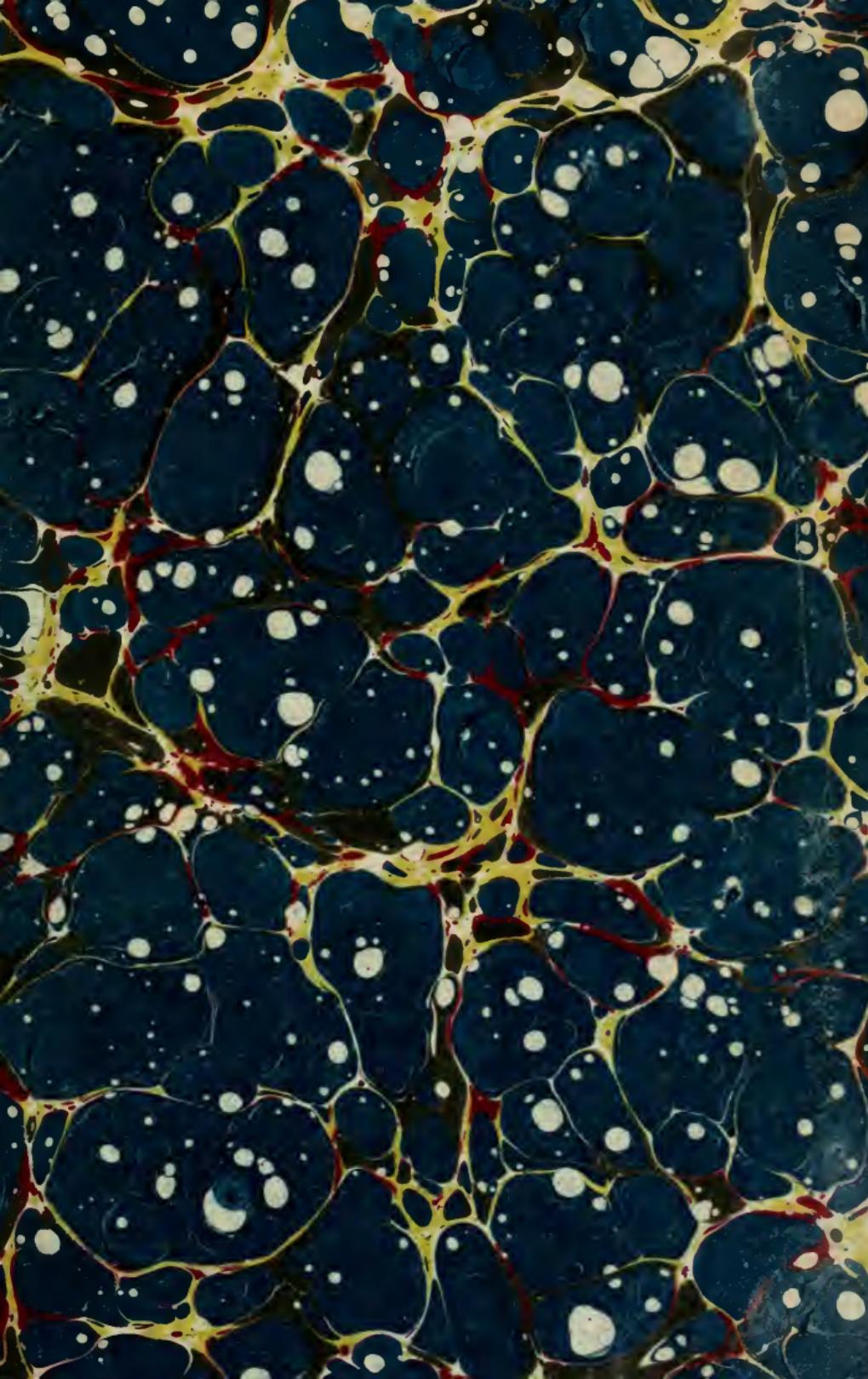




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The Origin of Californian Land-Shells.

BY J. G. COOPER, M. D.

In previous articles I have given some observations on the Distribution and Variations of the Californian Banded Land-shells, which naturally lead to the consideration of their probable origin or past history.

In the "Bulletin of the Museum of Comparative Zoölogy," (Cambridge, Mass., June, 1873, p. 202), Mr. W. G. Binney writes, "the west alone is left to us from whence to trace the Pulmonate Fauna of the Pacific region, and there the secret of its origin lies buried under the Pacific Ocean."

Mr. Binney probably alluded to the supposed existence of a continent in the South Pacific, embracing the mountain summits now forming the archipelago of Oceania, which became submerged, as Prof. Dana suggests, during the later tertiary period, while most of California was emerging from the ocean.

But even if this were proved to have happened, the great distance of the nearest islands (the Hawaiian) from us, and the great depth of the ocean between, as well as north of them, besides the total dissimilarity of their living land-shells from ours, forbids any supposition of a former land connection by which such animals could travel directly from one country to the other. A glance at a globe shows that the islands, besides being tropical and wholly south of lat. 23°, are as far from us as the Aleutian Islands, the Arctic Ocean, or Florida, and I propose to show that whatever migration to California has occurred, came from the direction of the regions named last.

No confirmation is given to a derivation from the west, by the more probable former existence of an "Atlantis" connecting the two continents across the Atlantic, the few island remnants of which really contain several species of land-shells common to one or both sides.

The great similarity of our banded groups to those of Europe has always been an argument for supposing them to have had a common origin. The same similarity is found in many others of our animals as well as plants, and is plainly connected with the well-known similarity of climates in the two countries. But as the known laws of nature do not permit us to consider climate as the cause of specific resemblances, we must look for some other way of accounting for them in this case.

The fact that very similar species exist in Japan and the Amoor Valley, Siberia, contradicts, indeed, the theory of climatic causes, since we know that the climate of those regions is very similar to that of our Atlantic States, where no similar species exist. At the same time, their existence there suggests the probable central point from which all originated.

Going back in geological history to the supposed beginning of all living species, few; if any, of the terrestrial, can be traced farther back than the

Eocene Tertiary, and most of them much less far. But some included in the comprehensive genus "Helix," are found fossil in the Eocene of Nebraska, etc., sufficiently like living American forms to be considered the "Darwinian" ancestors of perhaps the whole of them! Or we may go back only to the Miocene epoch, when trees scarcely distinguishable from the Californian Redwood and *Libocedrus* flourished in Greenland and Spitzbergen, between lat. 70° and 78°. What is more natural than to suppose that land-shells also, like those now living among our redwoods and cedars, existed in the shade of those trees? I have no doubt that such will yet be found fossil in the lignite beds of the Arctic Zone.

It is easy then to see, that having their central position (if not their origin) in points so near the present North Pole, the subsequent gradual cooling of those regions, which is supposed to have driven the living species of Redwoods southward to California and Japan, as well as other trees into Europe, would, if a slow change of climate, also drive southward the land-mollusca "at a snail's pace" into the same regions, where we now find their descendants occupying countries, which are about equidistant in longitude, around the northern hemisphere, in lats. 40°-50°.

We have strong confirmation of this theory, in the well-known distribution of circumpolar species of land-shells southward, on both continents, along meridians of similar temperature, and along mountain ranges (especially those running southward, as in America), and which are supposed to have thus migrated south during the "Glacial Epoch."

Besides these two groups, the "circumpolar" and the "representative" species, we also have on the west slope a very few of the Eastern American types. I do not, however, consider these as evidence of a migration *wes'wrd*, but would explain their occurrence as proving a former existence of ancestors common to both, in the middle regions of Oregon and Nebraska, where are found so many tertiary remains of animals that once inhabited both regions, before the Rocky Mountains became a barrier to migration, or caused different climates on the two slopes.

The few fossil land-shells yet found in California are not sufficiently abundant or ancient to furnish data for their geological history. The fresh water forms, however, which I hope at some future time to describe and illustrate, indicate a very different and more tropical group in the Pliocene and Miocene strata.

The occurrence of *Pupa* and *Conulus* in the carboniferous strata of Nova Scotia, shows that land-shells existed long before the Eocene period.

The great northern glacial drift, and local glaciers farther south, have so generally destroyed the softer tertiary deposits that it must be long before the routes of migration can be traced from Greenland southward, but as tertiary land plants are found there fossil, some similar deposits must have escaped elsewhere in the intermediate regions. Species much like the living ones of California may be expected to occur in the Pliocene of British Columbia.

There can be no doubt that the local migration has been *westward* along this coast, from the facts before stated as to the occurrence of species in the coast ranges and islands, which are unquestionably not older than Pliocene in age, while their allies in the Sierra Nevada may have existed there since the Eocene, but at a greater elevation than they are now found. As they move

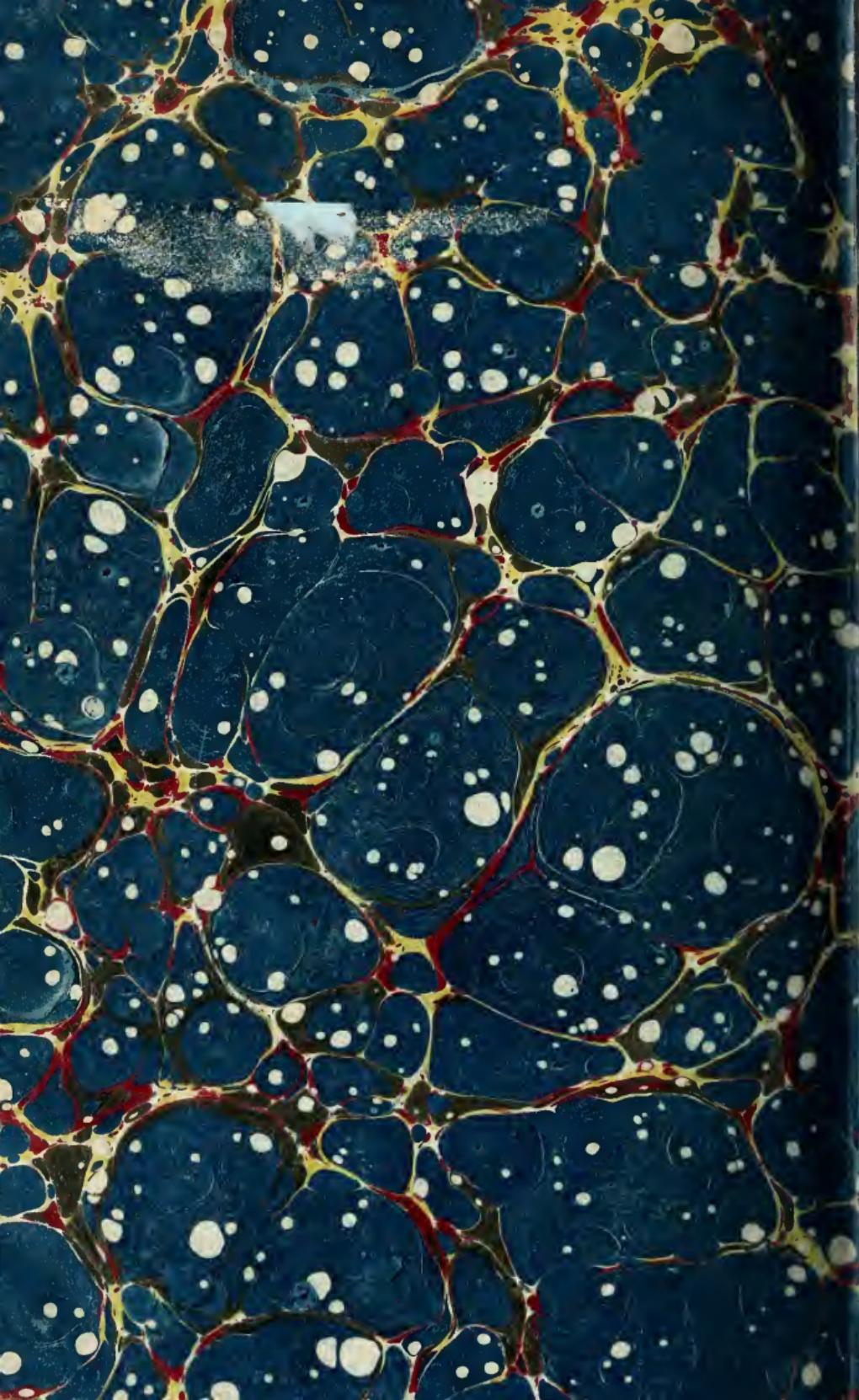
westward, we also find the few older forms developing into many "specialized" varieties.

Going south of California we find further confirmation of the theory of southward migration in Mexico, where species closely resembling the *Pomatia* of Europe occur on the higher mountains, which, unless special creations, could only have reached the two regions by a process like that I have described. The genera *Bulimus*, *Glandina* and *Clausilia* may also have traversed a similar route, though their absence in the tertiary strata of the Eastern States seems to be evidence to the contrary. They may, however, be found in the tertiary of the Great Basin, which is known to contain fossils of some other genera now found only south of the United States (*Berendtia* and *Holosnira*). Indications, however, are known, which point to a connection of tropical regions by land in tertiary times, independent of a polar route. The supposed "Atlantis" connecting South America with Africa would also have connected it *eastwardly* with Asia and Oceania.

The humble and despised snails thus become among the most important evidences of geological changes and conditions of the land, climate, etc., in the past history of the globe. Being terrestrial and easily fossilized when of moderate thickness, they furnish evidence not supplied by any other class of fossils, while their persistency of types is shown by the close resemblance of the carboniferous species to modern tropical forms. One species at least, which still lives in the Eastern States, is found only fossil in England (in Pliocene or later strata) like the trees found under similar conditions, and careful examination of fossil forms on both continents will no doubt show other curious coincidences.

It may be mentioned also that genera of abundant occurrence in the Eastern States have a few representatives in Europe and Asia, as they have on this Coast.

Every fact like this tends to prove that their former migrations have not been to the east or west, but from a common northern centre toward the south.



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