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My dear Dawson

Hornotaxis
& *Carboniferous*
atmosphere &c

I hope that long before this you have got my letter written in the beginning of this month in which I spoke of the first part of your Acadia, which I have since been reading steadily with increased pleasure & profit & which I find Etheridge is reading with equal satisfaction. It is so full of original observation & sound theoretical views that it must, I think, make its way & will certainly be highly prized by the more advanced scientific readers.

I was pleased to find that you took several opportunities of mentioning my determination of the true position of the upper or lower carboniferous beds. When Warburton was president of the Geol. Soc. he used to take every opportunity of representing me as having been in error in the view which I took of their relative age, the opinions of Louis de Lajon & Gesner having, I suppose, outweighed in his mind all that I said to the contrary.

Page 126 I think Huxley's doctrine of hornotaxis would never have been put forth in such strong

tenus had he been more of a field geologist. To talk of the Devonian of Europe corresponding possibly in age with the Carboniferous of North America or the Chalk of Europe with the Eocene of Asia is not the way to correct the error into which those fall who imagine that they can exactly synchronize every minor group. What we have to remember is that our records are so fragmentary that at several intervals all memorials of minor periods of vast duration as measured by centuries may be wanting & on comparing the coal period of New South Wales or China with that of Nova Scotia it is conceivable that no one stratum or set of strata in one of these regions may be strictly contemporaneous with any one in the other region. But the whole may have been formed in all three areas between the close of the Devonian & the beginning of the Permian periods. The more our Indian surveys advance the more do they become persuaded that they have in the Himalaya counterparts of several of our European subdivisions of the Liassic & Cretaceous & on comparing the Northern & Southern Hemispheres the proofs of real contemporaneity

of similar formations as opposed to homotaxis
are growing stronger ~~per~~.

Page 127. You will see in my 10th edition that I
am inclined to be sceptical about an atmosphere
surcharged with carbonic acid (see vol 1 pp 227 & 412)
You have done well to give that wonderful section
of the South Joggins in detail. I certainly think
that a thickness of 16,000 feet implies the
existence a waste of great continental areas
& of large deltas, the evidence of subaerial
conditions is overwhelming & I always
think with pleasure of the privilege of having
seen in the Great Dismal Swamp such
accumulations of pure vegetable matter going
on & hundreds of fallen & prostrate trees
rotting away. I am also glad to have observed
near New Madrid so many areas where
hundreds of erect trees submerged ever since
the earthquake of 1811 are still standing erect
& leafless in the water.
What amount of subsidence must we imagine
to allow of the superposition of strata 16,000
feet thick. Must we have a sinking to that
amount. In all great deltas the tendency
of conversion into dry land by the deposition

of sediment must be counteracted in those areas where there is a suspension of such deposition by the condensation of mud into shale, loose vegetable matter into coal & loose sand into more compact sand & sandstone. When therefore fifty generations of your *Sigillaria* have accumulated uninterruptedly there will have been a subsidence owing to the materials below having been gradually pressed down & packed into a smaller space quite independently of a general sinking down of the earth's crust in that quarter. This may help the coming on of those conditions which produced the lagoons in which the *Meradites* & *Serpula* flourished.

p. 148. The predominance of *Leptodendron* in the Lower Coal both of Europe & Nova Scotia precludes homotaxis.

The vast distance from each other of the two beds which contain *Pupa Velusta* is very interesting. Some barrels full of the mud of that lower bed should be transported to Montreal & slowly examined at leisure. When I showed your figure of *Zonites* or *Coules* to Mr. J. Vernon Holliston so often cited by me in reference to Madeira shells, he

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remarked how unlike it was to *Zonites* & how much it resembled in all but size the common *Helix subplicata* of Madeira of which I send you a specimen by post. The size no doubt of your fossil is very different but the lip of your specimen looks like that of a young shell & *Helix subplicata* must begin by being equally small. The only forms of *Zonites* I find in my cabinet are smooth shells very unlike *Zonites priscus* but nothing can be more clear than you have got a true *Linnæan Helix* & that is a very great point. I suspect that most of the subgenera of *Helix* are worthless, Hollaston has so practiced an eye for the *Helicidae*, that if your drawing is correct his comparison of it with the Madeira shell is worth attending to. His comment on your magnified drawing of *Pupa vetusta* was that it looked like a small *Bulinus* having no tooth - but this last remark applies usually to the common *Pupa muscorem*.

Page 185 - As to occasional upheaval the conversion of continuously subsiding land may in a delta be accompanied

with the occasional re-conversion of
submerged areas into subaerial swamps
by the sediment brought down from the
interior. - The river & its mud is a
counteracting or antagonistic cause to
subsidence & if you introduce upheaval
the *onus probandi* is on you.

Page 199 I am glad you have dwelt
on scratches produced by roots & branches
trailing in the mud. Some ancient
supposed glacial furrows may be
due to this cause.

Page 277 The old gravel of the Coal
Epoch being like modern gold bearing
alluviums is truly interesting. I wish it
were mined for gold like the Californian
gravel & then you might learn something
more of ^{the} air-breathers of the Coal.

Page 319. I suppose the vast thickness
of the principal coal seam of the Albion
mines was due to a process of matting
like that to which you attribute to
Cannel coal. It did not all grow as
a forest (?) our Chesil Beach (see

"Principles" vol 1. p. 534.) Shuts in a
brackish estuary called the Fleet - which
would have become in the Carboniferous Period
a swamp filled with Sigillaria etc.

Page 142. I had forgot to say how sur-
-prised I was that Lesley whom I have
seen lately here should have raised such
strange objections to some of your conclusions
he knew over how vast an area the
Appalachian Coal measures extend, suppose
them to be 3,000 feet thick & that the
rate of subsidence was two & a half foot
in a century - as soon as the river or rivers
coming from where the Atlantic now is
filled up a certain space, it would
push the Delta farther on, but if the
rate of sinking was 5 foot instead of
2 & a half, the mass of sediment-
deposited would be thicker near the old
land, instead of a larger area of sea
being reclaimed. If the Nova Scotia
coal measures are thicker than those
of other regions it does not prove
that the quantity of mud & sand was

greater, but that the rate of sinking was such as to cause the deltas to be limited in horizontal extension. I cannot see what objection there can be to isolated basins. There may have been many independent rivers like those which enter the Gulf of Mexico. If different coal basins of the U.S. resemble each other as I presume Lesley means to say. It ought to be a relief to him to find Nova Scotia is exceptional as to thickness for a general uniformity would be the real puzzle ~~for~~ it would imply that corresponding movements in the earth's crust extended simultaneously over a large part of the Northern hemisphere, of which we have no counterpart in the present state of things.

This letter has run to such a length that I shall stop here adding a few words only on private matters in another page resuming my criticisms in a future letter & hoping some day you will freely comment in the same manner on new parts of my Principles 10th ed. ever yrs Cha. Lyell