference

You read the horizontal grid reference from left to right (West to East), these horizontal numbers or letters are called 'Eastings'. You then read the vertical grid reference from bottom to top (South to North) and these numbers or letters are called 'Northings'. The grid reference (known as the 'GR' or 'Label') for each square of the grid refers to the SW corner of that square. (A good mnemonic to remember that you need to read along before up is: You have to go into a building to go up in the lift.)

The example in Figure 2 shows the gradually increasing accuracy of an OS map reference for Stonehenge as the grid reference becomes six-figures.

SU	refers to a 100km square (small square U within 500km square S)
SU 1 4	is the two-figure grid reference referring to a 10km square within 100km square SU
SU 12 42	is the four-figure grid reference referring to a 1km square within 10km square SU 1 4
SU 122 421	is the six-figure grid reference referring to a 100m square within 1km square SU 12 42.

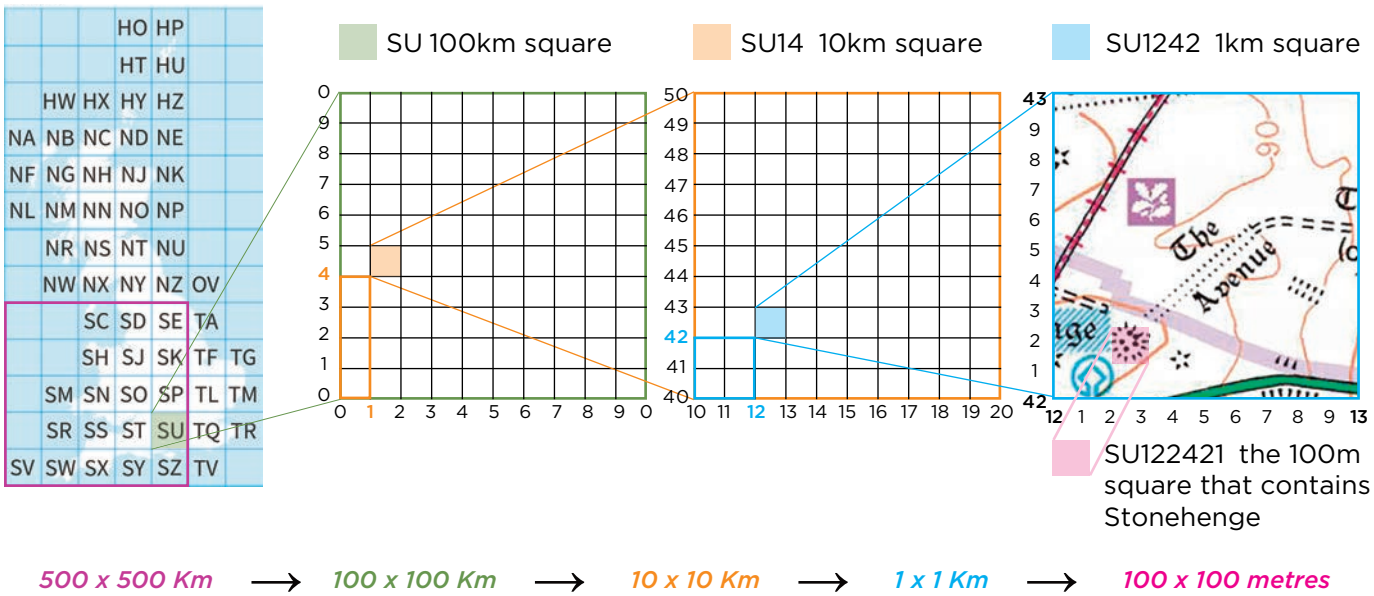


Figure 2: Where is Stonehenge? Developing grid references from two-figures to six-figures increases the accuracy and detail of a depicted location.

Figure 3: Pictorial maps can give misleading ideas about scale, such as these rather over-sized icons.

Map symbols and keys

A map is a pictorial form of communication, but it can't show everything in a single image. Map-makers are selective about the information they include and ensure clarity of understanding by using colours, patterns and symbols. Children's pictorial maps and OS maps show two extremes of the information and level of detail included in maps.

Pictorial maps

Pictorial maps for young children often include animals, people or buildings to indicate what might be found in different places. This can result in young children developing misleading ideas of how to read maps, particularly in relation to scale (see Figure 3). Pictorial maps don't always include a key to scale or the meaning of symbols, so care is needed in their use!

OS maps

OS maps are highly stylised and use a great range of symbols; there are even conventions about what font style should be used on OS maps. (Figure 4).

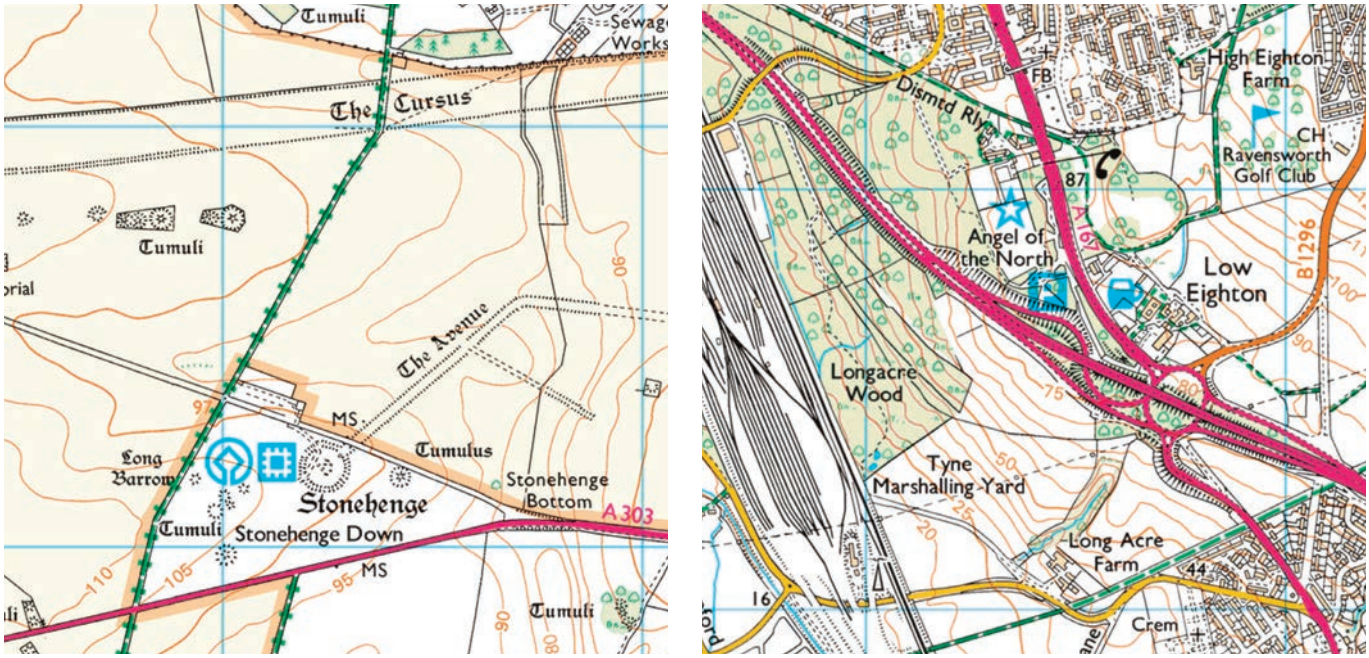


Figure 4: Text style and usage on OS maps also have conventions to define different types of map features. Different styles of text are used for Stonehenge and the Angel of the North.

It is no good if only the cartographer knows the meanings of the symbols they have used to draw a map. To communicate the meaning of symbols, they are explained in a key included in a panel on each map. Keys are arranged by the type of feature. Symbols are best learned on a 'need to know' basis, in a relevant context. Exploring symbols in a 1km square on an OS map can lead to many discoveries about a place, and looking at surrounding squares gives a wider context of that place's history, use and features.

You can download the keys to OS 1:50,000 and 1:25,000 scale maps at:_
https://www.ordnancesurvey.co.uk/oswebsite/docs/legends/50k-raster-legend.pdf and
https://www.ordnancesurvey.co.uk/docs/legends/25k-raster-legend.pdf

Scale and scale bars

The scale of a map explains how large an area (shown pictorially) is in real life. Maps are often referred to as small-, medium- or large-scale. Small-scale maps depict a large area but with little detail (e.g. a world map); large-scale maps show a smaller area in more detail (e.g. a town or place in the UK).

In an atlas, the scale varies from one map to another. In some school atlases the SW Peninsula in England looks the same size as Italy simply because the maps are drawn at different scales.

FACT Scale can be expressed as a proportion

- OS 1:50,000 map: 1cm on map represents 50,000cm (500 metres) on land (smallish scale)
- OS 1:25,000 map: 1cm on map represents 25,000cm (250 metres) on land (larger scale)
- OS 1:2500 plan: 1cm on map represents 2500cm (25 metres) on land (very large scale)

A scale bar is also used to indicate how distances between areas in real life compare with the distances depicted on a map. Using a ruler (for centimetres) or a copy of the scale bar (for other partitions), measure the distance between two places on the map and then multiply by the scale to find the real distance. In Figure 5, if the distance is five partitions then the real distance is 5x100m, so 500m.

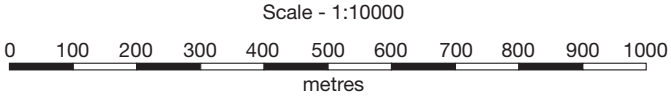


Figure 5: A scale bar indicates how the distance between areas in real life has been represented on the map.

Map projections

The best representation of Earth that geographers use is the globe. It can show physical features (land and oceans, plus landscape features indicating climate, vegetation and topography without political boundaries) or political features (the boundaries people have imposed in the formation of individual countries). Some globes combine both physical and political features. On globes, the land masses (continents) are always depicted in their correct shape and relative size.

The challenge for cartographers is how to show the three-dimensional world on a flat, two-dimensional map (imagine flattening the peel of a whole orange). World maps, which project the spherical world onto a flat surface, have been created in several ways but always with North to the top. Each 'solution' is a map projection, usually named after its 'inventor'.

All projections (and there are many) of the world onto a map distort the shape of the land masses and most distort the relative size (unlike globes that keep the relative size of continents intact). Some world map projections retain parallel lines of latitude but draw lines of longitude parallel instead of converging at the Poles. This distorts the projection of the land shape (compare the size of Greenland on a globe and on a world map). Figure 6 shows five common projections. All these projections are centred on the Atlantic Ocean and Africa. The huge Pacific Ocean is divided at the sides of the map, giving it less impact.

In the Mercator projection (1569) lines of latitude and longitude are all straight, distorting the shape and relative size of land masses.

In the Eckert IV projection (1906) lines of latitude are unequal in spacing and scale, resulting in lines of longitude curving and converging towards the Poles.

Goode (1923) devised a map with interruptions that minimizes distortion and resembles a flattened orange peel.

The Gall (1855) and Peters (1974) projections represent countries in their true proportion to one another. An equal-area projection shows continents, countries and oceans according to their actual size, so comparison is possible; but the shape is distorted: the projection of the world being stretched N-S about the equator and squashed towards the Poles.

Eckert IV and Peters are the most commonly used projections in education.

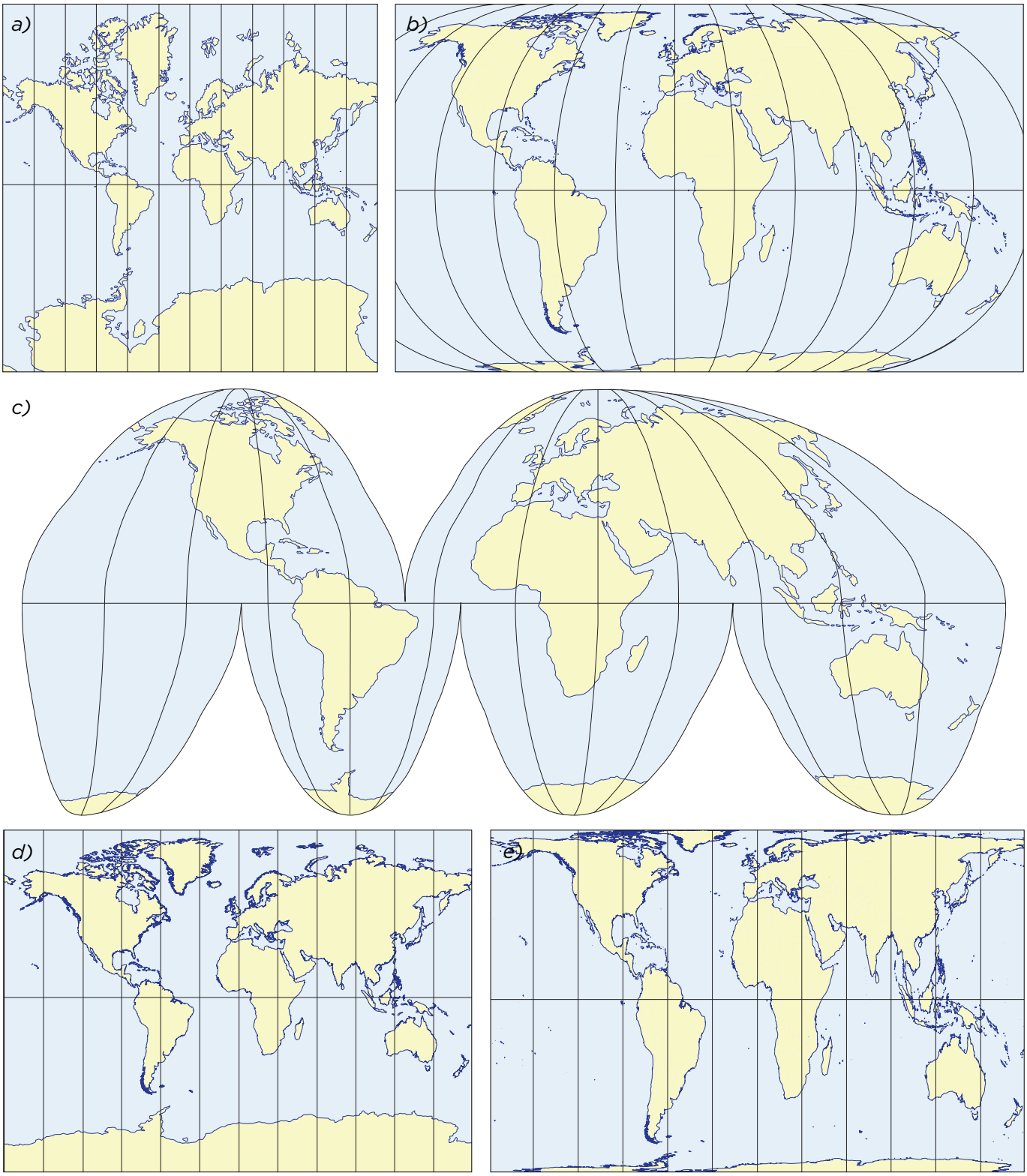


Figure 6 a) Mercator, b) Eckert IV, c) Goode, d) Gall and e) Peters: The differences between these projections are clear when compared with each other.

Glossary

Altitude/elevation – height indicated on a flat map by a line (contour line) or a dot (spot height)
Compass – an instrument used for navigation and orientation that shows direction relative to North, East, South and West
Compass needle – the magnetised metal needle mounted to spin feely in a compass; it always points north
Compass point – one of the 32 marks on the dial of a compass that show direction
Compass rose – a diagram showing the orientation of N, E, S and W and the intermediate points, used on maps and traditional compasses
Contour/contour line – a curve along which the height/altitude/depth of the land/sea has a constant value
Equal area map projection – the representation of an approximately spherical world as a flat map that preserves area measure, generally distorting shapes in order to achieve this
Four-figure grid reference – four grid numbers (two eastings then two northings) that define a location. On OS maps a four-figure GR identifies a 1km/1000m square
Grid lines – a (usually) N-S and E-W grid superimposed on maps to provide a system for defining locations. The OS grid lines are spaced 1 kilometre apart
Grid reference – the unique reference to a feature or location on a map, whose position can be found by reading the numbered grid lines eastwards (eastings) then northwards (northings)
Informal symbols – symbols devised/invented (often by children) to communicate the meaning of a map
Key – a guide that communicates the meaning of the symbols/colours/conventions used on a map
Latitude – imaginary 'horizontal' lines that circle the globe, diminishing in size from Equator to Poles, with the Equator the zero/0° line, from which angular distances are measured, north or south
Large-scale maps – more detailed maps, such as a town plan (on 1:10,000 scale and 1:2,500 scale for urban areas) that show smaller areas in more detail
Longitude – imaginary 'vertical' lines from Pole to Pole with the Greenwich meridian the zero/0° line, from which angular distances are measured, east or west
Map – a drawing or diagram that gives spatial information about the physical and built features of an area of land and/or sea. Includes pictorial, sketch, street, town plan and OS maps, with OS maps using the most conventions; from a vertical or oblique perspective
Map projection – the representation of an approximately spherical world as a flat map, necessarily involving distortion. Some projections distort shape, others distort latitude and/or longitude
Ordnance Survey (OS) – the UK's national mapping agency that produces digital and paper maps of England, Scotland and Wales at different scales
OS Symbols – the standard conventions used by the OS to represent features on an OS map.
Scale – the relationship between the distance on a map and the corresponding actual distance, expressed in words, fractions or as a ratio, or shown as a bar. Distortion due to the map projection used can cause variation in scale across a map
Scale line/bar – a line or bar marked on a map to indicate the scale at which the map is drawn
Six-figure grid reference – six grid numbers (three eastings then three northings) that define a location. On OS maps a six-figure GR identifies a 100m square
Small-scale maps – less detailed maps, such as in a world atlas (on 1:25,000 and 1:50,000 scale or more) that depict larger areas in less detail
Symbol – a mark/character/pattern/colouring used on a map to represent an urban/rural, land/water feature

Further ideas, links and resources to support your use of maps in teaching can be found at:
www.geography.org.uk/investigating-grid-references-and-map-symbols-at-key-stage-1-2

 ISBN 978-1-84377-441-9.
Published by The Geographical Association, 160 Solly Street, Sheffield S1 4BF.
Company number 07139068.
Website: www.geography.org.uk.
The Geographical Association is a registered charity: no 1135148.