E. O. Ulrich

Notebook No. 3, 1901.

Southern Appalachian Valley (1)

Chickamauga Series.

U. S. GEOLOGICAL SURVEY
TRAVERSE BOOK

9-904

This N. B. was formerly N. B. 1. References to Sou. Appa. Mts. (N. B. 1.) are in this N. B. 3.

Table for computing differences of level from angles of elevation or depression
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h_1 in feet.									D	h_2	D	h_2
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1	.014	.887	1.760	2.635	3.511	4.389	5.270	6.154	139	1	1089	61
2	.029	.902	1.775	2.649	3.525	4.403	5.284	6.169	197	2	1098	62
3	.043	.916	1.789	2.664	3.540	4.418	5.299	6.183	242	3	1107	63
4	.058	.931	1.804	2.678	3.555	4.433	5.314	6.198	279	4	1116	64
5	.072	.945	1.819	2.693	3.569	4.447	5.328	6.213	312	5	1124	65
6	.087	.960	1.833	2.708	3.584	4.462	5.343	6.228	342	6	1133	66
7	.102	.974	1.848	2.722	3.598	4.477	5.358	6.242	369	7	1141	67
8	.116	.989	1.862	2.737	3.613	4.491	5.373	6.257	394	8	1150	68
9	.131	1.003	1.877	2.751	3.628	4.506	5.387	6.272	418	9	1158	69
10	.145	1.018	1.891	2.766	3.642	4.521	5.402	6.287	441	10	1167	70
11	.160	1.033	1.906	2.781	3.657	4.535	5.417	6.301	462	11	1175	71
12	.174	1.047	1.921	2.795	3.672	4.550	5.431	6.316	483	12	1183	72
13	.189	1.062	1.935	2.810	3.686	4.565	5.446	6.331	503	13	1191	73
14	.203	1.076	1.950	2.824	3.701	4.579	5.461	6.346	522	14	1199	74
15	.218	1.091	1.964	2.839	3.715	4.594	5.476	6.361	540	15	1208	75
16	.232	1.105	1.979	2.854	3.730	4.609	5.490	6.375	558	16	1216	76
17	.247	1.120	1.993	2.868	3.745	4.623	5.505	6.390	575	17	1224	77
18	.262	1.134	2.008	2.883	3.759	4.638	5.520	6.405	592	18	1231	78
19	.276	1.149	2.023	2.897	3.774	4.653	5.535	6.420	608	19	1239	79
20	.291	1.164	2.037	2.912	3.789	4.667	5.549	6.434	624	20	1247	80
21	.305	1.178	2.052	2.927	3.803	4.682	5.564	6.449	639	21	1255	81
22	.320	1.193	2.066	2.941	3.818	4.697	5.579	6.464	654	22	1263	82
23	.334	1.207	2.081	2.956	3.832	4.711	5.593	6.479	669	23	1270	83
24	.349	1.222	2.095	2.970	3.847	4.726	5.608	6.494	683	24	1278	84
25	.363	1.236	2.110	2.985	3.862	4.741	5.623	6.508	697	25	1286	85
26	.378	1.250	2.125	2.999	3.876	4.755	5.638	6.523	711	26	1293	86
27	.392	1.265	2.139	3.014	3.891	4.770	5.652	6.538	725	27	1301	87
28	.407	1.280	2.154	3.029	3.906	4.785	5.667	6.553	738	28	1308	88
29	.422	1.294	2.168	3.043	3.920	4.800	5.682	6.568	751	29	1315	89
30	.436	1.309	2.183	3.058	3.935	4.814	5.697	6.582	764	30	1323	90
31	.451	1.324	2.197	3.072	3.949	4.829	5.711	6.597	776	31	1330	91
32	.465	1.338	2.212	3.087	3.964	4.844	5.726	6.612	789	32	1337	92
33	.480	1.353	2.227	3.102	3.979	4.858	5.741	6.627	801	33	1345	93
34	.494	1.367	2.241	3.116	3.993	4.873	5.755	6.642	813	34	1352	94
35	.509	1.382	2.256	3.131	4.008	4.888	5.770	6.656	825	35	1359	95
36	.523	1.396	2.270	3.145	4.023	4.902	5.785	6.671	837	36	1366	96
37	.538	1.411	2.285	3.160	4.037	4.917	5.800	6.686	848	37	1373	97
38	.552	1.425	2.299	3.175	4.052	4.932	5.814	6.701	860	38	1380	98
39	.567	1.440	2.314	3.189	4.067	4.946	5.829	6.716	871	39	1387	99
40	.582	1.455	2.329	3.204	4.081	4.961	5.844	6.730	882	40	1394	100
41	.596	1.469	2.343	3.218	4.096	4.976	5.859	6.745	893	41	1401	101
42	.611	1.484	2.358	3.233	4.110	4.990	5.873	6.760	904	42	1408	102
43	.625	1.498	2.372	3.248	4.125	5.005	5.888	6.775	914	43	1415	103
44	.640	1.513	2.387	3.262	4.140	5.020	5.903	6.790	925	44	1422	104
45	.654	1.527	2.401	3.277	4.154	5.034	5.918	6.804	935	45	1429	105
46	.669	1.542	2.416	3.292	4.169	5.049	5.932	6.819	956	46	1436	106
47	.683	1.557	2.431	3.306	4.184	5.064	5.947	6.834	946	47	1442	107
48	.698	1.571	2.445	3.321	4.198	5.079	5.962	6.849	966	48	1449	108
49	.712	1.586	2.460	3.335	4.213	5.093	5.977	6.864	976	49	1456	109
50	.727	1.600	2.474	3.350	4.228	5.108	5.991	6.879	986	50	1462	110
51	.742	1.615	2.489	3.365	4.242	5.123	6.006	6.893	996	51	1469	111
52	.756	1.629	2.503	3.379	4.257	5.137	6.021	6.908	1006	52	1476	112
53	.771	1.644	2.517	3.394	4.272	5.152	6.036	6.923	1015	53	1482	113
54	.785	1.658	2.533	3.408	4.286	5.167	6.050	6.938	1025	54	1489	114
55	.800	1.673	2.547	3.423	4.301	5.181	6.065	6.953	1034	55	1495	115
56	.814	1.688	2.562	3.438	4.316	5.196	6.080	6.967	1043	56	1502	116
57	.829	1.702	2.576	3.452	4.330	5.211	6.095	6.982	1053	57	1508	117
58	.843	1.717	2.591	3.467	4.345	5.226	6.109	6.997	1062	58	1515	118
59	.858	1.731	2.606	3.481	4.360	5.240	6.124	7.012	1071	59	1521	119
60	.873	1.746	2.620	3.496	4.374	5.255	6.139	7.027	1080	60	1527	120

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Table for computing differences of level from angles of elevation or depression
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4												

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Cooyehuttee Creek band of Conasauga, Chilhowee series, Chickamauga series, Ocoee, Beans Mt., Straits - mentioned in note	76
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3						4.418	5.299	6.183	242	3	1107	63

Dove limestone heavy at Loc.87, Ringgold	91
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Harriman to Spring City, Locs.39-41	37
Hayes, C.W. - unites passage beds with Chickamauga	55

Table for computing differences of level from angles of elevation or depression (applicable to scale of 1 : 30000).

Difference of level $\begin{cases} + Dh_1 + h_2 & \text{for angles of elevation.} \\ - Dh_1 + h_2 & \text{for angles of depression.} \end{cases}$
D = distance in scale divisions $\frac{1}{60}$ inch each; a = angle of elevation or depression; $h_1 = 50$ feet $\times \tan a$;
 h_2 = correction for curvature and refraction.
Argument for h_1 is a ; argument for h_2 is D.

h_1 in feet.									D	h_2	D	h_2
	0°	1°	2°	3°	4°	5°	6°	7°	Scale divisions.	Feet.	Scale divisions.	Feet.
0	.000	.873	1.746	2.620	3.496	4.374	5.255	6.139	000	0	1080	60
1	.014	.887	1.760	2.635	3.511	4.389	5.270	6.154	139	1	1089	61
2	.029	.902	1.775	2.649	3.525	4.403	5.284	6.169	197	2	1098	62
3									242	3	1107	63
4												

Heiskell:

upper = Ottosee, Loc.35	29
red sandstone and shale at Locs.107,108, Buzzard Roost Gap, may be	93
Heiskell-Beaver Ridge part of Pearisburg trough represented by Buzzard Roost (Rocky Face) and Dalton sections	93
Hewassee Gap and Gee Creek - Lenoir-Chicka- mauga limestone at, Loc.67	63

Holston marble:

at Loc.54, Philadelphia,Tenn.	49
not recognized east of Stockton Creek, Loc.58	53
Holston marble and Tellico sandstone = equivalent of thin band in Beaver Creek Valley	24

Jacksboro,Tenn.:

to Elk Valley	15
section at	19
Jacksboro,Utica,Bays,and Rockwood in Loc.24,Knoxville	23

Knox:

top of, at Robertsville	7
strata above of Stones River age	5
Knox beds at Careyville described	13
regular succession from Lee conglomerate down to	19
at Loc.64, east of Athens	59
in section at Locs.61-65,east of Athens	61
at Locs.97-105,Ringgold,Ga.	91
at Locs.107,108, Buzzard Roost Gap	93
at Loc.109,Dalton to waterwords and cot- ton mills	95

Table for computing differences of level from angles of elevation or depression
(applicable to scale of 1 : 30000).

Difference of level = $\begin{cases} + Dh_1 + h_2 & \text{for angles of elevation,} \\ - Dh_1 + h_2 & \text{for angles of depression.} \end{cases}$
D = distance in scale divisions $\frac{1}{30000}$ inch each; α = angle of elevation or depression; $h_1 = 50 \text{ feet} \times \tan \alpha$;
 h_2 = correction for curvature and refraction.
Argument for h_1 is α ; argument for h_2 is D.

h_1 in feet.									D	h_2	D	h_2
	0°	1°	2°	3°	4°	5°	6°	7°	Scale divisions.	Feet.	Scale divisions.	Feet.
0	.000	.873	1.746	2.620	3.496	4.374	5.255	6.139	000	0	1080	60
1	.014	.887	1.760	2.635	3.511	4.389	5.270	6.154	139	1	1089	61
2	.029	.902	1.775	2.649	3.525	4.403	5.284	6.169	197	2	1098	62
3									242	3	1107	63

Knoxville, Tenn.:

Loc.24, Chickamauga series	23
Loc.30, Knoxville and Shooks Gap road	27
Loc.31, Chickamauga limestone	27
Loc.32, Sevier shales 2 miles south of Knoxville	27
Loc.35, one half mile from Loc.34 in Beaver Valley	29
Knoxville and back toward Clinton	29

La Follette, Tenn.:

regular succession from Lee conglomerate down to Knox	19
Rockwood iron ore at La Follette same horizon as in Elk Valley	19
Lake Ottosee, Chilhowee Park, Tenn., Loc.33	29

Lebanon ls.:

rocks at big bend of Clinch River look like	11
Loc.17, Clinton to Jacksboro, evidently equivalent of Lebanon of central Tenn.	13
Stones River probably Lebanon, Loc.25, Knoxville	23
in comments on Raccoon Valley	24
most exposures between Harriman and Spring City, Loc.39a	37
undoubtedly at Loc.39a	43
fossils at Loc.76, northeast of Oltewah, of usual Lebanon types	71
horizon at Loc.78, Oltewah to Cleveland by way of Mahon Gap, looks like	73
at Loc.80, Snow Hill P.O., Oltewah to Cleveland	73
at Locs.84-87, section across eastern fork Chattanooga band	81

Table for computing differences of level from angles of elevation or depression
(applicable to scale of 1 : 30000).

Difference of level = $\begin{cases} + Dh_1 + h_2 & \text{for angles of elevation.} \\ - Dh_1 + h_2 & \text{for angles of depression.} \end{cases}$
D = distance in scale divisions $\frac{1}{10}$ inch each; a = angle of elevation or depression; $h_1 = 50 \text{ feet} \times \tan a$;
 h_2 = correction for curvature and refraction.
Argument for h_1 is a ; argument for h_2 is D.

h_1 in feet.									D	h_2	D	h_2
	0°	1°	2°	3°	4°	5°	6°	7°	Scale divisions.	Feet.	Scale divisions.	Feet.
0	.000	.873	1.746	2.620	3.496	4.374	5.255	6.139	000	0	1080	60
1	.014	.887	1.760	2.635	3.511	4.389	5.270	6.154	139	1	1089	61
2	.029	.902	1.775	2.649	3.525	4.403	5.284	6.169	197	2	1098	62
3									242	3	1107	63

Lebanon ls.cont'd.:

at Locs.93m94,Chattanooga to Ringgold .	87
upper Lebanon at Loc.96,Chattanooga to Ringgold, probably equivalent to bed at Shelbyville,Murfreesboro,and Columbia	87
Stones River and Lebanon at Locs.93-96a, Chattanooga to Ringgold	89
at Locs.97-105	91

Lee conglomerate:

at Swagerty Cove	41
regular succession from down to Knox at La Follette	19

Lenoir ls.:

good exposures of lower 100 feet,Loc.53, Philadelphia,Tenn.. . . .	47
at Loc.54,Philadelphia	49
may occur under cover,Loc.58,section across Marble Bluffs	53
under cover at Loc.60,Sweetwater to Athens .	55
at Loc.60	57
at Loc.64	59
largely composed of dove ls.at Loc.71, Benton south to Ocoee River	65
fairly well exposed at Loc.72,Fitzerton .	67
Benton band of,near Fitzerton, Loc.73, probably Beekmantown	67
Lenoir-Chickamauga ls.at Hewassee Gap and Gee Creek,Loc.67	67

Table for computing differences of level from angles of elevation or depression
(applicable to scale of 1 : 30000).

Difference of level = $\begin{cases} + Dh_1 + h_2 & \text{for angles of elevation,} \\ - Dh_1 + h_2 & \text{for angles of depression.} \end{cases}$
 D = distance in scale divisions $\frac{1}{30}$ inch each; a = angle of elevation or depression; $h_1 = 50 \text{ feet} \times \tan a$;
 h_2 = correction for curvature and refraction.
 Argument for h_1 is a ; argument for h_2 is D .

	h_1 in feet.								D		h_2	
	0°	1°	2°	3°	4°	5°	6°	7°	Scale divisions.	Feet.	Scale divisions.	Feet.
0	.000	.873	1.746	2.620	3.496	4.374	5.255	6.139	000	0	1080	60
1	.014	.887	1.760	2.635	3.511	4.389	5.270	6.154	139	1	1089	61
2	.029	.902	1.775	2.649	3.525	4.403	5.281	6.169	197	2	1098	62
3									242	3	1107	63
4												

Localities:

1. Clinton, Tenn.	1
2. Clinton, south of courthouse . .	3
3. not given	
4. Clinton - Clinch River bank . .	3
5. Clinton, low hill south courthouse	5
6. Clinton	5
7-11. Clinton to Robertsville	7
12-15. Clinton to Robertsville	9
16. Big bend Clinch River	11
17,18. Clinton to Jacksboro	13
19. Jacksboro to Elk Valley	15
20. Elk Valley	17
22. Jacksboro, section at	19
24,25. Clinton to Knoxville	23
26. Knoxville	23
27-29. Beaver Valley going southeast .	27
30-32. Knoxville and Shooks Gap road .	27
33. Chilhowee Park, Lake Ottosee . .	29
34,35. Beaver Valley	29
36. Edge of Dutch Valley	33
37. Clinton to, Oliver Springs, Harriman, etc.	33
38. North and east of Harriman . . .	35
39. Harriman to Spring City	37
40. Northeast of Spring City	37
41. Near Spring City	37
42-44. Spring City to Sequatchie . . .	39
45. Spring City to Sweetwater	43
46. Tenmile Creek - Spring City to Sweetwater	43
47-49. Tenmile Creek	43
50,51. Sweetwater	45
52. Sweetwater to Loudon	47
53. Philadelphia, Tenn.	47

Table for computing differences of level from angles of elevation or depression
(applicable to scale of 1 : 30000).

Difference of level = $\begin{cases} + Dh_1 + h_2 & \text{for angles of elevation,} \\ - Dh_1 + h_2 & \text{for angles of depression.} \end{cases}$
D = distance in scale divisions $\frac{1}{30}$ inch each; a = angle of elevation or depression; $h_1 = 50 \text{ feet} \times \tan a$;
 h_2 = correction for curvature and refraction.
Argument for h_1 is a ; argument for h_2 is D.

h_1 in feet.									D	h_2	D	h_2
	0°	1°	2°	3°	4°	5°	6°	7°	Scale divisions.	Feet.	Scale divisions.	Feet.
0	.000	.873	1.746	2.620	3.496	4.374	5.255	6.139	000	0	1080	60
1	.014	.887	1.760	2.635	3.511	4.389	5.270	6.154	139	1	1089	61
2	.029	.902	1.775	2.649	3.525	4.403	5.284	6.169	197	2	1098	62
3									242	3	1107	63
4												

Localities cont'd.:

54.	Northeast of Philadelphia	47
55,56.	East across Loudon belt	49
57.	Section across Ordovician belt 1 mile SE. Adolphus P.O.	51
58,59.	Section across Marble Bluff belt	53
60.	Section, Sweetwater to Athens	55
61-63.	Section across Chickamauga band SE. of Athens	57
61a.	Near Benton	63
64.	Section east of Athens	59
65.	White Cliff Springs road	59
61-65.	Section of	61
66.	Athens to Benton	63
67.	Hewassee Gap	63
68.	Up Fourmile Creek near Benton	65
69.	Long belt 1 mile east of Benton	65
70,71.	Benton, south to Ocoee River	65
72.	Fitzerton	67
73.	Benton band of Lenoir limestone near Fitzerton	67
74.	Climer, about 7 miles east of Cleveland in gully	67
74a.	Near Cleveland	69
75,75a.	Cleveland, west to Oltewah	71
75b.	Railroad cut west side of White Oak Mt.	78
76.	Northeast of Oltewah	71
77-79.	Oltewah to Cleveland by way of Mahon Gap	73
80.	Snow Hill P.O., Oltewah to Cleveland	73
81.	One-third mile before turning into Mahon Gap road	75
82.	Quarry 8 miles east of Chattanooga	79
83.	Western slope of Missionary Ridge	79
84-87.	Section across eastern fork Chattanooga band	81

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(applicable to scale of 1 : 30000).

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Argument for h_1 is a ; argument for h_2 is D.

h_1 in feet.									D	h_2	D	h_2
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0	.000	.873	1.746	2.620	3.496	4.374	5.255	6.139	000	0	1080	60
1	.014	.887	1.760	2.635	3.511	4.389	5.270	6.154	139	1	1089	61
2	.029	.902	1.775	2.649	3.525	4.403	5.284	6.169	197	2	1098	62
3									242	3	1107	63
4												

Localities cont'd.:

88-92.	Chattanooga to Lookout Valley and return	83-85
93-96a.	Chattanooga to Ringgold	.87-89
93.	Entering Chickamauga area from Rossville, then east into Ringgold road	87
94.	Cedar glade	87
95.	Chickamauga Park	87
96.	Upper Lebanon limestone, Chickamauga to Ringgold	87
96a.	Twenty feet lower than 96	89
97.	Hill 1 mile west of Ringgold	91
97-105.	Section at Ringgold	91
106.	Ringgold to Dalton	92
107, 108.	Buzzard Roost section	93
109, 110.	Roadside between cotton mills and waterworks, Dalton, Ga.	95-97.
Lookout Mt., gully in roadside around point of		
		83
Lookout Valley near Chattanooga, Loc. 91 - corrected and amended section from Trenton ls. up to first iron bed of Rockwood		
		82
Lorraine:		
	shales at Loc. 17, Clinton to Jacksboro, probably of	13
	shales holding Lorraine fossils pass into shaly Bays, then into Rockwood, Loc. 37	33
	at Loc. 42	39
	at Loc. 90, Chattanooga to Lookout Mt. and return, reminds of Columbia Leipers formation on Mt. Parnassus	83
	at Locs. 97-105	91
	at Loc. 106, Ringgold to Dalton, undetermined interval between Lorraine and Rhynchotrema beds	92

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 h_2 = correction for curvature and refraction.
Argument for h_1 is a ; argument for h_2 is D.

h_1 in feet.								D	h_2	D	h_2	
	0°	1°	2°	3°	4°	5°	6°	7°	Scale divisions.	Feet.	Scale divisions.	Feet.
0	.000	.873	1.746	2.620	3.496	4.374	5.255	6.139	000	0	1080	60
1	.014	.887	1.760	2.635	3.511	4.389	5.270	6.154	139	1	1089	61
2	.029	.902	1.775	2.649	3.525	4.403	5.281	6.169	197	2	1098	62
3									242	3	1107	63

Loudon belt, east across, Locs.55,56	49
Lower Kings Bridge,Fashion,Oran,etc., spent July 27,1901,at	99
Lupton road, Clinton to Robertsville, Loc.10	7
Lupton,Tenn.,shaly ls.at, extremely like Pierce at Murfreesboro	9
Maclurea bedmknotty, at Loc.53,Philadelphia	47
Mahon Gap:	
Oltewah to Cleveland by way of, Locs. 77-79	73
one-third mile before turning into Mahon Gap road, Loc.81	75
Marble bed of Sevier shale - 25-foot ls.bed 200 or 300 feet above, Loc.65	59
Marble Bluff belt, section across, Locs.58,59.	53
Mare,gray, Belle - comments on her illness	33,35
Maury phosphate at Catoosa Station, Loc. 106, Ringgold to Dalton	92
Missionary Ridge,western slope of, Loc.83 .	79
Moccasin ls. - represented probably at Loc. 12,Clinton to Robertsville	9
Red sandstone and shale at Locs.107,108, Buzzard Roost Gap, is probably	.93
"Mohawkian, basal" 0 in Clinch River section - rocks at Loc.53,across Marble Bluff belt, may be	53
Mollusca, good slab of secured 1 mile east of Robertsville	9
Mosheim and Beekmantown at Loc.69, long belt 1 mile east of Benton	65
Mt. Parnassus: members of Lorraine at Loc.90, Chattanooga to Lookout Mt.and return, re- mind of Columbia Leipers formation on	83

Table for computing differences of level from angles of elevation or depression
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 h_2 = correction for curvature and refraction.
Argument for h_1 is a ; argument for h_2 is D.

h_1 in feet.									D	h_2	D	h_2
	0°	1°	2°	3°	4°	5°	6°	7°	Scale divisions.	Feet.	Scale divisions.	Feet.
0	.000	.873	1.746	2.620	3.496	4.374	5.255	6.139	000	0	1080	60
1	.014	.887	1.760	2.635	3.511	4.389	5.270	6.154	139	1	1089	61
2	.029	.902	1.775	2.649	3.525	4.403	5.284	6.169	197	2	1098	62
3									242	3	1107	63
4												

Philadelphia, Tenn. -

- Loc.53 47
- Loc.54, NE. of 47

Murfreesboro ls.:

- Blue ls. at Loc.46, Tenmile Creek, looks like. 43
- rock at Loc.79, Oltewah to Cleveland by way of Mahon Gap, looks like Ridley and Murfreesboro 73
- upper Lebanon at Loc.96, Chattanooga to Ringgold, probably equivalent to bed at Shelbyville, Murfreesboro, and Columbia 87
- Ocoee - in note 76
- Oliver Springs, Harriman, Rockwood, and Spring City - trip to from Clinton 33
- Oltewah, Tenn.:
 - Cleveland west to, Locs.75, 75a 71
 - northeast of, Loc.76 71
 - Oltewah to Cleveland by way of Mahon Gap, Locs.77-79 73
 - Oltewah to Cleveland, Snow Hill P.O., Loc.80 73
- Oran, Treadwell, Cohutta Mt., etc., spent July 27 at 99
- Ordovician butting against St. Louis, Loc.42 . 39
- Ordovician-Silurian band, Buzzard Roost (Rocky Face), just west of Chattanooga Mt., at Loc.106, Ringgold to Dalton 92
- "Passage beds", compare with basal beds of of Lenoir at Marble Bluff 53, 55
- Pearisburg trough: Buzzard Roost (Rocky Face) and Dalton sections appear to represent Heiskell-Beaver Ridge part of 93
- Pierce ls.:
 - limestone at Loc.13, Clinton to Robertsville, looks like 9
 - in comments on Raccoon Valley 24
 - at Loc.77, Oltewah to Cleveland by way of Mahon Gap, well shown 73

Pierce ls. cont'd.:	
collected from at Loc.80, Snow Hill P.O., Oltewah to Cleveland	73
Pine Mt. - Chester ls. extends two-thirds up, probably fault between and repetition . . .	17
Pinhook Ferry and Rhea Springs - only exposure of Clinch seen in band between was at Loc.45	43
Pragmore band mentioned	45
Questions and suggestions on Chickamauga series	in back of book
Raccoon Valley:	
comments on section across	24
section across, along Clinton and Knox- ville road	25, 26
same condition at Loc.46, Tenmile Creek, as in Raccoon Valley	43
Rhea Springs and Pinhook Ferry - only exposure of Clinch seen in band between was at Loc.45	43
Ridley ls.:	
at Locs.84-87, section across eastern fork Chattanooga band Chickamauga	81
rock at Loc.79, Oltewah to Cleveland by way of Mahon Gap, looks like	73
collected from at Loc.80, Snow Hill P.O., Oltewah to Cleveland	73
Ringgold, Ga.:	
Loc.93, entering Chickamauga area from Rossville and turning east into Ring- gold road	87
Locs.93-96a, Chattanooga to Ringgold, west side of creek	87-89
Locs.97-105, hill 1 mile east of Ring- gold	91
Loc.106, Ringgold to Dalton	92

Rockwood, Spring City, Harriman, and Oliver Springs -
trip to from Clinton 33

Robertsville - Clinton to - Locs. 6-15 . . . 7-9

Rockwood, Spring City, Harriman, and Oliver
Springs - trip to from Clinton 33

Rockwood:

neither Rockwood nor Bays between Locs.
10 and 13, Clinton to Robertsville 9

Rockwood is probably Lorraine at Loc. 17,
Clinton to Jacksboro 13

may be Lorraine in description of Cathey
Chickamauga 13

at Elk Valley, comments on 15

Rockwood iron ore at La Follette same
horizon and character as Elk Valley . . . 19

not well shown at Loc. 24, Knoxville . . . 23

shales holding Lorraine pass into shaly
Bays and then into Rockwood at Loc.
37, Clinton to Oliver Springs 33

at Loc. 42, Spring City to Sequatchie
Valley 39

at Swagerty Cove 41

good exposure of lower part, Loc. 75a,
White Oak Mt. 78

at Loc. 83, western slope Missionary
Ridge 79

at Locs. 84-87, section across eastern fork
Chattanooga band Chickamauga 81

corrected and amended section of Trenton
up to first iron bed of Rockwood 82

Rockwood-Chickamauga boundary mentioned,
Loc. 89, Chattanooga to Lookout Valley . . 89

at Locs. 107, 108, Buzzard Roost Gap . . . 93

Clinton fossils in west band of, Loc. 75,
Cleveland to Oltewah 71

(Rocky Face) Buzzard Roost - Ordovician-Silur-
ian band, just west of Chattanooga Mt.,
at Loc. 106, Ringgold to Dalton 92

Rogers and Candy creeks, in note	77
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Rossville - entering Chickamauga area from and turning east into Ringgold, Loc.93 . . .	87
Ste. Genevieve ls. - beneath Chester ls. at Swagerty Cove	41
St. Louis ls.:	
at Swagerty Cove	41
at Loc.88, gully in roadside around point of Lookout Mt.	83
Ordovician butting against, Loc.42, Spring City to Sequatchie	39
St. Peter ss. - two beds in section at Clinton equivalent to	5
Sequatchie Valley, Spring City to - section at, Loc.42	39
Sevier sh.:	
two miles south of Knoxville	27
at Locs.27-32	27
more ls.in than usual,exposed in road . . .	29
marble bed of, 25-foot ls.bed 200 or 300 feet above, Loc.65	59
in section Locs.61-65, east of Athens . . .	61
at Locs.107,108,Buzzard Roost Gap . . .	93
at Locs.109,110,Dalton, may be Conasauga	97
Shelbyville - upper Lebanon ls. at Loc.96,Chatta- nooga to Ringgold, probably equivalent to bed at Shelbyville,Murfreesboro,and Colum- bia	87
Shooks Gap and Knoxville road, Loc.30 . . .	27
Snow Hill P.O., Oltewah to Cleveland, Loc.80, .	73

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Spring Place, near Dalton	99
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Stones River:	
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Chickamauga in valley at foot of Waldens ridge undoubtedly S.R.	13
is probably Lebanon at Loc. 25, Knoxville	23
overthrust of Rome ss. is less so that Chickamauga band exposes S.R.	33
lower part shown at Loc. 82, quarry 8 miles east of Chattanooga	79
at Locs. 84-87, section across eastern fork Chattanooga band Chickamauga	81
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Spring City east to, Locs. 45-49	43
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to Loudon, Loc. 52	47
to Athens, section, Loc. 60	55
Tellico ss.:	

Tellico ss.:	
at Loc.60	57
at Loc.64, east of Athens	59
in section at Locs.61-65, east of Athens .	61
Tellico ss. and Holston marble equivalent of thin band in Beaver Creek Valley	24
at Locs.107,108, Buzzard Roost Gap	93
Tenmile Creek, Loc.46 - same conditions as in Raccoon Valley	43
Treadwell, Cohutta Mt., Dalton, Dawnville, etc., spent July 27, 1901, at	99
Trenton:	
at Locs.84-87, section across eastern fork Chattanooga band Chickamauga	81
estimates, Stones River and Trenton to base of Rockwood	81
corrected and amended section from Tren- ton up to first iron bed of Rockwood .	82
Tullahoma chert - at Swagerty Cove	41
Utica, Jacksboro - at Loc.24, Knoxville . . .	23
Waldens Ridge, Tenn.:	
Loc.16, big bend Clinch River	11
Chickamauga in valley at foot of un- doubtedly Stones River	13
Waterville, area south to - note on	77
White Cliffs Springs road, Loc.65	59
White Oak Mt. - railroad cut west side of, Locs.75a,75b	78
Wilson P.O. - stayed overnight at house near, July 3, 1901	31

Table for computing differences of level from angles of elevation or depression
(applicable to scale of 1 : 30000).

1	0.0000	10	0.0000	19	0.0000
2	0.0000	11	0.0000	20	0.0000
3	0.0000	12	0.0000	21	0.0000
4	0.0000	13	0.0000	22	0.0000
5	0.0000	14	0.0000	23	0.0000
6	0.0000	15	0.0000	24	0.0000
7	0.0000	16	0.0000	25	0.0000
8	0.0000	17	0.0000	26	0.0000
9	0.0000	18	0.0000	27	0.0000
10	0.0000	19	0.0000	28	0.0000
11	0.0000	20	0.0000	29	0.0000
12	0.0000	21	0.0000	30	0.0000
13	0.0000	22	0.0000	31	0.0000
14	0.0000	23	0.0000	32	0.0000
15	0.0000	24	0.0000	33	0.0000
16	0.0000	25	0.0000	34	0.0000
17	0.0000	26	0.0000	35	0.0000
18	0.0000	27	0.0000	36	0.0000
19	0.0000	28	0.0000	37	0.0000
20	0.0000	29	0.0000	38	0.0000
21	0.0000	30	0.0000	39	0.0000
22	0.0000	31	0.0000	40	0.0000
23	0.0000	32	0.0000	41	0.0000
24	0.0000	33	0.0000	42	0.0000
25	0.0000	34	0.0000	43	0.0000
26	0.0000	35	0.0000	44	0.0000
27	0.0000	36	0.0000	45	0.0000
28	0.0000	37	0.0000	46	0.0000
29	0.0000	38	0.0000	47	0.0000
30	0.0000	39	0.0000	48	0.0000
31	0.0000	40	0.0000	49	0.0000
32	0.0000	41	0.0000	50	0.0000
33	0.0000	42	0.0000	51	0.0000
34	0.0000	43	0.0000	52	0.0000
35	0.0000	44	0.0000	53	0.0000
36	0.0000	45	0.0000	54	0.0000
37	0.0000	46	0.0000	55	0.0000
38	0.0000	47	0.0000	56	0.0000
39	0.0000	48	0.0000	57	0.0000
40	0.0000	49	0.0000	58	0.0000
41	0.0000	50	0.0000	59	0.0000
42	0.0000	51	0.0000	60	0.0000
43	0.0000	52	0.0000	61	0.0000
44	0.0000	53	0.0000	62	0.0000
45	0.0000	54	0.0000	63	0.0000
46	0.0000	55	0.0000	64	0.0000
47	0.0000	56	0.0000	65	0.0000
48	0.0000	57	0.0000	66	0.0000
49	0.0000	58	0.0000	67	0.0000
50	0.0000	59	0.0000	68	0.0000
51	0.0000	60	0.0000	69	0.0000
52	0.0000	61	0.0000	70	0.0000
53	0.0000	62	0.0000	71	0.0000
54	0.0000	63	0.0000	72	0.0000
55	0.0000	64	0.0000	73	0.0000
56	0.0000	65	0.0000	74	0.0000
57	0.0000	66	0.0000	75	0.0000
58	0.0000	67	0.0000	76	0.0000
59	0.0000	68	0.0000	77	0.0000
60	0.0000	69	0.0000	78	0.0000
61	0.0000	70	0.0000	79	0.0000
62	0.0000	71	0.0000	80	0.0000
63	0.0000	72	0.0000	81	0.0000
64	0.0000	73	0.0000	82	0.0000
65	0.0000	74	0.0000	83	0.0000
66	0.0000	75	0.0000	84	0.0000
67	0.0000	76	0.0000	85	0.0000
68	0.0000	77	0.0000	86	0.0000
69	0.0000	78	0.0000	87	0.0000
70	0.0000	79	0.0000	88	0.0000
71	0.0000	80	0.0000	89	0.0000
72	0.0000	81	0.0000	90	0.0000
73	0.0000	82	0.0000	91	0.0000
74	0.0000	83	0.0000	92	0.0000
75	0.0000	84	0.0000	93	0.0000
76	0.0000	85	0.0000	94	0.0000
77	0.0000	86	0.0000	95	0.0000
78	0.0000	87	0.0000	96	0.0000
79	0.0000	88	0.0000	97	0.0000
80	0.0000	89	0.0000	98	0.0000
81	0.0000	90	0.0000	99	0.0000
82	0.0000	91	0.0000	100	0.0000
83	0.0000	92	0.0000		
84	0.0000	93	0.0000		
85	0.0000	94	0.0000		
86	0.0000	95	0.0000		
87	0.0000	96	0.0000		
88	0.0000	97	0.0000		
89	0.0000	98	0.0000		
90	0.0000	99	0.0000		
91	0.0000	100	0.0000		
92	0.0000				
93	0.0000				
94	0.0000				
95	0.0000				
96	0.0000				
97	0.0000				
98	0.0000				
99	0.0000				
100	0.0000				

Table for computing differences of level from angles of elevation or depression

If lost, please return To
E. O. Ulrich,
U. S. Geological Survey,
Washington, D. C.

Note book 3

See note concerning Straits deposits &
Oceon pp. 76-77.

Clinton, Tenn. June 20th 1901.

Arrived at this point early this morning. Found driver waiting, he having gotten in evening before. The horse being sore and the buckboard in need of mending, I spent the day on foot looking over many exposures within a mile or two of town.

So far as seen the Chickamauga here compares pretty well with Stones River, but without giving a careful study of the fossils am not prepared to say that this band of it belongs to the western side of ~~the~~ barrier. Perhaps the Jackabero locality will throw ^{more} light on the point.

Collected fossils at two localities.

Loc. 1. This is in a quarry about a $\frac{1}{2}$ m. n.e. of town. The limestone is compact, bluish to drab color, in layers from 2" to 1 ft., separated by earthy ^{or shaly} seams, varying from less than an inch to several feet in thickness. The limestone layers contain *Tetradium cellulosum* and the rough layers and shaly seams between them *ammonites* and *Parasitic Nicholsonella* etc.

A shaly layer above them is full of *O. triemaria*, Rafin. *minisotensis*, *Lophospira parvulata*, *Subulites* sp., *Pelecypoda* and a slender ramose bryozoan. Also *Escharopora* (cf. *Pirna* sp.) and *Corindella*. *Leperditia fabulites*? was observed & collected next day.

Stones River at Knoxville

245d

Loc. 2. This is a 100 yds. south of the Courthouse. The limestone is heavy bedded, compact, with seams full of *Tetradium cellulosum*, *Lepidodictya* fab., *Conradella* etc. = *Lewisella*.

2 Just over them the soil is filled with small chert and siliceous clay - *Lep. fab.*? observed. Black chert seams also in limestone. The horizon cannot be far removed from one shown at loc. 1. (The limestone & chert reminds of Knox - see further -)

Clinton, Tenn.

June 21. Rained dreadfully most of the night and all of this morning. Could not therefore start for Jacksboro. Clearing up in afternoon collected on Clinch River bank.

4 = Loc. 4. In about 50 ft. of strata, more or less shaly and overlain by very cherty dove and earthy blue limestone, saw and collected numerous fossils. The lowest exposed was full of *Tetradium cellulosum* just over this came *Dracopis* ^{*Lepidodictya*} a small *Maclurea* ^{*Zygospira*} and other forms. Probably *Lewisella*. In the upper 10-15 ft. a *Pachydictya* (sp. foliata) was very abundant. ^{*Androtichia imposita*} *Coeloceras* ^{*Androtichia imposita*} *symmetra*? occurred, with several *Trochostoma*. Also a *Modiolopsis*, *Dalmanella* of peritoma type, *Strophomena* & *Rafinesquina*, ? *O. diffluta*, *Hydractinia*, *Thalops* etc.

This horizon probably is a little beneath loc. 1, and also near horizon of loc. 3.

Made section of Chickamauga, beginning on hill 200 or 300 yds. S. of Courthouse and going westward. To edge of Knox which covers the surface just on hill just across R.R. track. Rocks dip S. about 35°. Red section in west part of

Section at Clinton, Tenn.
(See bottom p. 3).

246 Sequence of beds probably wrong E. side

750-800 ft. of strata above Knox, all of Stones River age. How about lower two beds (12' & 4') being equivalent to St. Peter S.S.? at loc. 6 these two reach thickness of 50'-60'.

If *Tetradium* in bed 9 is *T. cellulosum* and not *sympygidium*, would make bed Louisville. If the latter spec., then beds 10 & 11 would be correlated with upper Stones River leaving 13 & 14 probably lower Chickasaw ls. in age.

Correlation?

CT

June 22 - Clinton To Robertsonville & return.

Loc. 6. At base of Chick. in shown. Top of Knox shows some reddish S.S. - above it conglomeratic seams in perhaps 50 ft. of strata some of which belong to the dolomite & sandstone basal layers of the Chick. as seen at colored chunk at Clinton. Some of the conglomerate consists of rounded chert fragments, from very small to several inches in diameter.

Loc. 7. A fourth mile south of 6 the principal Chick. is exposed in road. Small *Lepiditella*, *Tetradium*, *Lophospira* planis, and other gastros. Took only the *Ostracoda*.

Shown contact should run $\frac{1}{2}$ m further west than on map. *Adams* are abundant several hundred yds. west of road.

245E
Loc. 8. In shaly part (evidently portion of 350' bed) of Chick. found a brachiopod near *Portogiantha riddleana*, very abundant with it *Lepiditella palatilis*? *Pteryginites* sp., *Strophomena*

245K
Loc. 9. Half mile further on struck another band of shaly limestone. Found *Rhy. minutissima* var. very abundant. With it occurred a *Dalmanella*, *Lepiditella*, *Stroph.* recta-like form, small *Rafinesquina*, *Michelinella pulchra*? and other Treps and fine specimen *Escharesa ramosa* - *disjuncta* (Linn.). This horizon apparently same as river bank at Clinton.

245
Loc. 10. Turned into Lupton road. * Soon after crossing first branch came to Loc. 10 where a layer was found full of *Lepiditella* ^{*sumida*} and curved *Coronites*. Also obtained a Lingule. Still in 350 ft. shaly member.

245L
Loc. 11. The road continues to rise and brings in higher beds. Fossils were obtained here out of a rotten limestone looking like High Bridge Carter ~~rock~~ li. The fossils seem to bear out this possible correlation. 50-100 ft. higher in series than Loc. 10.

* There seems to be a mistake on map concerning location of Lupton. The road - which it is situated is not on the map. It lies west of the high ridge.

Loc. 12, ^{245v}

After crossing a narrow flat the road rises once more, exposing the following section:

1. About 40 ft. of shaly and earthy li., all parts holding abundant preserved *Hel. borealis* and *Tripodomata*. In the lower earthy part *Bellerophon* and *Cyrtoceras* occurred.
2. At the top no. 1 merges into a red, arenaceous shale containing a few thin hard plates and no fossils. Only about 15 ft. of this are exposed, but the interval between 1 & 3 might well contain 50 ft. of rock.
3. Similar to bed 1, but much less fossiliferous. Saw a few *Hel. borealis* and took a weathered specimen (ink cross X on it) of *Constellaria*.

These 3 beds probably represent *Cathay* & *Bigby*.
^{also *Moranville*}

A short distance further a turn in road causes repetition of 2 & 3 of preceding. 2 is here seen to be made up of soft yellow, red & green shales. Got *Raf. alternata* from 3.

^{245H}
Loc. 13. At Lupton, shaly limestone afforded thin slabs with bifoliate ^{tryp.} *brugosa* looking extremely like *Pisces* li. at Murfreesboro, but species and horizon really very different (much higher).
Weather very hot - almost played out.

^{245a}
Loc. 14 (1 mile east of Robertsville) got a good slab of mollusca - apparently same horizon as Loc. 11.

^{245g}
Loc. 15 Picked up several slabs of covered with a small *Strophomena* (a plano-convex form) and two species (1 specimen each) of *Tripodomata brugosa*. With them occurred a few *Protorhynchus ridleyana*.

Am satisfied that there is neither *Beys* li. nor *Rockwood* form. between Loc. 10 and 13. There seems to be a fault between Loc. 12 & 13, but it must run nearer Lupton than shown on map. Looks to me like a good deal of guess work was employed in plotting geology on this map.

June 23rd - Sunday. Clinton
Spent whole day on studying and
packing of fossils.

June 24th Clinton.

Spent morning on my mail, which had
been neglected.

In P.M. went into big bend of Clinch
river n.e. of town. Collected fossils
at another locality and horizon near
loc. 1. The rocks looked much like &
probably are equal to Lebanon. In the
bend the rocks dip mostly toward the
n.e., and to this fact probably is
due the bend of river. Failed to
get any good idea of the Bays li. & Rockwood
which is shown here on map. Saw the
? Cathey equivalent and above it a large
body of yellow and red shales. What are
these? (June 25th - These red shales are
the same as what I saw today along
Walden's Ridge. They are Ordovician, and
possibly are ^{included in} Rockwood.)

This region seems to have been included in land
of Trenton time,

Jan 25th
Clinton To Jacksboro.

Chickamunga in valley at foot of Waldens ridge is undoubtedly Stones River, excepting the upper part at Loc. 18 where unquestionable Cathey is found. The rocks here were full of *Bellerophon*, *Bucania*, *Cyrtodonta*, *Neb. borealis*? *Rhy. mirabilis*, *Zygospira recur.* (large form) *Constellaria* etc.

At Loc. 17 ^{245Y} Numerous Trilobes of small forms as in Glade li. east of Murphysboro. Evidently equivalent to Lebanon li. of Central Tenn. (Compare Louisville con. 1912)

Above the Cathey Chick. there is a reddish shale, (noticed previously ^(522 pp. 9+11) near Lupton), that must be several hundred feet thick. At one point some harder arenaceous layers in it contained casts of a *Rafinesquina* similar to (perhaps identical with) the flat low. Lorr. form of *R. alternata* at Cin. li. With it were molds of a ramose *Onygon* not unlike *Amphi. septora*. Perhaps these shales are of Lorraine age. (Probably Eden)

The particular point where these fossiliferous layers were observed was within the area marked Rockwood on map. No other strata corresponding to that formation were observed. Is it possible that this Rockwood is Lorraine?

At Careyville, where Chick. comes up again the ~~upper~~ beds of Knox (cannot say they were the ~~uppermost~~) are not conglomeratic. They contained some small grains of sand however. Noticed also a red layer similar to one seen at colored church at Clinton.

Encountered awful rain, that swept away several bridges. Had hard time to reach Jacksboro, but finally did near 7 P.M.

June 26th Jacksboro to Elk Valley.

Left Jacksboro localities to be studied until my return from Elk Valley. Did this because I had company offered me across the mountain by a drug drummer familiar with the road. The road proved to be not only very bad at its best, but execrable on account of recent severe washings and lack of working.

Loc. 19. When first entering Elk Valley, ^{which} ~~the~~ ^{belonging to the base} with very cherty limestone, ~~that~~ ^{of the Niagara Lt.}

~~the first~~

Examined several of the beds of iron in Rockwood form. The Elk valley Rockwood is what I thought it was, and surely is not the same as the shaly strata ^{troughing} ^{Waldens Ridge}. The fossils occurring in the iron probably indicate Clinton age. A considerable collection of fauna could be secured from these ores. As far as they appear to me on first sight, the Dayton, O. Clinton is nearly the same age. Took some specimens from the first opening seen. The point is near Loc. 19. The most common & conspicuous fossil is the crinoid ^{stem} button. With this small Cyclonites, Liopora, Homotoma, Helopora, Phacopora, Strophomena? etc.

Bradfield

June 27. Elk Valley

At Loc. 20 there is Chester li. & shale of the horizon of Sloans Valley, Ky. A small bag of characteristic bryozoa.

Looked all about Elk Valley for Chickamunga but could not find it. Numerous exposures of Chester looking much like Chick. Is it possible Chester was mistaken for Chick.? Certain it is, there is no Chick: where shown on map. Nor does road cross R.R. at ~~the~~ Elk Valley as shown on map.

The road to La Follette was tough, though a shade better than from Jacksboro. Yesterday, however, was cool, while today again was hot.

Our ^{Belle} mares were much worried and feared [^] would be sick on us. Had to drive slow so it was almost night before we reached La Follette.

Chester li. extends ^{2 1/2} up Pine Mt. Probably a fault between or repetition. At base of Cumberland Mt. Though Big creek gap, large iron and coal industries are being built up. Will look into Rockwood & Chick. in morning.

June 28th

Very hot! La Follette, Tenn

There is a regular succession from Lee Congl. down to Knox along S.E. Slope and base of Cumberland Mt. at La Follette (Big Creek Gap). The whole series stand nearly on edge and are passed over inside of a mile. Unfortunately

The Chickamauga is not well shown. There must be 1000 ft or more. Along the main street of La Follette there is an exposure of ~~the~~ rotten li. ~~to~~ ^{like} ~~the~~ ^{up} ~~the~~ ^{Plaster} li. Reminds very much of High Bridge. Fossils: *Lophospira* ~~parvula~~ ^{loc 21 opposite hotel} *amblicoma*, two *Ephyridiaster*, *Zygospira* ~~resembling~~ ^{cutta} li. *Tetradium* *cellulosa* *Lophospira* *parvula*. (? *Murphyella* li.)

247H

Section at Jacksboro.

Section from S.E. to N.W. at Jacksboro.

Loc. 22C sent to Barber.

Rockwood iron ore, at La Follette, is precisely same horizon and character as in Elk Valley.

Band about 5 ft. thick. 350 Ton furnace to be in operation Nov. 1.

In gap 250 coke ovens built - several hundred more to be put up.

Clinton, Tenn. June 29.
 Reached this point about 7.30 P.M. after a
 hard & long drive. Very sore back from
 jolting of buckboard. Shall put in
 day on office work - making up accounts
 and mail. Have enough to keep me
 busy all day.

June 30. Sunday.
 Spent today studying notes and fossils
 & packing the latter. Fossils consume
 much time, but in this work they
 are very necessary; since the whole
 question must be decided upon their
 evidence.

July 1. Clinton To Knoxville.

Just before reaching Loc. 24 saw Catheys limestone with large *O. bonalis* & *Trigyna* (Trigo.) Took none. The fossils & litho. precisely as at Loc. 18. & at Jackabars.

Loc 24 Immediately following (without intervention of Jackabars Utica) came yellow & red shale in which (near middle) occurred a thin li. band or lens, 10" or less, full of a *Dalmanella* (? *Strophomena*) cfr. Jackabars Utica species.

Above these shale came an arenaceous li. (Bugs li.) some layers of which are fossiliferous. *Halopora* (? *fragilis*) and small pelecypoda. Judge this li. to be either Medina or Clinton, the latter more likely. **Bugs li.**

Next came Rockwood, not well shown, but contains a little fossiliferous iron.

After writing above found rock ^(conglomerate) in Bugs li. containing *Lingula* (? like *cuneata*.) **up. 1912**

Loc. 25. Stones River - probably Lebanon.

after leaving Loc. 25 The road crosses Cambrian shale & S.S. and then Knox chert to Loc. 26 where base of Chick. comes in.

It looks very much as though this is still to the west of the barbour, ^{though} the lithol. & fossils ~~are~~ quite different from the Clinton streak of Chick. see section. Red shales at bottom indicate proximity to base.

If any of the Racoon Valley section belongs east of the barrier, then it is the lower 400 ft. and possibly the upper 200 or 300. The 900 ft. lying between these terminal portions are, at least in great part almost certainly referable to the interior sea. Lithologically this part compares sufficiently well with Lebanon li. and Pierce li. to be correlated with them. The fossils too have on the whole a western aspect. The peculiar knotty character of the Chick. at Knoxville - further east is wholly wanting in them; and, further, none of the characteristic fossils of the true strait-bands (Sponges, Rhipidomys, Maclurea, peculiar bryozoa and corals) occur in them, so far as observed.

In the Beaver creek valley there is a similar though thinner band indicating the presence of the western sea. This lies above a red marble and red shales believed to be respectively equivalent to Holston marble & Tellico s.s. Loc. 35 has a western aspect and reminds in its fauna, of both Pierce & Lebanon.

Will a shifting east & west of the axis of the barrier explain all the difficulties?

Was there a temporary depression allowing invasion of interior fauna? Try the theory of the Middle Tennessee fauna in a long bay and of the more eastern one being deeper fauna.

Loc. 28 - horizon at Loc. 27,

In Beaver Valley going S.E. first cross
shales, then shaly limestone with fossils (not well
exposed) (Loc. 28) then ^{red marble, then} red, arenaceous calcareous
shales, then lower shale. Loc 29. (Look well
into Loc. 29) 1/2 m. SE of Powell, Tenn. W. of
Knoxville Tenn.
246 R.

Knoxville, July 2nd

248 F
Loc. 30. On Knoxville & Shocks Gaps road,
Lower part of ~~Shocks~~ ^{Ottawa} shales. Bag 82 with small
bryozoa in dirt to be washed. Thin beds of marble
with these shales.

248 H
Loc. 31 Chickamauga li. - bag 58.
The peculiarly "knotty" limestone, that under the
weather breaks up into more or less rounded pieces.

248 G
Loc. 32 - Sevier shales,
2 m. South of Knoxville

Made no detailed sections in Knoxville region,
first because I am pressed for time and second
because I believe I can get all I need in that
line from Mr. Keith (Terribly disappointed).

July 3.
Knoxville, back toward Clinton.

Spent this morning examining cuts in and just without Chilhowee Park (Lake Ocoee). Collected a considerable number of bryozoa of the types secured there in 1897-98. A few brachiopoda & other things. The horizon that furnished the most of the fossils must be near the middle of Severn shale or a trifle below same. There are 3 or 4 foss. bands in the middle 200 ft. of thickness just below middle.

After dinner started back for Clinton. Time is growing short, or would have gone farther east beyond Knoxville. Will look into these eastern Chick. bands further south.

Loc 33 = 248 E
In SE of Beaver valley, at Loc 34 the series is exposed in road. Among the shales a harder layer or two, one with *Butthotrephes* fossils in abundance and considerable variety - at least 3 sizes. Evidently Lowville.

Loc 34 = 248 E
Half mile further on met with more limestone in Severn shale than usual. - 6'-8' thick. The li. is thin bedded and full of fossils, some of the slabs being crowded with *Plectambonites*. This may be true sericea but it is not identical with the interior form ~~so-called~~ *P. sericea**) There were other brachiopods - 2 or 3 sp. *Orthis*, one much like *Tricentaria*. A large celled *Monotrypa*? was abundant. A small *Spirifer*-like ~~crab~~ ^(Tetradium?) & *Hetero-spongia*? more rare. *Miculites*, with cells 1 mm. *Pachydiplax* ^{foliata or} *robusta*? and reticulate form much like the *Pierce stictoporella*.
* Probably the same as Lebanon li. form.

As I cannot reach Clinton, stopped over night at farm house near Wilson P.O. This place is on Cambrian shales. A half mile less of Chick^{ie} ^{is west of} than shown on map.

July 4.th

Finished S.E. half of Raccoon valley section. (see p. 25) and collected fossils at Loc. 27b, c & d. Reached Clinton a little before lunch.

Spent P.M. packing fossils, which make up 4 boxes. Will ship these in morning before leaving.

See p. 24 for remarks on Raccoon & Beaver valleys Chickadee bands.

July 5. Trip from Clinton To Oliver Springs,
Harriman, Rockwood & Spring City.

Loc. 36. Chichamunga band western edge of
Dutch Valley. The eastern side of band
shows rather heavy bedded blue, subcrypt. li.,
full of *Dal. testudinaria*, *Rhy. micriscus*, *O.*
pectinella & *bryozoa*. No specimens. Farther north (1-2 mi.)
westward of Rome S.S. is beds so that this thick band exposes Stones River.

Loc. 37. Yellowish to brown & red shales, holding
Lorraine *Raf. alternata*, *O. sinuata*, *Plat. lyra* (large &
smaller forms) and molds of numerous *Trochs*. These shales
pass very gradually into shaly Bays li. and
then into shales containing a thin seam of
Clinton iron ore (Rockwood). The whole series
may be called Rockwood, there being little
difference litho. between any of the members.
The whole as seen, embracing from Lorraine
to Rockwood iron, not over 100 ft. thick.
No fossils taken.

See p. 13.

The Bays li. is scarcely distinguishable - perhaps it
is really wanting. A thin seam (1 ft. or less) of iron ore
containing *Phacopora* (and other Clinton fossils, but not
the large cycled column buttons) occurs just beneath a
hard layer (1'-2') of S.S. looking more like the stone in
Bays li. east of Clinton, than any other layer seen here.
It is evidently Clinton, & if the layer in question is
really Bays li. then that formation is also Clinton.
& not Medina. The layer holding *L. crumata* east
of Clinton probably underlies the Bays or is at bottom
of it.

At Oliver Springs the gray mare Belle became sick
while we were at Hotel taking dinner. At 1 P.M. we
bled her and worked with her (kneading her sides
and abdomen) for an hour when she seemed to have
recovered from her colic. After another hour
of rest we started once more on our way.

To Harriman. Although we walked the team all the way, the mare again showed signs of returning illness when still five miles from Harriman, and it was with extreme difficulty that the remaining distance was covered. Immediately upon reaching a stable (about 7.45 P.M.) we sought the best available advice and began working with her. She was once more bled, then drenched and worked with till 11.00 when we concluded all had been done possible to save her life. The wisacrus gave me little hope so the general opinion was that she would die before morning.

July 6th

Much to my gratification, the mare is alive and much better this morning. Have no doubt now of her complete recovery. She is very stiff and has swollen ankles, while the bloating is still very perceptible.

Examined Chick. li. n. & e. of Harriman, but was driven in by rain before 10 A.M. The rain continued all through the day.

In the R.R. cut where the rocks dip n.w., met with undeniable ~~Chick. li.~~ ^{upper Carter li.} Fossils were few but all highly characteristic, above them on the slopes of the hill to the n.w. heavier bedded li. crop out that I take to represent Carter li. Exposures examined aggregate over 400 ft., but the whole Chick. here is doubtless three times that thickness. Picked up a few specimens among them *O. tricenaria*, *Stro. filitesta*, *Leperditia jacksoni*, *Leperditia jacksoni* portion of a *Paleoceras*. and fragments of *Echinospira*.

July 7th Sunday. The mare looks this morning as though she may be well enough to carry us to Spring City tomorrow. Ankles swollen, but otherwise looks as usual. Much cooler this A.M. but cloudy and threatening. Probably rain before day passes away. Will put in day writing letters and studying route.

July 8th Harriman to Spring City.

Satisfactory exposures of Chick. li. are few between these two points. Most of them, if not all, are Lebanon li. or lower in Stones River. At Loc. 39^a about $\frac{1}{5}$ of a mile east of Rockwood, clayey beds, probably low in Stones River, are exposed between wagon and R.R. Scarcely a fossil to be seen. Now and then a bed plane showed large numbers of a *Lepidodictya*. The slabs however were all too much weathered to afford good specimens. Took one or two pieces.

Looked up iron mine just north of this point. The iron contained Clinton fossils as Loc. usual. Took along an *Orthis* and a large-39. stemmed crinoid (both poorly preserved) that I had not seen before.

$\frac{1}{2}$ to 5 m. n.e. of Spring City clayey layers similar to Loc. 39^a are exposed, with some shaly red layers. Fossils extremely few - took only two specimens of a convoluted laminar organism that I do not recognize. The horizon is not far above Knox - probably not over 200 ft.

A mile nearer Spring City considerable exposures of Chick. li. are crossed by road. Some of these are decidedly cherty, the chert in small pieces, and somewhat earthy in character. At the s.w. end of the exposure a few slabs and specimens of *Trip. longica* were obtained. A few brachiopoda with them. The fossiliferous layers are above the cherty ones. The dip about 80° n.w. - almost vertical.

July 9th
Spring City To Sequatchie valley

At Loc. 42 found Ordov. butting against
St. Louis brick dipping 20° west

Possibly top of Cathey includes some Lorraine, but faulted to recognize it.

After crossing the anticlinal the same series of beds is pressed over in reverse order. The Lorraine as usual flaggy & shaly, The Carter more heavy bedded, the Black River with 4 or 5 thick, continuous plates of chert, the Hornetage not well distinguished, shaly, with not many Dal. list. The Bigby representation is best marked in its basal member which is full of Rhynch. ^{meridional} ~~meridional~~ and is rather remarkable for a very large form of *O. tricenaria*. The rock is not phosphatic but looks more like the north-central form, equivalent.

The Cathey is heavy, nearly all li., full of the usual run of fossils - minus the *Bygonia* which are few - and has the general character of Cathey & Bigby in N. cent. form. *O. berrahis*, in larger and small varieties, is abundant, as also are *Pelecypoda* & small *Cephalopoda*.

The Rockwood was not well exposed on route, but seems to be more solid than farther east. Whether it includes Lorraine or not I had no means of determining. The trip was a very hard one anyway, with from 35 to 40 miles and twice over the mountain, a hard one. Collected very few of the numerous fossils I might have gotten.

Reached Spring City 8.30 P.M.

In passing through Swagerty Cove & down the mt. into Sigwartine, met Chester li. much of it oolitic, containing the usual limestone fossils of that form. Above it evidence of a shale formation (probably up. Chester) that is generally covered by waste from Lee Conglo.

Beneath the Chester oolite came St. Louis li. & oolite, with a small covered interval. Got some fossils - *O. dubia*, & 3 corals that are in this formation at Princeton, Ky.

Beneath this follows slightly cherty St. Louis, with *Lonsdalea prolifera* rare. Fossils not good in rock. Then very cherty Tullahoma or Ft. Payne chert. Then Black shale, followed by Rockwood (rather well seen) & finally Cathy etc.

140
2
280

Spring City road to Sweetwater.
July 10.

The only exposure of Chick. seen in band between
Raccoon Springs & Pinkhook ferry was at

Loc. 45. Here there was the usual & undoubted
Lebanon li. with usual fossils of which
took a few.

On east side of Tennessee river there is a considerable
bluff (just n. of Pinkhook landing) of Rockwood formation.
With the dip, which is about 15° in S.E. direction,
there must be at least 100 ft. Some of the layers
are precisely like Bays li. of Clinton region
(sandy, light green to blue limestone). The balance
consists of red shales, some soft, others - a foot or so
thick - hard. Saw no fossils.

247F
Loc. 46. At Ten mile creek we have about the same
conditions as in Raccoon Valley. At the base there
are 200+ rather hard, red shaly layers, with an occasional
yellow, earthy limestone holding small *Bravania* or *Solenopora*.
At the top of these come in blue compact li. looking
much like Murphysboro li. but less cherty. In the
last saw a *Dalmanella* with alternating striae (Took one)
It is a convex form, reminding of *perveta* section, but with
striae as in *Testudinaria* section. (Didn't Safford name
one like this?) (cf. *O. stans* Saff.)

P. M. (July 11)

Sweetwater To London.

- 2484
Loc. 52. Somewhat less than 2 miles N. of Sweetwater Lenoir limestone with *Maclurea Knoxvilleensis* and coral (? massive *Protarea*). Secured a specimen or two of each. The li. is knotty massive and breaks up into small pieces on weathering. The bed is a little above that at Loc. 50 & 51, but probably belongs to the lower 100 ft. of the series.

- 2485
Loc. 53. About two miles south of Philadelphia the road crosses a fine exposure of the lower 100 ft. of Lenoir li. In all about 50 ft. of li. are exposed, beginning at the bottom with lower knotty *Maclurea* bed. About 10 ft. above these, and continuing for 8 or 10 ft., come similar, though yellower, earthy li., breaking up into small slabs & very small thin pieces, full of *Orthis*, *Stroph.*, & *Raf.* A form similar to *O. tricinaria* (the same genus at Sweetwater) but not that species, (cfr. *calligramma* & other European forms) occurs in great abundance. With it two other species unknown to me. A small *Raf.* or *Stroph.* *Leptæna* similar to *L. micostata*. The small *Stroph.* is quite strange, looking, at first sight, like a *Plectambonites sericea* with coarse striae.

2486
Above them perhaps 10 ft. are massive and more solid li., holding a few massive & hemispheric bryozoa and *Maclurea*, here generally with the shell.

- 2487
Loc. 54. The upper *Maclurea* bed exposed in upper part of section at Loc. 53 is again exposed $1\frac{1}{2}$ m. N.E. of Philadelphia. The *Maclureas* are very large and hard to get in good condition. Got a couple of opercula. With them a *Stromatopora* very much like *S. myosin* is abundant.

London belt
Dec. 27 1886

Where the Holston marble is at the surface the soil is deep and of a strikingly dark red color.

Entire thickness of Lenoir in this band
Scarcely 400 ft. (? not over 300')

July 12th

East across the London belt.

London letter

Dec. 55 & 56.

Section across Marble Bluff belt.

"Marble" here probably refers to the Mercurian

After crossing a Knox ridge, in which the rocks dip n.w., we pass over a narrow valley, with no exposures. Lenoir li. may occur here under cover. The map shows a narrow streak of Holston marble east of this creek, but I did not recognize it. In ascending hill just west of creek there is residue of some kind of rock in which heavy plates of chert occur. Beneath these chert layers come yellowish shales (soft) and then a layer of crystalline li. (blue) here & there full of a *Solenopora*. A little further on the same layer is capped by shaly layers full of *Orthis* & *Rafinesquina* & a few *Solenopora*. This horizon represents the *Receptaculites* bed, though that species was not seen. Got a good lot of *Brachiopoda* & *Solenopora*. (Pseudocrania here.) The rocks dip S.E. 10°-20°.

Rocks at Loc. 59 look like western sea Carter, but probably have nothing to do with it. Compare *Leperditia* with *Gabulites* and Nevada species. Probably = what I have been calling "passage beds." also "basal."

Tried to get another section of the Adolphus belt, but failed to find a single exposure in following the belt two miles and more S. from Gallion Gap. The Valley is the nearest level piece of land seen by me in E. Tennessee.

July 13. Sweetwater to Athens

Failed to get another good exposure of the Sweetwater tract of Lenoir li. S.W. of that town.

After crossing the 3-4 mile wide Knox band lying east struck the Athens Chick. band somewhat about Roy Knob. Many roads in this region not shown on maps.

The Lenoir li. is under cover, but proceeding toward Athens along the N.W. side of the knobs the road passes almost continuously over and nearly parallel with edges of Athens shale. This is probably blue when fresh but in the weathered condition is ^{soft} yellowish, with nearly white and brown streaks. The whole has an unctuous feel. It embraces at least two hard seams. The upper one is ^{about 20' thick} blue-gray, very earthy and knotty - appearing almost conglomeritic. Above it an unknown amount of shale. Beneath it come perhaps 200' of shale (? say 200') then another hard band 15 to 20 ft. thick. This is made up of flaggy, siliceous - shaly layers, dark blue and fine grained when fresh, and showing evidence of disturbance during time of deposition. Beneath this again an unknown amount of shale. The beds dip N.E. 10° - 40°. Saw no fossils whatever.

Loc. 60

Section across Chick. band S.E. of Athens

I find it very difficult to measure these strata. The dip changes often and the beds seem to be repeated on account of small faults & folds. There is a considerable amount of the red marble. It underlies a field & is shown in the middle of it by a small stream. Covering of soil 2'-4'. Outcrop again in road & western margin of field.

The lower 40 ft. of the 140 ft bed of Tullahoma (middle div.) is filled with bryozoa, (ramose and *Phylloporina* & bifoliate.)

The lens at Loc. 63 afforded a considerable number of bryozoa (laminar chiefly) and brachiopods. Among the latter there is an *Orthis*, subquadrate in shape and biconvex, with a narrow sinus, that I sent Schuchert from the Knoxville loc. 32. The *Orthis* is abundant near Marble Bluff is rare, while the *Rafinesquina* of that locality is common enough but poorly preserved. *O. tetricaria*? & *O. pectinella*? and an *Strophomena*? a *Plectambonites*? and *Dalmanella*? near *testudinaria* occur with them.

July 14: Athens, Tenn.
Sunday.

Spent the day in packing & studying journals
and maps. Evening writing letters.

July 15. Morning spent in section east of W.

* Section begins at point about 1 m. n.e. of Athens and follows
White Cliff Springs road running $\frac{1}{4}$ to $\frac{1}{2}$ m. s. of Tellico R.R.

Crossing the fields for a mile S. struck the regular White Cliff Spr. road which we followed back to Athens. Added little to previous knowledge save that we met ^{at Loc. 65} with a 25 ft. limestone bed 200 or 300 ft. above marble bed of Sevier shale. It may be same horizon as that shown at Loc. 63., but here there is more li. and there are filled with small ramose Trilob. giving a very similar appearance to the Tellico at Loc. 61. At this loc. (65) there were no other fossils while at 63 the bryozoa were chiefly *Lamium* & associated with *Crinoid*. It is probably ^{that} there are several of these fossiliferous horizons, and further that they occur as lenses.

The fossiliferous horizon in the Pittsburg shale is
 Loc. interesting. Except an occasional
 64 247N

64 247 ✓

Strophomenoid shell, the fossils are all trilobites and Ostracoda. A species of Amphyx is very abundant, while a small Illaenus and a Dikellocephalus? are not rare. Certain it is that none of these forms ~~are~~ is known in the Interior fauna.

As near as I can make it out at present the section here is about as follows.

July 16th Athens To Bruton.

After fixing and sending in my accounts left Athens about 8.30 A.M., going S.E. through Williamsburg Coghill & Wetmore.

The Chick. tract east of Williamsburg, which we crossed in a S.E. direction affords a magnificent exposure of the Athens shale, which must have great thickness here. Did not measure it but doubtless Hays has the figures. Walked all the way across the tract (which is an almost continuous exposure) hoping to find a fossiliferous band. There are very many hard beds and seams & cracked perhaps a hundred but without success - not a sign of a fossil.

Broke up a couple of blocks of Tellico & in one found a couple of brachiopods.
66 Saw no exposure of the Lenoir li.

The Lenoir-Chick li. at Hiwassee gap is shown standing vertically in east bank of Ice creek. This seems to be merely a small block ^{turned} & dropped into the fault.

The rock is like that at Athens, but could form no conception of its thickness. Perhaps 40 ft. are exposed. It is very sparingly fossiliferous and none ^{of the fossils} were in recognizable condition save some ? calcareous algae of elongate fusiform (? sometimes branched) form, of which I carried away several specimens for study. Similar algae were noticed at other localities.

On leaving town and just beyond first fork of road looked at an exposure apparently Lenoir li. of Sevier but probably Tellico, from which obtained ^{specimens} of *Phylloporina*. With them occurred casts of *Phylloporina*. Rock & fossils look like loc. 61.

July 17th Benton South To ^{Over} Conasauga river.

Just as the road turns out of Benton up
 Farmville creek some limestone is met that looks
 Loc. just like the eastern phase of Lenoir. It is
 68 The same in character and fossils as the
 long belt 1 m. east of Benton which I
 examined in good exposures (Loc. 69) There is
 Loc something like 100 ft. of it, composed of nearly
 69. white & blue "dove" li. interbedded with as much
 banded li., and whitish, cream to faint-purple layers
 that may be dolomitic. Often they appear crystalline
 Fossils are very rare in good condition, though
 an occasional layer, especially in lower half, where a
 little clay ^{now this seems} mixed with the li., may be filled
 with Molluscan shells. But they cannot be gotten
 out. Took one of the best species I saw;
 also small specimens of rock. Gastropoda, Cyph.
 & small Paleyopoda are the fossils - saw neither brachi-
 nor Bryozoa.

Medusa and Bellerophon 247

no fossils

The Athens s.s. indicates shore wash probably during
 Loc short period of ^{erosion} ~~extension~~ of Chickamauga. Both the upper
 70 & lower division of the Athens shale are (as was
 indicated for an east direction by the Willimburg-Judy
 belt) more sandy in composition than in the Athens
 belt. Many of the layers in the ^{upper} shale are decidedly
 arenaceous. The lower bed is soft & much like that at
 Athens.

Loc. Lenoir li., ^{from Medusa} differing from Loc. 69 in being more largely
 71 composed of dark "dove" li. Indeed, some is almost black.
 About the same as at Loc 67.
 At least 100 ft (? 125') are exposed here. Shale
 west of it & fault east.

Loc. 72 At Fitzgerald the Lenoir li. is fairly well exposed. In the upper part near the fault line a 4 ft coarse oolite is shown in gully along road. Took fragment. Just beneath it a gray li. afforded several sp. of small gastropoda. Rock dip 40°-45° n.w. & must be 150' - 200' thick. General character as at Loc. 69.

Loc 73. ^{Mosheim & Nevada} Benton band of Lenoir li. about as at Loc. 69. Thickness of li. about 200 ft. ^(Estimate exposed) Middle part ^{gypsum beds} saw numerous ^{within} gasts. in rock somewhat like *Eccymophoria* ^{contingent} another like *Plethospira*. With them fragments of trilobites so much broken as to be unrecognizable. ^{about} ^{base} ^{layer} ^{shown} a large ^{spherical} *Orthoceras* 1" - 1 1/4" in diameter and an *Ophileta*-like form. Resembling the Californian species. No fossils beneath this & none taken from loc., it being too hard to obtain anything satisfactory. The banded layers occur, as at Loc. 69, in lower 50 ft.

Probably
Bentonia
zone 1908.

Red s. indicating more Lenoir li. continued west for a distance sufficient to give 100 ft more of thickness, i.e. 300 ft. The same may be true of Loc. 69. See Hayes estimates.

Loc 74. At Climer about 7 m. east of Cleveland, the Lenoir is very well exposed. As near as I can get at it the thickness is not far from 280 ft. The top merges rather gradually into *Athys* sh. (the latter reaches Benton & Cleveland road) The li. near the contact (which is well shown in new ^{cut on} road, being earthy and thin shaly. The upper 40 or 50 ft. - especially the lower 20 ft. - this is exposed for a considerable distance in the n. & s. road & a 100 yds or so

24842

24842

Loc.
74
Cont.

South of the E. & W. road, Here a gully shows a massive layer, intersected with insculpting & branching strings ($\frac{1}{8}$ to $\frac{1}{2}$ inch in dia. & probably calcareous algae) ~~With~~ The rock weathers rapidly and when first uncovered has an inch or so of a perfectly white ^{soft} chalky covering. In this and adhering to the hard rock beneath are numerous gastropoda and fewer pelecypoda and cephalopoda. The gastropoda are particularly interesting since among the 6¹²-8 distinct and otherwise quite new species, I recognize

Platystrophia
not identical
species

one, if not both of the peculiar trochomimoid Lophospira I described from E. Tenn. in the Mamm. work. Unfortunately I failed to secure a good specimen of either species, they being very fragile and difficult to chip out of the hard matrix. However, there is now no doubt of the exact horizon from which they were derived. With more time I might have succeeded better in my efforts to secure specimens. Still, I got 20 or 30 and among them some good specimens. All the species are different from known interior forms.

2480

Beneath this layer there was a mottled (red, white & green) one.

Loc.
74^a

Above it very clearly the sponge, Gerronella and Monotrypa bed that I collected from in 1897-8. Fossils were abundant but had no time to do the layer justice. A brachiopod occurred with the fossils found.

July 18 —

Took early train from Cleveland for Chattanooga hoping to get maps there. Failed to do so, but left orders to forward to Cleveland if same should come today.

Returned to Cleveland before noon. After dinner spent two hours in exposures around postoffice at Chattanooga. Fossils very few. One layer south of p.o. contained the *Protorhynchia* obtained near Clinton, with some small *Ostracoda*. On west side, 50 ft. higher in series, saw strings & macerated masses of *Tetradium* & *Lep. fabulites*. The rocks are clearly Stones River.

After dinner started west from Cleveland for Pottersville. Picked up a *Gervillia* in spinose shale in ^{west} ~~western~~ band of Rockwood got some Clinton fossils in iron ore. There is no doubt of the Clinton age of this iron ore. *Rhinopora* occurred with other Clinton bryozoa.

In eastern band some hard sandy layers contained *Helopora*, *Dalmanella* & other fossils. These layers look like Bays li. further north. Softer shales occur over them to the east (the rocks dip S.E.) but am inclined to believe the iron bearing soft shales occurring to the west are brought down by a small fault.

Chickamauga fossils of the usual Lebanon types occurred just north ^{East} of Pottersville. Took a few. One specimen possibly is of fish. The horizon represents either Lebanon or Carter.

July 19. Ooltewah to Cleveland by way of Mahan Gap.

Frequent exposures on road north of Ooltewah, but none was fossiliferous till one about $3\frac{1}{2}$ m. n.

Loc. 77. where Pierre li. was well shown in bank of a small stream. Dip about 20° n.e. Some of the thin slabs are filled with bryozoa and look so much like those at Loc. 13 that I believe they are ^(not same species of) equivalent. A few feet over these came Rhyndostroma and Dalmanella peruviana of large size, with Phylloporina and masses of several ramose Traps. The strata have the general characteristics of Pierre, and the part of this kind exposed is about 20 ft. thick. Following them (up) come red, calca. shales, & these are overlain by yellow earthy li. & shaly beds. Cannot get any sense thick these beds may be. Collected a basket full of fossils.

In next half mile met with two more fossiliferous horizons. The first (78) is higher in series than 77, having the Pleurotomites etc. behind to characterize Lebanon. Loc. 79 on other hand, ^{between the two} is ~~lower~~ ^{higher}, the rock being quite cherty like ^{Ridley} Murfreesboro li. ^(= Ridley) The last rock is full of massive (1"-2") bryozoa, Raf. & ? Dal. and Leptodictella, and ^{Pendulodictya attenuata} Obtained collections of both loc., though not much at either.

2 miles s.e. of Snow Hill P.O., found a good exposure of presumably Lebanon li., some of the layers being full of Pleurotomites & Dal. submarginata. Got some good slabs of both & better ones of bryozoa - in all a good haul. The latter, Ridley & Lebanon collected from will probably all fall within 125 ft.

For $\frac{1}{2}$ mile before turning into Mahans Gap road, the n. & s. road passes over as fine a case of Lebanon Loc. li. glade as one could wish to see. The rocks 81. are nearly horizontal and represent a higher part of the series than at Loc. 80. They are fossiliferous in streaks and with time a good representation of the fauna could be collected. Picked up only a few as samples —: *Stroph. filitexta*, *Lep. fulva*, *Escharopora lileana*, *Bathypora extans* etc.

The Lebanon li. seems to have about its normal thickness of 100-150'. Some yellowish to gray-blue li. above may represent Carter, which is scarcely 50 ft thick. At the top of this came a few feet of li. with plates of chert, (! Black River) Then an earthy li. looking like up. Carthy. Has Tetr. fibrations in it.

The whole Chick. seems to be little if any thicker than 700-800 ft. (Add to this 200 seen later we have 900-1000. Hayes estimates it 2200. Where does it come in?)

When about to enter the gap an exposure of li. is noticed in road & field. This may represent 150-200 feet more of Ordov. than the layer with *T. fibrata*. Could not satisfy myself that this was Lorraine. Noticed a *Perrinites* not unlike *convoluta* and *compressa*. Other fossils too poor to be recognized except a *Bygonia* like *radiata* with *Raf. alternata*. It is possible this may be still Trenton. Perhaps some light will be shed upon the point at some other locality.

Note

It is significant that, while S. of Beans Mt. the Chilhowee series is wanting, the Chick. series ^{here} comes to butt against the Ocoee. In accordance with my theory concerning relations of Ocoee & straits Chick. this indicates that denudation of Chilhowee range had progressed so far in this region when the strata finally ~~gave way~~ ^{gave way} to the lateral pressure that the strata in the ~~basin~~ ^{east} basin were pushed completely over the dividing ridge of land.

The ~~development~~ ^{development} of the coarse Athens S.S. in this region is again significant & points to the same cause. ~~Thus~~ The heavy S.S. of the denuded Chilhowee ^{S.S.}

are the source from which the Athens was derived. The latter is heaviest where these have been entirely removed. That the Athens S.S. extends as a thinning wedge ^{eastward} beyond Athens probably indicated a current flowing north.

A third significant fact is the absence of great faults between the ^{w.} edge of the Coopersville creek band of Conasauga shale and the P.O. of Conasauga (see Cleveland sheet) across this area the strata form an unusually broad double arch from which the Chick. series (straits) was entirely denuded.

The absence of Lenoir li. & Athens shale & ss. in the Chick. area S. of Waterville & east of Cleo, is important in giving a line on the barrier separating App. Strait & Interior sea. It shows (1) this area was land during missing epochs (2) that there was a subsidence about beginning of Tennessean, which helps the theory of red deposits indicating subsidence, and (3) that the axis of the barrier was between Cleveland and White Oak ridge - probably not over 3 or 4 miles west of that town, and nearly coincident with courses of Candy & Rogers creeks.

Saturday, July 20th Cleveland, Tenn.

Spent the day, while waiting for forwarding of maps from Chattanooga, (which did not come) studying and packing two boxes of fossils.

The gastropods from Clinch P.O. prove more interesting and numerous specifically than I anticipated. There are about 12 species and all distinct from Interior sea species. Wish I had time to spend a couple of days on this band of Lenoir. Got only a taste of its very interesting and important fauna.

White Oak Mt. Up. Medina

July 21.
Near Loc. 75a

There is a good exposure of lower part of Rockwood form. in R.R. cut on west slope of White Oak Mt. (The wagon road makes a short curve around hill cut through by R.R.) This portion of form. includes considerable beds of hard, fine-grained s.s. The s.s. is brownish, generally somewhat ferruginous. Some of the layers are fossiliferous. Took several pieces to break up. The horizon = Loc. 75^{sup. 71} probably is equivalent to what Keith farther north calls, in part at least, Bays Limestone. The s.s. here^{also} is probably a little calcareous.

July 21. Sunday. From Cleveland To Chattanooga.

See opp. page

Quarry about 8 m. east of Chattanooga. Here about 25 ft of the lower part^(entire) of the Stones River is shown. The rock is decidedly craggy except the upper band or two and one 18" layer below the middle. Many of the layers are mottled red & dove, the red in vertical section giving the rock a peculiar wavy laminated appearance. The lower three feet are light colored & nearly even tinted. Five or six feet from bottom of quarry the top of a layer shows small pieces of chert. Fossils are very rare, except in one li. layer which contains numerous small *Stenodonta*. That it is impossible to determine satisfactorily a few feet higher a layer contains *Tetradium columnare*. Took specimens of rock & fossils.

247G
Loc. 83. Western slope of Missionary ridge. Saw some weathered Rockwood shale. A short distance beyond met first limestone (is it top of meander?). This is blue & earthy & contains *A. bernalis*, *Rhy. mirabilis* & *ryzocera* (This is Loc. 83a). About 60 ft. beneath this, the limestone layers being clayey laminated, i.e., *Rhynchotrema*, *O. v. v.* & other fossils. Below this come shales (hard) like those at Fayetteville Tenn. Then came dark li. With the *Rhynchotrema* and just over it was a heavy layer with *Gastropoda* & large *Zyg. meander*.

From Loc. 87 picked up only a few of many specimens. Some layers made up of fossils. There are about 20-25 ft. of shaly li.s, characterized by *Plectambonites* and in the upper part by bryolites & ramose bryozoa. Loc. 86a probably still represents Ridley, & 87 lower Lebanon. The *Plectambonites* seems to come in earlier than at Columbia or the lower Lebanon is not present there.

July 22.
I make total thickness of Stones River & Trenton (i.e. to base of Rockwood) not to exceed 1500 to 1550. Hayes says 1600.

The average dip for the whole band does not exceed 15° (on much it is not over 5°-10°, or none over 25°-30°). The band is about 6000 ft. wide, & dipping on just in four, gives 1500 ft. Adding 150' (?200') difference in attitude between eastern & western edges of band gives a maximum of 1700. From thickness from Knox to base of Rockwood probably don't 1400 ft.

Loc. Returning to Chattanooga, this exposure
 92' on main road is a good one of
 247 B about 20 ft of Mt. Parnassus (Columbia Terr.)
 beds of Lorraine.

Took a small bag of fossils.

Lost my good hammer between this
 locality & the Richmond exposures

July 2nd Chattanooga To Ringgold, Ga.

Loc. 93. Entering Chickamauga area from
 Rossville & turning east into Ringold
 road we first crossed lower limestone of
 Chick. that I regard as equal to
 Murfreesboro li. At Loc. 93 a shale
 bed is exposed with a single layer
 holding fossils. These consist of *viridula*
ingozia and a *Dalmanella*. Am
 not certain whether this is *Pierce* or
 the lower part of *Lebanon* exposed at
 Loc. 87. Probably *Chick* rather. Took
 some. Saw no *Plantambonites*.

Loc. 94. It is *Lebanon* because the rocks immediately
 following form a glade with some layers almost
 entirely made up of *Raf. nunesotensis*.
 Took 2 or three pieces. This glade has
 not enough cedars & too
 many oaks to be natural.

Loc. 95. This is in Chickamauga Park. The fossils
 are principally *Asperidictyella* & a *viridula*
ingozia. Am not certain whether it
 belongs above or beneath Loc. 94. The
 rocks dip slightly toward the latter. If
 dip is continuous then 95 is beneath. If above
 then a fold intervenes.

Loc. 96. This I take to represent upper *Lebanon* li.,
O. tricarinata & *Zygospira* being abundant with
 the *Plantambonites*. It is probably equivalent
 to the *Plantambonites* bed at Shilohville, Murfreesboro
 & Columbia, while the *Plantambonites* bed at Loc. 87
 may be a lower horizon not recognized in

Mid. Tenn.

96a This slab with small ramose *Bygonia* came from about 20 ft. lower than loc. 96.

Taking this belt as typical of Chick, these the formation is strictly equivalent to Stones River. The Lebanon division is the best developed and nearly as characteristic as in Mid. Tenn.

There are no Trenton rocks in this belt, they having probably been worn away.

It is a little singular & surprising that *Lepidodictis fabulatus* is not more common. Indeed it is rather rare.

All of the foregoing localities - 93 to 96a - are on the west side of creek.

July 26th Ringgold To Dalton

8

Did best I could toward finishing upper end of Ringgold section.

Between the *Rhynchotrema* beds + the Lorraine *armatus* li. (Loc. 106) there is an undetermined interval of perhaps 200 ft. Part of this may be Lorraine but the most of it probably Fontana. Saw no exposure of it.

Nor did I see a sharp line between Lorraine + Rockwood, if any exists. The Rockwood consists of perhaps 4-500 ft. of shales and li. with some of the beds very ferruginous, especially those to be called sandstone rather than li. There are besides occasional pieces of fossil of the ordinary Rockwood fossil or, but whether there are any considerable beds of it I could not determine. At, apparently, the base of the Devonian, at Caloosa station, the heavy phosphate is represented by a sandy layer. The nodules in shale are marble like in shape, neither of commercial value.

Buzzard Roost (Rocky Face) Ordovician Silurian band (just west of Chattanooga Mountain) seems to begin with a heavy bed of red shale, rather hard. Saw no limestone between this and Knox, though a residual clay between two contains the plates of chert generally resulting from the decay of the "passage beds". The red shale has a thickness (see section next page) dips 70°-85°

Section Through - W To E - Buzzard Roost Gap.

Although I looked carefully I did not see a sign of a fossil in any one of the beds. Doubt however very much that it contains Rockwood. Believe it is all Ordovician and again about to *Platystrophia*, *Tellin* or *Spirifer*, or rather as above described in Clinton or interior troughs. (How about its being the Heiskell?) 1909.

Feb. 22, 1909.

Rocky Face (Buzzard Roost) and Dalton Silurian appear to represent the Heiskell-Beaver Ridge part of Parisburg trough which passes under northward at Vancouver (on London sh.) and may emerge again in Rocky Face and Dalton outcrops. Apparently the faunas at Dalton and Loc. 27 (near Heiskell) bear out this interpretation.

83

At Dalton. P.M. July 26th.

(Loc. 109)

The Top of the Knox shows in road side, between Water works & Cotton mills shows some effects of erosion in conglomeratic character of some of the plates of chert contained in the decomposed rock. It is now either a ^{trivial} shale or the more usual Knox cherty soil. The shale is varicolored, and much of it soapy in feel. A little graphitic here and there. Bands of chert, from an inch to a foot in thickness occur in the shale. ^{also} Siliceous species occur in it ~~also~~ without regularity. Possibly it represents the "passage beds" which are sometimes shaly and always contain seams of chert.

There is no direct connection between this shaly top of the Knox and the red beds making up the hill to the north of Loc. 109, but after crossing the valley gulf to the base of the Knob some Knox chert is encountered, so that - no great interval is likely between the Loc. 109 shale and the red shale at base of knob.

Possibly there is a fault between the lowest red shales at foot of Knob and the bed of brown cal. s.s. which dips much more rapidly (45°)

than any of the others. The usual dip is 10°-15° n.w.

Fossils occurred in beds 7, 8 & 9 of the following section, ^{especially in 8.} These include a few bryozoa, but the commonest is a small *Dalmanella*, between the *testudinaria* and *perovata* strata. If I remember correctly this occurred in other strata localities. The fossils are all poor but took a number hoping they may prove recognizable.

Am now fairly confident that - the Dalton

band belongs to the strait, but the placing
of the Buzzard Roost gap band must await
study in office or further light in field.

Section from Water works at Dalton. to top of
Knob $\frac{1}{2}$ m. north of it.

Compare this section & Dalmanella with Loc. 46. (p. 43)

* Am not certain but believe there is a considerable body
of Seneca shale that belongs above this section. It lies
along eastern edge of Dalton. However, it may
be Conasauga shale. Ask Hayes.
Doubt as any of the previously cracked (crumpled) li. of the bottom.
Hayes' map gives this shale as Conasauga.

Saturday, July 27.
Spent day between Dalton & base of
Cohutta Mt. Going east through Darnville,
over Lower Kings Bridge, & through Tashiean,
returning by way of Orme and Treadwell.
East of Tashiean there is a heavy bed
of Athens shale, in a band about 2 m.
wide. Holds about the same characters
as at Athens. None of the exposures,
which were few, on either going or return
trip, gave any new ideas. Got no
fossils from it nor did I attempt
to measure thickness. The band
ceases a couple of miles N. of Spring
Place. Saw no limestone in connection
with the shale, though some residue
indicated it on western edge.

Extremely hot, and feeling
anything but well.

Sunday July 28

Spent day putting up accounts,
which showed that I am near
the end of the allotment than I
expected. P.M. wrote Hayes and
Col. Rizer and in evening Mrs. H.
Headache & very tired all day.
Heat seems to be affecting me at last.

July 29.

100

Drove S. from Dalton toward Rome, reaching a short distance South of Floyd's Springs by nightfall. Fanned we would not find a place to put up for the night, but after several refusals found a Mr. Brown who left it to his wife — with the usual result.

The only point worthy of mention is the showing of an apparently greater thickness of red shale at base of Dalton section. In the section on a preceding page (97) I make it about 100 ft., the thickness being doubtful on account of probable small fault. What I saw this morning makes me believe the basal red shale may be 300 or 400 ft. thick.

Boxed specimens sent in
on Appalachian Valley Trip.

From	Clinton, Tenn.	4 boxes.
"	Athens "	2 "
"	Cleveland "	2 " (prepaid)
"	Chattanooga "	2
"	Dalton Ga. to Newport,	1