請閱讀以下各段文字後寫下主要之大要內容：

1) In many ways, the volcanoes of Japan provide a classic example of how volcanism is created when tectonic plates converge. East of the Japanese northeast coast, two of the great plates that cover the planet in a shifting mosaic meet one another. This part of Japan sits on the so-called North American or Ohotsuku plate; eastwards lies the Pacific plate beneath the Pacific Ocean. Moving steadily westwards, the Pacific plate bends and plunges down beneath the North American plate at their juncture, forming a dip in the ocean floor called the Japan trench.

This downward deflection of one plate by another is called subduction. Typically, it creates a chain of volcanoes in the upper plate, some distance behind the zone of subduction and running parallel to the boundary where the plates meet. The hard upper portion of the subducted plate plunges as a solid slab into the softer, hotter mantle below. This slab typically contains minerals that incorporate water locked up in their crystal lattices.

As the slab sinks, the rising temperatures and pressures squeeze the water out of the crystals. Rising into the wedge of mantle lying above the subducted slab, this water drastically lowers the mantle rock's melting temperature, triggering melting into magma. This buoyant magma then rises and emerges in spectacular fashion in a so-called volcanic arc at the top of the mantle wedge. Because the subducted slab has to sink some distance before it gets hot enough to lose its water, the volcanoes arise some way behind the upper plate boundary. Northeast Japan is dotted with a line of volcanoes called the Japan arc, produced by the subduction further east. (25%)

2) Images of the innards of the Earth created from earthquake records have given new insight into the creation of the highest mountains on Earth, as well as tracking the demise of an ocean which was once as great as the Atlantic is today.

Until 65 million years ago, a great ocean, the Tethys, separated India from Asia. There were no Himalayas and no Tibetan Plateau. These high points of today's globe were created by the slow collision of India and Asia, and are still being forced upwards today as the plate carrying India grinds to a halt. The area around present-day Lhasa was an island, dividing the Tethys into two parts. But what became of this ancient ocean?

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A team led by Rob Van der Voo of the Department of Geological Sciences, University of Michigan, Ann Arbor, Michigan has found signs of this ancient ocean deep beneath the Indian subcontinent. Van der Voo and his colleagues report the results of a study of 82,000 earthquakes. By reconstructing the paths taken by earthquake waves through the Earth, they have created a three-dimensional computer model of the interior of the Earth beneath India and the surrounding area. The map shows subterranean structures within the Earth to a depth of 2,800 km, the point at which the outer solid part of the earth gives way to its molten core. Near the surface, less than 1,000 kilometres deep, blocks of continental rock were pushed down as India and Asia were crushed together by the slow movements of the earth. These continental rocks are less dense than the rocks beneath, and so they float upwards, just as an iceberg floats in the ocean. These light rocks are the roots of the high mountains of the Himalayas.

Further down, between 1,000 and 2,800 kilometres deep, Van der Voo's group found a sequence of slabs of material that were originally the sea floor beneath the Tethys ocean. These slabs were pushed down into the Earth as India moved northwards towards its final meeting with Asia. Because they are colder and heavier than the rock below, they have continued to sink further into the Earth. These rocks deep within the Earth lie in three zones separated horizontally and vertically, each corresponding to different phases of the northwards motion of India, during which different parts of the floor of the Tethys sank into the mantle. (25%)

3) The term "scientific revolution" has been used in a technical rather than promotional sense by the historian of science Thomas Kuhn (1962). A scientific revolution is defined by Kuhn as a new pattern of generalizations about nature that emerges suddenly to guide the future direction of research. Kuhn's viewpoint contrasts with the traditional one that science grows in a continuous manner by a process of steady accretion. Terming the process by which a scientific revolution occurs a " paradigm change," Kuhn argues convincingly that this process is a discontinuous one in the sense that social revolutions are discontinuous: there is no reconciliation of opposing views within the context of some higher authority. The new viewpoint embodying the paradigm change simply wins by gaining the consent of the relevant community. After the scientific revolution, that is, after the paradigm change has been generally accepted, important new lines of research are guided by the new generalizations.

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Many facets of plate tectonics and sea-floor spreading were anticipated by earlier theories. This was true also of such major paradigm changes as the discovery of oxygen and the development of the fluid theory of electricity, both of which had strong precedents in earlier theories. What occurred at the times of paradigm change was a sudden acceptance by a sizable segment of the scientific community because of the presentation of new experimental data and compelling theoretical arguments in favor of the theories. Once accepted, each of the new paradigms served to shape future research.

The history of our present-day ideas about plate tectonics and sea-floor spreading is similar to the above examples. They clearly had their antecedents in earlier theories of continental drift, mantle convection, and sea-floor renewal. Yet prior to the mid-1960's, research in tectonics could scarcely be regarded as being in a state of scientific health. Experimentation and observation, not having a firm theoretical basis, were poorly focused and lacked specific objectives. With the introduction of the concept of plate tectonics, many new avenues for well-focused theoretical and experimental research suddenly became apparent in many of the subdisciplines of earth science. Many lines of productive research closely related to plate tectonics continue up to the present time. (25%)

請閱讀以下各地理名詞定義後,比較它們的異同 (25%)

4) **Canyon:** A relatively narrow, deep depression with steep sides, the bottom of which has a continuous slope.

Valley: A relatively shallow, wide depression, the bottom of which usually has a continuous gradient. This term is generally not used for features that have canyon-like characteristics for a significant portion of their extent.

Channel: A river-valley like elongated depression in ocean basins commonly found in fans or cones.

Trench: A long, narrow, characteristically very deep and asymmetrical depression of the sea floor, with relatively steep sides.

Trough: A long depression of the sea floor, characteristically steep sided, and normally shallower than a trench.

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