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Duncan Carr Agnew

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1. Introduction

This report was originally prepared in June 2009 under contract to the US Geological Survey (USGS), specifically for Dr. Susan Hough (USGS Pasadena). This was part of an effort, now published¹ to improve estimates for the four largest New Madrid earthquakes by obtaining intensity estimates from four experts – of whom I was one. As will be evident from the material below, developing these estimates involved a number of developments; in the interest of making these available I am placing this report in the SIO Technical Publication series. The cover page and this introductory paragraph are new: everything following this paragraph is unaltered from the original report.

This report gives the intensities of shaking for the four largest earthquakes in the “New Madrid” sequence of 1811-1812: at about 2 AM and 6 AM on December 11, 1811; at about 8 AM on January 23, 1812; and at about 4 AM on February 7, 1812. The reports of shaking are much more extensive for these four events than for any others of this sequence. However, few of these descriptions are elaborate, and none describe the shaking or its effects in any way commensurate with the descriptions used in intensity scales. I have therefore tried to be especially clear about how I determined the intensity values.

2. Procedure

There are three stages to finding intensities for historical earthquakes:

- A. Collection of sources of information; in this case, this has been done by Street (1984), supplemented by additional information located by S. E. Hough.
- B. Translation of the descriptions given in the sources into the phraseology used for earthquake effects in the intensity scale chosen.
- C. Choice of an intensity value, or range of values, based on matching the effects described to the group of effects associated with each value of the intensity.

For modern earthquakes, Step B is done through the use of standardized questionnaires, which force the observer to summarize his experiences in the phrases used in the intensity scale. For historical earthquakes, steps B and C are often combined, with the person estimating intensities going straight from a description to an intensity value. In this case I have tried to keep these steps separate.

2.1. Standardization of Reports

In order to make my choices in Step B more explicit, and also to help organize the information available, I wrote a simple program that mimics a questionnaire, and outputs standardized results into a simple ASCII database. The actual questions asked, and possible answers for most of them, are determined by a table that is read by the program, and which can easily be modified. The program is called `mallen`, after Maxwell W. Allen, who initiated an early postcard questionnaire system in California: it uses the *awk* programming language. The table used for this particular study is given in Appendix A.

¹ Hough, S., and M. Page (2011). Toward a consistent model for strain accrual and release for the New Madrid Seismic Zone, central United States, *J. Geophys. Res.*, **116**, B03311, doi:10.1029/2010JB007783

The program firsts asks for information about a particular record within a document. A record is taken to be a report, by a particular source, of earthquake effects at a given place (and time if available). There may be multiple records in a particular document; one example would be reports on the same earthquake in different places; another, reports of a sequence of earthquakes in the same place at different times. Once information about the record is collected, the program asks for information about earthquake effects, which are grouped into various categories and subcategories. In most cases, the effects are chosen from a specified set of descriptions by entering a single letter; for example, the subcategory `Felt by location`, which is part of the category `Effects on people`, has the possible answers `i` (felt indoors only) `s` (felt by some outdoors), and `a` (felt by all outdoors).

In a few cases the date of the effect was not available; these records were entered but not used in estimating intensities. Not infrequently the time of the effect was given neither explicitly nor implicitly (by using phrases such as “after sunrise”); but it can usually be safely inferred. Appendix B lists those reports for which the time or date were too uncertain for the record to be useful.

Part of the data entry process also included entering some or all of the initial sentence of each document. This was done to enable easy comparison with newly-available information, and to check to see if newspaper articles were copies of each other. It is somewhat surprising, but true, that even a few words are often sufficient to uniquely identify a sentence. Out of 258 openings of documents, there were 20 lines in which the first few words were identical, forming 10 pairs: 4 of these turned out to be previously-unknown duplicates that had caused information to be improperly associated with more than one location. Appendix B provides further details.

Appendix C gives the standardized reports for each earthquake and location. Each report (there may be more than one for a given place and time) begins with the page number from Street (1984) in italics, followed by the time (reported or inferred) in lowercase boldface, and then the list of effects, separated by semicolons. There is a field (the last one) available for free-form entry, which has been used to add comments or describe unusual effects.

Table 1: Inconsistent Effects in MM Scales

Level	MM31	MM56	MM93
IV	Felt indoors by many, outdoors by few.		Felt by many to all. Trees and bushes shaken slightly.
V	Felt indoors by practically all, outdoors by many or most.	Felt outdoors	Felt level not used. Trees and bushes shaken moderately to strongly. Pictures fell. People had difficulty standing or walking.
VI	Felt by all. Trees, bushes shaken slightly to moderately. Fall of pictures.	Felt by all. Trees, bushes shaken visibly or hear to rustle. Pictures off walls. Persons walk unsteadily.	(Must be reports of physical damage)
VII	Trees, bushes shaken moderately to strongly. Some, or many, find it difficult to stand.	Difficult to stand.	(Only reports of physical damage are considered).

The order of locations is a path chosen to put nearby stations close together in the list; it starts near New Madrid, goes NE from there, then down the eastern seaboard, back to New Orleans, and up the Mississippi.²

² This path was found by solving (approximately) the Traveling Salesman Problem for the locations of all reports.

2.2. Intensity Estimation

The basis for the intensity estimates is the Modified Mercalli Scale, 1956 version (Richter 1958), which aimed to be a clarification of the Modified Mercalli Scale set out by Wood and Neumann (1931); hereafter I will refer to these as MM31 and MM56. However, Stover and Coffman (1993) state that considerable experience with the MM31 scale has led to some changes and redefinitions, which I summarize in Table 1, using MM93 for their modification of the scale. Different effects are separated by using different colors: **blue for felt level**, **green for observed shaking of plants**, **brown for pictures on walls**, and **red for difficulty standing**.

The reasons for some of these differences are given by Dengler and Dewey (1998), and J. W. Dewey (pers. commun): in particular, that the effect of “difficulty standing” was often reported in postcard questionnaires when other effects indicated intensity V, rather than VII. A possible reason was that even at intensity V about 10% of people report this effect (Dengler and Dewey 1998); and it could be caused either through mild motion sickness (likely caused by long-period motions) or by high accelerations and jerk causing an actual inability to remain standing.³

In light of these issues, I made a few modifications to the MM56 descriptions for the intensity scale I have used; the result is given in Appendix D. Along with the modifications, I have changed the order to be that in which effects were asked for (Appendix A) and printed (Appendix C); I have also omitted effects, such as those relating to automobiles, not relevant to the early 1800’s. As pointed out by Musson *et al* (1995), changes in the effects listed should, strictly, be denoted by giving the scale a new name. Given the small degree of changes, and the imprecision of the descriptions available, I think it is probably valid to take the scale in Appendix D to be equivalent to that used by Stover and Coffman (1993), and hence equivalent to the MM scale that has been used for most historical U.S. earthquakes.

In applying this scale I have also made the following choices:

1. In accordance with the comments of Richter (1958) I have generally ignored statements such as “houses shook severely”.
2. I have also given low (but not zero) weight to comparisons between shocks, especially claims that an earthquake was the strongest one yet.
3. The highest weight is put on the behavior of inanimate objects; descriptions of the amount of alarm are given the lowest weight, but are used if nothing else is available.
4. I have assumed that buildings in the larger towns were masonry, of a poor grade, unless frame buildings were mentioned explicitly. For smaller villages I assume the buildings to be log cabins with clay or stone chimneys, and that such buildings have the same resistance to shaking as the frame buildings referenced in the MM scales.
5. In some cases I have assumed that “cracking” refers to the noise produced by buildings, rather than to damage: that is, I take “crack” to be synonymous with “creak”. One example (Dayton *Ohio Centinel*, 1812/2/13, Street page 208) is for the February 7 earthquake at Troy, Ohio, for which I assume “a violent shaking and cracking of the houses” refers to sounds.
6. In keeping with the definition of the scale, I have assigned intensity IX to cases of widespread ground disruption, though this is now not generally regarded as a reliable indicator. Since there were no well-built structures to be destroyed, intensity X is not justified for any location. Ending the scale with IX seems to be in keeping with current usage, for example in the Shakemap program (Wald *et al* 2005).

³ Jerk, the rate of change of acceleration, is an important factor in the human perception of motion; see Grant and Haycock (2008).

3. Results

There are reports from 91 locations for the larger (2 AM) shock on December 16, 1811, and from 37 places for the second-largest on that day, at around sunrise at New Madrid. There are usable reports from 51 locations for the January 23, 1812 shock, and from 48 locations for that of February 7, 1812. Table 2 lists all the intensities determined, along with a quality factor: A indicates that the descriptions pretty well match those for that intensity level, with the letters B through D for descriptions that are increasingly contradictory or vague.

Table 2: Intensity Estimates

Lat	Long	Place	Intensity and Quality			
			Dec 16 (1)	Dec 16 (2)	Jan 23	Feb 7
36.710	-81.977	Abingdon VA	I (B)			
38.805	-77.047	Alexandria VA	V (A)	III (C)	IV (B)	III (B)
42.250	-78.030	Allegheny County NY	IV (B)			
38.701	-90.149	American Bottoms IL	VII (C)			
38.978	-76.492	Annapolis MD			III (B)	
42.395	-77.697	Arkport NY		III (C)		
35.601	-82.554	Asheville NC	V (B)	VII (B)		
33.471	-81.975	Augusta GA	V (A)		IV (C)	V (B)
39.290	-76.612	Baltimore MD	III (C)	III (C)		III (C)
37.500	-86.500	Barrens KY			VI (C)	
32.432	-80.670	Beaufort SC				VI (B)
39.947	-82.257	Brownsville OH				V (C)
40.024	-79.884	Brownsville PA	III (C)			V (A)
38.571	-90.190	Cahokia IL	VI (C)			
37.306	-89.518	Cape Girardeau MO			VII (B)	VIII (B)
36.252	-85.952	Carthage TN	V (C)	V (C)	V (C)	
32.777	-79.931	Charleston SC	V (C)		V (C)	V (C)
43.239	-72.425	Charlestown NH	III (C)			
35.626	-89.866	Chickasaw Bluffs TN	VI (C)			
39.333	-82.982	Chillicothe OH	V (B)	V (C)	IV (C)	VI (B)
39.162	-84.457	Cincinnati OH	V (B)	V (B)	V (B)	VII (A)
39.601	-82.946	Circleville OH				VI (C)
39.505	-83.153	Clarksburg OH	V (C)			
38.534	-89.989	Clinton Hill IL	VI (C)			
34.001	-81.035	Columbia SC	V (C)			VI (C)
35.615	-87.035	Columbia TN	V (C)			
32.589	-80.927	Coosawhatchie SC	VI (B)			
40.272	-81.860	Coshocton OH			VI (C)	
36.015	-83.415	Dandridge TN			IV (B)	
39.759	-84.192	Dayton OH	V (B)		V (C)	V (C)
42.331	-83.046	Detroit MI			IV (B)	
36.616	-89.237	Dorena MO	VIII (B)			
38.774	-76.076	Easton MD			III (C)	
36.058	-76.608	Edenton NC	IV (C)		III (B)	
38.270	-85.770	Falls of the Ohio KY	VI (D)			
41.850	-87.650	Fort Dearborn IL	V (C)			
37.144	-88.719	Fort Massac IL	VII (C)			VI (C)
38.553	-92.032	Fort Osage MO	VI (A)			
35.150	-90.049	Fort Pickering TN	VI (C)			
31.554	-88.035	Fort St. Stephens AL	VI (C)			
41.131	-85.129	Fort Wayne IN			IV (D)	V (D)
38.201	-84.873	Frankfort KY	VI (B)	V (B)	VI (C)	VI (C)
35.925	-86.869	Franklin TN	V (C)	V (C)		
38.303	-77.461	Fredericksburg VA				IV (C)
38.210	-84.559	Georgetown KY			V (C)	
33.377	-79.294	Georgetown SC	VI (A)			IV (C)
40.043	-75.180	Germantown PA				II (C)
41.582	-85.834	Goshen IN	V (C)			
40.886	-74.043	Hackensack NJ		III (C)		
41.764	-72.685	Hartford CT			V (C)	

37.836	-87.590	Henderson KY	VII (C)	VII (B)		
38.268	-90.380	Herculaneum MO	VI (C)	VII (B)		
37.574	-85.740	Hodgenville KY	V (C)		VI (C)	V (C)
37.330	-87.550	Hopkins County KY	V (C)			
42.253	-73.791	Hudson NY	III (C)			
36.525	-89.390	Island Number 9 TN	VI (C)			
40.691	-73.806	Jamaica NY			III (C)	
38.278	-85.737	Jeffersonville IN	V (C)			
39.050	-84.500	KY south of Cincinna	III (C)			
35.961	-83.921	Knoxville TN	IV (B)		IV (C)	
43.426	-73.712	Lake George NY			IV (C)	
39.714	-82.599	Lancaster OH	V (C)	IV (C)		VI (B)
34.380	-82.310	Laurens and Newberry	V (C)			
39.435	-84.203	Lebanon OH	V (B)			
37.989	-84.478	Lexington KY	V (C)	IV (C)	V (C)	VI (B)
36.175	-89.668	Little Prairie MO	V (C)	VII (A)		
37.220	-88.330	Livingston County KY				V (C)
38.254	-85.759	Louisville KY	V (B)	IV (B)	VI (B)	VI (A)
37.186	-86.100	Mammoth Cave KY			V (D)	
39.415	-81.455	Marietta OH	V (B)		IV (C)	IV (C)
38.641	-83.744	Maysville KY				VI (C)
41.641	-80.151	Meadville PA	V (C)	IV (C)		
33.080	-83.232	Milledgeville GA	IV (C)			
37.220	-87.150	Muhlenberg County KY	V (C)			
36.166	-86.784	Nashville TN	VII (B)			VI (B)
31.563	-91.408	Natchez MS	VI (A)			
31.761	-93.086	Natchitoches LA	VI (C)			
35.108	-77.044	New Bern NC				V (D)
37.950	-90.021	New Bourbon MO	VIII (B)	VI (C)		
41.308	-72.928	New Haven CT	III (A)		III (A)	II (C)
36.586	-89.528	New Madrid MO	VIII (C)	VIII (B)	VIII (C)	VI (B)
29.955	-90.075	New Orleans LA	I (A)		IV (C)	IV (B)
40.714	-74.006	New York NY	I (A)		III (C)	IV (B)
40.736	-74.172	Newark NJ			III (C)	
39.091	-84.496	Newport KY	VI (C)		V (C)	
36.847	-76.285	Norfolk VA	IV (B)	IV (B)	IV (B)	
36.250	-89.620	N of Little Prairie		VII (C)		
42.531	-75.524	Norwich NY	III (A)			
39.199	-76.637	Nottingham MD			II (C)	
42.975	-76.141	Onondaga Valley NY	V (C)	IV (C)		
34.024	-91.344	Ozark Village AR	VII (B)			
38.210	-84.253	Paris KY			V (C)	
39.952	-75.164	Philadelphia PA		II (C)		III (B)
34.843	-81.468	Pinckneyville SC				V (C)
33.428	-80.029	Pineville SC	VI (C)			
40.441	-79.996	Pittsburgh PA	V (C)	IV (C)		V (C)
35.772	-78.639	Raleigh NC	III (C)	III (B)	III (B)	V (D)
37.836	-87.590	Red Banks KY	VII (C)	VII (C)		
37.554	-77.460	Richmond VA	IV (B)	III (A)	IV (B)	V (B)
36.090	-80.242	Salem NC	IV (A)	III (B)	IV (D)	
32.084	-81.100	Savannah GA	V (C)	IV (B)	IV (B)	V (C)
35.868	-83.562	Sevierville TN	IV (B)		V (C)	
36.876	-86.656	South Union KY	V (C)	V (C)		VI (D)
36.509	-86.885	Springfield TN	V (C)	V (C)		
38.627	-90.198	St. Louis MO	VI (B)	VI (B)		VII (B)
33.958	-80.535	Stateburg SC	V (C)			
37.981	-90.042	Ste. Genevieve MO	VI (B)			
36.400	-80.250	Stokes County NC	IV (C)			
36.728	-76.584	Suffolk VA			IV (B)	
40.039	-84.203	Troy OH				VI (B)
37.775	-87.931	Uniontown KY	VIII (A)			
38.677	-87.529	Vincennes IN	VI (B)		VI (B)	VI (B)
38.895	-77.036	Washington DC	V (B)		IV (B)	IV (C)
38.616	-83.809	Washington KY	V (C)		V (C)	

31.579	-91.299	Washington MS	V (C)				
40.174	-80.246	Washington PA	III (C)				
37.520	-87.680	Webster County KY				V (D)	
38.850	-76.596	West River MD			IV (B)		
40.064	-80.721	Wheeling WV	V (A)	IV (C)	IV (C)		VI (C)
39.746	-75.547	Wilmington DE	II (C)	III (C)			
40.093	-83.018	Worthington OH	III (C)		V (D)		IV (C)
39.940	-82.013	Zanesville OH	V (B)	V (A)	IV (C)		V (B)

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Appendix A: Questionnaire Table

Document type (b/n/m/j/o/1/2/3/4/5):	Location of report:
b: book	Start of account
n: newspaper	Earthquake date (ymd):
m: manuscript	Earthquake time:
j: article in a journal or serial	Earthquake duration:
o: other	Summary adjective (including "felt"):
1: Anon (1812)	Comparison with other shocks:
2: Pearce (1812)	More details? (y/-)?
3: Mitchell (1815)	Reports of effects on people? (y/-):
4: Cramer (1814)	Felt level reported? (y/p/-):
5: Drake (1814)	p: reported as felt, no details
[b] Book title:	Felt by fraction (n/f/s/m/o/a/-):
[b] Book author:	n: not felt
[b] Book date:	f: felt by few
[b] Book publisher:	s: felt by some
[b] Book published at:	m: felt by many
[b] Book page:	o: felt by most
[b] Street (1984) page number:	a: felt by all
[n] Newspaper published at:	Felt by location (i/s/a/-):
[n] Newspaper title:	i: felt indoors only
[n] Newspaper date (ymd):	s: felt by some outdoors
[n] Newspaper page/column:	a: felt by all outdoors
[n] Street (1984) page number:	Giddiness reported? (s/n/-):
[m] Manuscript repository (w/s/o):	s: some giddiness
w: Western Historical Manuscripts Center	n: nausea
s: Shaker Collection	Alarm reported? (y/-/p):
o: other	p: alarm reported, no details
[o] Repository name:	Degree of alarm (s/m/r/p):
[m] Repository locator info:	s: slight alarm/some frightened
[m] Manuscript name:	m: many frightened
[m] Street (1984) page number:	r: many frightened and ran outdoors
[j] Journal article author:	p: all frightened
[j] Journal article title:	Difficulty standing (s/m/g/t/-):
[j] Journal date:	s: slight difficulty standing
[j] Journal title:	m: some difficulty standing
[j] Journal volume:	g: great difficulty standing
[j] Journal pages:	t: everyone falls over
[j] Street (1984) page number:	Difficulty walking (s/m/g/-):
[o] Description of other document:	s: slight difficulty walking
[o] Street (1984) page number:	m: some difficulty walking
[1] Book page:	g: great difficulty walking
[2] Book page:	Awakening of (f/l/m/a/-):
[3] Book page:	f: few or none awakened
[4] Book page:	l: light sleepers awakened
[5] Book page:	m: many awakened
[1] Street (1984) page number:	a: all awakened
[2] Street (1984) page number:	Reported noises? (y/-):
[3] Street (1984) page number:	Noise from frame structures? (s/h/-):
[4] Street (1984) page number:	s: slight creaking of frame structures
[5] Street (1984) page number:	h: heavy creaking of frame structures
Reporter (e/c/n/a/u):	Noise from the ground? (r/c/o/t/d/-):
e: editor of this newspaper/author of book	r: rumbling
c: copy from another newspaper	c: reports like cannon
n: account by named person	o: roaring
a: account by unnamed person	t: thunder
u: unclear source	d: distant thunder
[c] Location of newspaper copied from:	Reported effects on plants or animals? (y/-):
[c] Name of newspaper copied from:	Effects on plants (r/s/f/b/-):
[c] Date of newspaper copied from:	r: rustling of leaves
[n] Name of reporter:	s: shaking of bushes/trees
[n] Date of report:	f: fall of dead tree limbs or fruit
[a] Date of report:	b: breakage of tree limbs

- Effects on animals (f/b/t/o/-):
f: animals disturbed
b: animals broke loose
t: birds took flight
o: animals fall over
- Reports of effects on household goods? (y/-):
Hanging objects (s/n/v/-):
s: hanging objects swung slightly
n: hanging objects swung noticeably
v: hanging objects swung violently
- Small objects (o/f/-):
o: small objects overturned
f: small objects fall off shelves
- Pictures (b/t/f/-):
b: pictures bang against wall
t: pictures turn around
f: pictures fall off walls
- Doors and windows (r/m/b/-):
r: doors/windows rattle
m: doors/windows open or close
b: windows break
- Dishes/crockery (r/m/b/-):
r: dishes/crockery rattle
m: some damage to dishes/crockery
b: dishes/crockery break
- Furniture/barrels (r/m/o/b/-):
r: furniture/barrels rattled
m: furniture/barrels moved
o: furniture/barrels overturned
b: furniture/barrels broken
- Clocks affected? (s/-):
s: clocks start or stop
- Bells ring? (s/l/-):
s: small bells ring
l: large bells ring
- Liquid in containers? (d/s/-):
d: liquids disturbed
s: liquids spilled
- Reported effects on chimneys/stone walls/tombstones/plaster? (y/-):
Effects on plastering (c/s/f/-):
c: cracking of plaster/stucco
s: some fall of plaster/stucco
f: much fall of plaster/stucco
- Effects on chimneys (n/s/f/m/a/-):
n: no damage to chimneys
s: some damage to chimneys, no mention of falls
f: a few chimneys damaged, some fall
m: many chimneys damaged
a: all chimneys thrown down
- Effects on tombstones (f/m/a/-):
f: a few tombstones fall
m: many tombstones fall
a: all tombstones thrown down
- Effects on stone walls (or bad masonry) (s/c/m/m/t/-):
s: walls show slight cracking
c: walls show cracking, some falls
m: many walls collapse
m: many walls collapse
t: most walls collapse
- Effects on cornices/ornaments (s/c/m/t/-):
s: slight cracking of ornaments/cornices
c: cracking of ornaments/cornices, some falls
m: many cornices/ornaments collapse
t: most cornices/ornaments collapse
- Reports of structural damage? (y/-):
- Reports on frame structures? (y/-):
Damage to structure (n/s/m/d/-):
n: no damage to frame structures
s: frame structures slightly racked
m: major damage to frame structures
d: frame structures destroyed
- Reports on bad masonry? (y/-):
Damage level (n/s/c/d/m/t/-):
n: poor masonry-no damage
s: poor masonry-slight cracking
c: poor masonry-cracking, some falls
d: poor masonry-significant damage
m: poor masonry-many collapse
t: poor masonry-most collapse
- Reports on better masonry? (y/-):
Damage level (n/s/c/d/m/t/-):
n: better masonry-no damage
s: better masonry-slight cracking
c: better masonry-cracking, some falls
d: better masonry-significant damage
m: better masonry-many collapse
t: better masonry-most collapse
- Reports of effects on the ground? (y/-):
Ground cracking (f/w/t/-):
f: a few cracks
w: widespread cracking
t: massive cracking, deep crevasses
- Ground liquefaction (s/w/k/-):
s: some liquefaction
w: widespread liquefaction
k: sunk ground
- Sandblows (s/w/-):
s: some sandblows
w: widespread sandblows
- Bank caving? (s/w/-):
s: some banks caved
w: widespread bank caving
- Landslides? (f/s/w/t/r/-):
f: few slides on unstable slopes
s: small slides
w: widespread landsliding on steep slopes
t: landsliding on all slopes
r: rockfalls
- Any other effects?

Appendix B Problematic Records

Duplicate Records and Mis-associations

1811 December 16

Circleville Ohio

The report of effects here is identical in phrasing to an report of effects at Chillicothe Ohio, that was published there. The association with Circleville was an error made at the time, when the original report from the Chillicothe *Fredonian* was copied by the Marietta *Western Spectator* (Street page 48).

Clarksburg WV

The same words were used by the Marietta *Western Spectator* (Street page 50), reporting effects at Clarksburg Ohio, as were used by the Lexington *American Statesman and Columbian*, later, to describe effects at Clarksburg West Virginia (then Virginia; Street p. 51). It seems likely that the report from Virginia is in error.

Toronto Canada

The report from the York *Gazette* (in Toronto) of 1812/1/24 is the same as the report for Washington DC in the Frankfort *Kentucky Reporter* of 1812/1/11: both probably copying from the same source. There is thus no evidence that this shock was felt in Canada.

1812 January 23

New York New York

A report from Annapolis Maryland (Street page 6: the New York *Evening Post* (1812/1/29) copying from the Annapolis *Republican*) matches one from New York (Street page 160: the New York *Spectator* (1812/2/1)).

1812 February 7

New York New York

The New York *Spectator* and the New York *Columbian* of 1812/2/8 have identical reports.

Reports with Inadequate Time Information

Page	Date	Location
17	1811.12.16	Birdsville KY (Lilburn Lewis' farm)
23	1811.12.16	Cape Girardeau MO
27	1811.12.16	Carthage TN
67	1811.12.16	Dover TN
101	1812.02.07	18 miles from Jefferson GA, on Briar Creek
298	1812.02.04	New Madrid MO
214	1812.04.27	Lebanon OH

Reports with Inadequate Date Information

Page	Date	Location
	combined	Bedford County TN
22	combined	Cahokia IL
71	uncertain	Fort Blount TN
96	combined	Hickman KY
103	combined	Kaskaskia IL
133	uncertain	Montgomery County KY
134	combined	Mortons Gap KY
161	1812/1/31 or 1812/1/24	New York NY
169	uncertain	Paducah KY
201	combined	Shawneetown IL
226	uncertain	White County IL
303	uncertain	Big Prairie AR
297	uncertain	Little Prairie MO

Appendix C Descriptions of Effects

3 AM, 16 December 1811

Little Prairie MO [304] (2 AM); severe; slight alarm/some frightened. [294] (2 AM); "no material damage". [307] (morning); destroyed.

New Madrid MO [294] (2 AM); all frightened; great difficulty walking; roaring; a few chimneys damaged, some fall. [298] (2 AM); violent; all frightened; distant thunder; breakage of tree limbs; animals disturbed. [300] (2 AM); all frightened; major damage to frame structures; poor masonry-many collapse. [306] (inferred time); widespread cracking; (may be from more than one shock). [307] (morning); no material damage.

Island Number 9 TN [311] (inferred time); widespread liquifaction; widespread sandblows.

Dorena MO [66] (2 AM); heavy; poor masonry-many collapse.

New Bourbon MO [145] (2:05 AM); 10 min; very severe; many chimneys damaged. [145] (3 AM); 3 min; extremely severe.

Ste. Genevieve MO (inferred time); sensibly felt; poor masonry-no damage.

Herculaneum MO [93] (2 AM); 10-12 min; rumbling; no damage to frame structures; poor masonry-no damage.

Fort Osage MO (2:07 AM); 8 min; violent; some difficulty standing; distant thunder; fall of dead tree limbs or fruit; cracking of plaster/stucco; some damage to chimneys, no mention of falls.

American Bottoms IL [89] (inferred time); many chimneys damaged.

St. Louis MO [190] (2:15 AM); 2 min; violent; slight alarm/some frightened; rumbling; doors/windows rattle; furniture/barrels rattled; a few chimneys damaged, some fall; poor masonry-slight cracking.

Cahokia IL [89] (inferred time); large bells ring.

Clinton Hill IL [52] (inferred time); very violent.

Vincennes IN [210] (3 AM); felt; some damage to chimneys, no mention of falls; "no damage" besides chimneys and "the roofs of several houses thrown off".

Uniontown KY [209] (inferred time); all chimneys thrown down; poor masonry-cracking, some falls; a few cracks; some liquifaction.

Fort Massac IL [73] (2 AM); 5 min; all awakened; heavy creaking of frame structures; doors/windows rattle; all chimneys thrown down.

Springfield TN [204] (2 AM); felt; furniture/barrels rattled.

Nashville TN [136] (2:15 AM); very severe; many frightened; a few chimneys damaged, some fall; frame structures slightly racked.

Franklin TN (inferred time); alarm reported, no details; all awakened; doors/windows rattle.

Columbia TN [54] (2-3 AM); 10-15 min; violent; many frightened; all awakened; "accompanied by a peculiar sound".

Carthage TN [26] (3 AM); slight alarm/some frightened; all awakened; a few tombstones fall.

South Union KY [202] (1:05 AM); heavy.

Muhlenberg County KY [135] (inferred time); all frightened.

Hopkins County KY [98] (inferred time); distinctly felt; many frightened; shaking of bushes/trees; small objects fall off shelves; doors/windows rattle.

Henderson KY [94] (2:30 AM); severe; many chimneys damaged.

Red Banks KY [181] (2:30 AM); most violent; many frightened and ran outdoors; many chimneys damaged.

Owensboro KY [238] (inferred time); alarm reported, no details.

Hodgenville KY (Mt. Gilead, 3 mi N of Hodgenville) [97] (2 AM); 15 min; severe; some difficulty walking.

Louisville KY (near) (inferred time); severe; all awakened; doors/windows open or close; dishes/crockery rattle; furniture/barrels moved; no damage to frame structures. [118] (2:15 AM); 4-6 min; most alarming; a few chimneys damaged, some fall; chimney collapse actually took place at 8:30 AM.

Falls of the Ohio KY [79] (inferred time); felt; many chimneys damaged; poor masonry-cracking, some falls.

Jeffersonville IN [102] (inferred time); felt.

Frankfort KY [79] (2 AM); several minutes; considerable vibration; some damage to chimneys, no mention of falls. [79] (2:30 AM); 2 min; very sensibly felt; many frightened; some damage to chimneys, no mention of falls.

Lexington KY [112] (2-3 AM); felt. [112] (2:30 AM); several min; severe; distant thunder; doors/windows rattle. [112] (2:30 AM); 2 min; very severe.

Washington KY [218] (inferred time); very severe.

KY south of Cincinnati OH [43] (2:24 AM); few or none awakened.

Newport KY [158] (inferred time); a few chimneys damaged, some fall.

Cincinnati OH [42] (2:20 AM); 2-5 min; doors/windows open or close; furniture/barrels moved; some damage to chimneys, no mention of falls. [43] (2:24 AM); 6-7 min; all awakened; doors/windows rattle; furniture/barrels rattled; some damage to chimneys, no mention of falls; Phrasing very similar to Liberty Hall report. [43] (2:30 AM); all awakened; animals disturbed.

Lebanon OH [111] (inferred time); many frightened and ran outdoors. [213] (inferred time); terrible; many frightened and ran outdoors; doors/windows rattle; furniture/barrels rattled.

Dayton OH [62] (2-3 AM); severe; many frightened; all awakened; animals disturbed.

Goshen IN [89] (inferred time); alarm reported, no details; all awakened; animals broke loose.

Fort Dearborn IL (Chicago) [78] (inferred time); felt.

Worthington OH [234] (inferred time); light; felt by some.

Clarksburg OH [50] (2:30 AM); very severe.

Chillicothe OH [38] (2:15 AM); 3 min; violent; many frightened. (1-2 AM); sudden and violent; many frightened; all awakened.

Lancaster OH [107] (3-4 AM); severe; some giddiness.

Zanesville OH [241] (inferred time); 2 min; felt by many; all awakened; doors/windows rattle; furniture/barrels rattled.

Marietta OH [122] (2:35 AM); violent and very strong; many frightened; all awakened; slight creaking of frame structures; doors/windows rattle; (effects inferred from description of them being taken for an Indian attack). [122] (3:20 AM).

Wheeling WV [224] (3 AM); 15 min; all awakened; heavy creaking of frame structures; doors/windows rattle; furniture/barrels rattled.

Washington PA [221] (inferred time); slight.

Brownsville PA [20] (inferred time); slight; [time not given: may refer to 8 AM shock].

Pittsburgh PA [176] (3 AM); many frightened.

Meadville PA [130] (inferred time); 10-15 min; sensibly felt; all awakened.

Allegheny County NY [5] (inferred time); considerable severity; doors/windows open or close; small bells ring; hanging objects swung noticeably; liquids spilled; time uncertain, may refer to 8 AM shock.

Onondaga Valley NY [167] (inferred time); felt.

Norwich NY [165] (inferred time); slight; hanging objects swung slightly; liquids disturbed.

Charlestown NH [29] (inferred time); felt.

Hudson NY [99] (inferred time); felt.

New Haven CT [150] (inferred time); hanging objects swung slightly.

New York NY [159] (inferred time); Not felt.

Wilmington DE [232] (3 AM); slight.

Baltimore MD [12] (3 AM); 40 min; felt.

Washington DC [215] (inferred time); sensibly felt; felt by many.

Alexandria VA [2] (2-3 AM); 30 s; sensibly felt; clocks start or stop; "furniture shaken".

Richmond VA [183] (3 AM); witnessed; slight creaking of frame structures; small bells ring.

Norfolk VA [163] (3 AM); 1 min; severe; light sleepers awakened; furniture/barrels moved; clocks start or stop.

Edenton NC [69] (inferred time); some difficulty standing; may refer to 8 AM shock.

Raleigh NC (2 AM); smart. [179] (2-3 AM); sensibly felt; felt by few; few or none awakened.

Salem NC [194] (3 AM); fairly strong. [194] (3 AM); felt; felt by many; doors/windows rattle. [194] (3 AM); felt.

Stokes County NC [205] (inferred time); felt.

Abingdon VA [1] (inferred time); not felt.

- Knoxville TN** (inferred time); roaring; shaking of bushes/trees. [104] (2 AM); 3-5 min; all awakened; doors/windows rattle; furniture/barrels rattled.
- Sevierville TN** [199] (1 AM); felt by many; distant thunder; doors/windows rattle; furniture/barrels rattled.
- Asheville NC** (1 AM); 3 min; violent; felt by all; many frightened; all awakened; rumbling; damage to "huts"--unspecified amount.
- Laurens and Newberry SC** [53] (inferred time); some damage to chimneys, no mention of falls.
- Columbia SC** [53] (2:30 AM); 1 min; ; reported as felt, no details; many frightened; all awakened; animals disturbed; some fall of plaster/stucco.
- Stateburg SC** [53] (inferred time); severe; no damage; location given as Strasburgh.
- Pineville SC** [175] (inferred time); alarm reported, no details.
- Georgetown SC** [85] (3 AM); severe; alarm reported, no details; furniture/barrels overturned; parade ground at fort settled 1-2 inches.
- Charleston SC** [30] (inferred time); distant thunder; hanging objects swung slightly; clocks start or stop; large bells ring; liquids disturbed; may refer to 8 AM shock. [53] (inferred time); many frightened; clocks start or stop; large bells ring.
- Savannah GA** [196] (3 AM); 1 min; felt.
- Coosawhatchie SC** [59] (3 AM); very sensible; many frightened; breakage of tree limbs.
- Augusta GA** [8] (2:30 AM); 2-3 min; severe; slight alarm/some frightened; all awakened; distant thunder; doors/windows rattle; shaking of bushes/trees; felt like the rocking of a cradle.
- Milledgeville GA** [132] (inferred time); large bells ring.
- Fort St. Stephens AL** [76] (inferred time); shake very much; birds took flight.
- Fort Stoddard AL** [77] (inferred time); felt; account is of two shocks, times not given.
- New Orleans LA** [154] (inferred time); not felt.
- Washington MS** [220] (inferred time); shaking of bushes/trees.
- Natchez MS** [138] (2:10 AM); 1-5 min; all awakened; shaking of bushes/trees; hanging objects swung noticeably; small objects fall off shelves; some damage to dishes/crockery; clocks start or stop; small bells ring; cracking of plaster/stucco. [139] (2 AM); pretty strong.
- Natchitoches LA** (2 AM); considerable; many frightened and ran outdoors.
- Ozark Village AR** [168] (inferred time); many chimneys damaged; major damage to frame structures; secondhand account.
- Fort Pickering TN** [75] (inferred time); trembled. [75] (inferred time); very severe; liquids spilled; few slides on unstable slopes; water thrown about in river.
- Chickasaw Bluffs TN** [37] (2:20 AM); felt

7 AM, 16 December 1811

Little Prairie MO [304] (about sunrise); very severe; widespread cracking; widespread sandblows. [306] (inferred time); major damage to frame structures; widespread cracking; sunk ground; time inferred from other accounts.

a few miles above Little Prairie, on the river MO [286] (after sunrise); breakage of tree limbs; sunk ground; widespread bank caving.

New Madrid MO [294] (7:15 AM); "most severe yet"; roaring. [298] (about sunrise); "more violent" than the 3 AM shock.

New Bourbon MO [145] (7:12 AM); 4 min; small objects fall off shelves; pictures fall off walls; dishes/crockery break; many chimneys damaged. [145] (7:29 AM); 2 min; slight. [145] (7:50 AM); lightly felt.

Herculaneum MO [93] (about daylight, before sunrise); 1.5-2 min; hanging objects swung noticeably; large bells ring; some damage to chimneys, no mention of falls; difficult to separate from following shock. [93] (about sunrise); hanging objects swung noticeably; large bells ring; a few chimneys damaged, some fall; difficult to separate from previous shock.

St. Louis MO [190] (8 AM); 30 sec; felt; almost as strong as the first.

Springfield TN [204] (about sunrise); some difficulty standing.

Franklin TN (8 AM); distant thunder; shaking of bushes/trees; liquids spilled.

Carthage TN [26] (about sunrise); not as severe as the first.

South Union KY [202] (7:20 AM); hard; shaking of bushes/trees.

Henderson KY [94] (sunrise); all chimneys thrown down.

Red Banks KY [181] (sunrise); most severe; many chimneys damaged; (chimney damage may be from 3 AM shock).

Hodgenville KY (Mt. Gilead, 3 mi N of Hodgenville) [97] (a little after sunrise); a few min.

Louisville KY [118] (a little after sunrise); much less strong than 2:15 AM.

Frankfort KY [79] (7-8 AM); felt; not as strong as 3 AM.

Lexington KY [112] (7:30 AM); less strong than 2:30 AM.

Cincinnati OH [42] (7:20 AM); 1 min; slightly less strong than 2:20. [42] (7:30 AM); comparable to 2:50 AM. (7:20 AM); 1 min; moderate rocking. (7:30 AM); slight. [43] (8 AM); less violent than 2:30 AM.

Chillicothe OH [38] (7:16 AM); 2 min; distant thunder; pretty violent; water in puddles thrown out. [38] (8:05 AM); poor masonry-no damage; tolerable hard. (8 AM); 30 sec; similar to 2 PM.

Circleville OH [48] (8 AM); 30 sec; similar to 1811 12 16, 3AM.

Lancaster OH [107] (at sunrise); "less terrible" than 3 AM shock; shaking of bushes/trees.

Zanesville OH [241] (8 AM); 4 min; considerable; shaking of bushes/trees; hanging objects swung noticeably; doors/windows open or close; clocks start or stop.

Marietta OH [122] (7:30 AM).

Wheeling WV [224] (8 AM); "not so violent" as 3 AM.

Pittsburgh PA [176] (7 AM); smaller than 3 AM shock.

Meadville PA [130] (8 AM); nearly as severe as 3 AM, but shorter; shaking of bushes/trees; liquids disturbed.

Arkport NY [7] (about sunrise); 15 min; felt by many; felt indoors only; some giddiness; slight alarm/some frightened; hanging objects swung slightly; doors/windows open or close; small bells ring.

Onondaga Valley NY [167] (inferred time); felt.

Hackensack NJ [90] (8 AM); 30 s; severe; some giddiness; pictures bang against wall.

Philadelphia PA [171] (8:10 AM); felt by few; few or none awakened; hanging objects swung slightly.

Wilmington DE [232] (8 AM); felt.

Baltimore MD [12] (8 AM); 40 minutes; felt.

Alexandria VA [2] (8 AM (about)); 30 s; sensibly felt; clocks start or stop.

Richmond VA [183] (8 AM); hanging objects swung slightly. [183] (6 AM). [183] (8 AM).

Norfolk VA [163] (8 AM); very violent; felt by many.

Raleigh NC (7 AM); 40 sec; slight alarm/some frightened; furniture/barrels rattled. [179] (7 AM); not as strong as 2 AM; felt by few; felt indoors only.

Salem NC [194] (8 AM); much less severe than 3 AM.

Asheville NC (soon after sunrise); more violent; more violent than 1 AM shock; felt by all; felt by all outdoors; nausea; alarm reported, no details; great difficulty standing; rumbling; animals fall over; furniture/barrels moved; few slides on unstable slopes; "houses shattered" but no details given.

Columbia SC [53] (8 AM).

Charleston SC [30] (8 AM (a little before)); 1 min.

Savannah GA [196] (8 AM); felt; some giddiness; distant thunder; no damage to furniture or glasses.

Augusta GA [8] (7:45 AM); felt.

Fort St. Stephens AL [76] (about sunrise); felt

8 AM, 23 January 1812

- New Madrid MO** [298] (inferred time); comparable to the shocks on 1811 12 16. [298] (inferred time); "as violent as the severest of the former ones".
- Cape Girardeau MO** [24] (inferred time); more violent than 1811 12 16; many tombstones fall; poor masonry-cracking, some falls; damage may be cumulative over three shocks.
- Vincennes IN** [211] (8 AM); severe; a few chimneys damaged, some fall; no damage to frame structures; poor masonry-no damage.
- Carthage TN** [28] (8 AM); 4-5 min; comparable to 1811 12 16.
- Russellville KY** [188] (8 AM); felt; comparable to 1811 12 16.
- Barrens KY** [128] (inferred time); shaking of bushes/trees; animals disturbed.
- Mammoth Cave KY** [121] (inferred time); many frightened and ran outdoors.
- Hodgenville KY (Mt. Gilead, 3 mi N of Hodgenville)** [97] (8 AM); several min; severe.
- Louisville KY** [113] (inferred time); small objects fall off shelves; a few chimneys damaged, some fall; a few cracks. [119] (8:50 AM); more severe than 1811 12 16; many frightened; small objects overturned; a few chimneys damaged, some fall; a few cracks; same effects reported as American Statesman and Columbian of 1812 1 26.
- Frankfort KY** [80] (6 AM); 1 min; very severe.
- Lexington KY** [113] (8:40 AM); very sensibly felt; felt by most. [113] (9 AM); felt. [113] (9 AM); comparable to earlier large shocks.
- Georgetown KY** [84] (9 AM); "perhaps as severe as" 1811 12 16.
- Paris KY** [170] (8:50 AM); 1.5 min; considerable; some giddiness; hanging objects swung violently; doors/windows open or close.
- Washington KY** [219] (9:15 AM); 1 min; considerable; distant thunder.
- Newport KY** [158] (inferred time); severe; some difficulty standing.
- Cincinnati OH** (9 AM); 4-5 AM; nearly equal to 1811/12/16 2:24 AM. [44] (9 AM); 3 min; very smart; equal to 1811 12 16 "say some". [44] (8:44 AM); 2-3 min; felt; at least as violent as 1811 12 16, 8 AM shock.
- Dayton OH** [63] (8-9 AM); more severe than any previous.
- Fort Wayne IN** [78] (inferred time); felt.
- Detroit MI** [65] (8:30); felt by some; hanging objects swung noticeably; liquids spilled.
- Worthington OH** [236] (9 AM); 1 min; severely felt.
- Chillicothe OH** [39] (9 AM); 2 min; considerable. (9:15 AM); violent; more terrible than Dec 16; liquids spilled.
- Zanesville OH** [243] (inferred time); comparable to 1811 12 16.
- Coshocton OH** [60] (8:17 AM); 1 min; severe; shaking of bushes/trees; liquids spilled; some fall of plaster/stucco; some damage to chimneys, no mention of falls.

- Marietta OH [123] (inferred time);** 4 min; a little less violent than 1811 12 16; rumbling; furniture/barrels rattled.
- Wheeling WV [224] (9:15 AM);** comparable to 1811 12 16.
- Lake George NY [229] (inferred time);** smart; (location given as William Henry).
- Hartford CT [92] (9:15 AM);** sensibly felt.
- New Haven CT [149] (9 AM);** 30 sec; felt; felt by few; felt indoors only; some giddiness.
- Jamaica NY [100] (9:15 AM);** sensibly felt; felt by some; hanging objects swung noticeably.
- New York NY [160] (9:10 AM);** felt; felt by some; slight alarm/some frightened; pictures bang against wall; dishes/crockery rattle.
- Newark NJ [141] (9 AM);** slight; felt by some; felt indoors only; pictures bang against wall; furniture/barrels rattled.
- Nottingham MD [166] (9:20 AM);** 1 min; felt by few; felt indoors only.
- Annapolis MD [6] (9:44 AM);** 2-3 min; severe; felt by some; felt indoors only; slight alarm/some frightened; some giddiness; hanging objects swung slightly.
- Easton MD [68] (9 AM);** 1 min; very sensibly felt; felt by many; some giddiness; slight alarm/some frightened; hanging objects swung noticeably; clocks start or stop.
- West River MD (Baltimore) [13] (9 AM);** 1-2 min; felt; felt indoors only; some giddiness; hanging objects swung noticeably; small objects overturned; like being in a heavy swell.
- Washington DC [216] (9:10 AM);** felt; felt by most; slight alarm/some frightened; hanging objects swung noticeably; dishes/crockery rattle.
- Alexandria VA (9:20 AM);** 30 s; distinctly felt; slight alarm/some frightened. **(8:20 AM);** 20 sec; comparable to 1811 12 16.
- Richmond VA [184] (9 AM);** distinctly felt; slight alarm/some frightened; slight difficulty standing; hanging objects swung noticeably; doors/windows open or close; liquids disturbed.
[184] (9:30 AM); felt; small objects fall off shelves.
- Norfolk VA [164] (9:03 AM);** same as 1811 12 16; some difficulty standing; some difficulty walking; hanging objects swung violently; clocks start or stop.
- Suffolk VA [207] (9:22 AM);** 8 sec; sensibly felt; felt by all; some giddiness; slight alarm/some frightened.
- Edenton NC [70] (9:15 AM);** 45 s; some giddiness; slight alarm/some frightened; distant thunder.
- Raleigh NC [180] (8 AM);** few sec; slight.
- Salem NC [195] (9 AM);** felt.
- Rogersville TN [187] (9 AM);** 3 min; severe; stronger than 1811 12 16.
- Dandridge TN [61] (8:50 AM);** 2 min; felt by most; hanging objects swung noticeably; doors/windows rattle.
- Knoxville TN [105] (8:40 AM);** 4 min; felt; much lighter than 1811 12 16; felt by most; many frightened; small objects fall off shelves; doors/windows rattle; furniture/barrels rattled.

Sevierville TN [199] (8:50 AM); 2 min; doors/windows rattle.

Charleston SC [32] (9:15 AM); 1 min; more severe than 1811 12 16; felt by many; poor masonry-slight cracking.

Savannah GA [197] (9 AM); 1 min; severe; some giddiness; hanging objects swung noticeably; pictures bang against wall.

Augusta GA [9] (8-9 AM); felt; equal, perhaps exceeded 1811 12 16.

New Orleans LA [155] (9 AM); few sec; slight; felt by few; felt indoors only; pictures bang against wall; dishes/crockery rattle; clocks start or stop

4 AM, 7 February 1812

New Madrid MO [298] (4 AM); hard; "much more violent than those preceding it"; massive cracking, deep crevasses; sunk ground; widespread sandblows; widespread bank caving; very large wave on the Mississippi. [307] (inferred time); material injury. [309] (inferred time); frame structures destroyed; poor masonry-significant damage; massive cracking, deep crevasses; sunk ground. [312] (inferred time); massive cracking, deep crevasses; sunk ground; widespread sandblows.

Cape Girardeau MO [24] (inferred time); 10-15 min; more violent than preceding two large shocks; many tombstones fall; poor masonry-significant damage; damage may be cumulative over three shocks.

St. Louis MO [192] (2-3 AM); severe; stronger than any before; a few chimneys damaged, some fall; poor masonry-significant damage.

Vincennes IN [212] (2:15 AM); heavy; a few chimneys damaged, some fall; no damage to frame structures; poor masonry-no damage.

Livingston County KY [117] (inferred time); rumbling; animals disturbed.

Fort Massac IL [74] (inferred time); some banks caved.

Nashville TN [137] (inferred time); a few chimneys damaged, some fall; poor masonry-slight cracking.

South Union KY [202] (3 AM); tremendous.

Russellville KY [189] (3:30 AM); stronger than any felt before.

Webster County KY [223] (inferred time); alarm reported, no details.

Hodgenville KY (Mt. Gilead, 3 mi N of Hodgenville) [97] (4 AM); 15 min; very severe; distant thunder.

Louisville KY [120] (inferred time); poor masonry-cracking, some falls. [120] (3:15 AM); perhaps as severe, and longer, than any before; a few chimneys damaged, some fall; cracking of ornaments/cornices, some falls. [120] (inferred time); poor masonry-cracking, some falls. [120] (3:15 AM); 4 min at least; most tremendous; stronger than any before. (inferred time); many frightened and ran outdoors; all awakened; a few chimneys damaged, some fall; poor masonry-slight cracking; letter dated 1812 2 8.

Frankfort KY [81] (3:30 AM); "more violent and durable than any heretofore felt".

Lexington KY [114] (3:30 AM); stronger than any before; distant thunder. [114] (3:30 AM); violent; stronger and longer than any previous; many frightened. [115] (3-4 AM); more alarming and violent than any before; rumbling; poor masonry-slight cracking.

Maysville KY [127] (inferred time); some damage to chimneys, no mention of falls.

Augusta KY [11] (3:20 AM); 3 min; very severe; much more severe than 12/16 or 1/23.

Cincinnati OH (3:45 AM); greatly surpassed any other; nausea; many frightened; a few chimneys damaged, some fall; poor masonry-slight cracking; damage probably cumulative. [46] (3:32 AM); 6 min; strong; by far the most powerful; a few chimneys damaged, some fall; poor masonry-slight cracking.

- Dayton OH [64] (3:45 AM)**; strongest felt so far; many frightened; all awakened; rumbling; animals disturbed.
- Troy OH [208] (3:40 AM)**; 3-4 min, extending to 10-15; violent; strongest event so far; all awakened; heavy creaking of frame structures; poor masonry-slight cracking; ("cracking" may mean creaking).
- Fort Wayne IN [78] (inferred time)**; felt.
- Worthington OH [237] (3:30 AM)**; "more severe and of longer duration" than any before; "no material damage has been done".
- Chillicothe OH [40] (3:30 AM)**; 25 min; tremendous; many frightened; all awakened; rumbling; shaking of bushes/trees; a few chimneys fall; poor masonry-slight cracking. **(3:45 AM)**; 3 min; very severe; distant thunder. **[49] (inferred time)**; rumbling; some damage to chimneys, no mention of falls.
- Circleville OH [49] (inferred time)**; rumbling; some damage to chimneys. **[49] (3:45 AM)**; 3 min; severe; much more terrible than others; rumbling.
- Lancaster OH [109] (inferred time)**; many frightened and ran outdoors. **[109] (3:30 AM)**; 5-6 min; violent; stronger than any others; many frightened and ran outdoors; all awakened; small bells ring; animals disturbed; account dated 1812 2 13.
- Brownsville OH [19] (inferred time)**; many frightened; all awakened.
- Zanesville OH [244] (3:45 AM)**; "more violent" than any felt before.
- Marietta OH [124] (3:40 AM)**; 5 min; felt; "more violent than any before felt".
- Wheeling WV [224] (4 AM)**; severe; "more severe" than anything before; many frightened and ran outdoors; some damage to chimneys, no mention of falls.
- Brownsville PA [21] (3-4 AM)**; 5-6 min; sensibly felt; felt by many; many frightened; all awakened; hanging objects swung noticeably; dishes/crockery rattle; stronger on the riverbanks.
- Pittsburgh PA [177] (4 AM)**; severely felt; stronger than 1811 12 16.
- New Haven CT [150] (3 AM)**; 1 min; ; few or none awakened; slight creaking of frame structures; pictures bang against wall; Not clear if it was felt.
- New York NY [159] (4:30 AM)**; smart. **[159] (inferred time)**; 2 min; distinctly felt; felt by some; felt indoors only; some giddiness; slight alarm/some frightened; hanging objects swung noticeably; dishes/crockery rattle. **(4-5 AM)**; sensibly felt; felt by many.
- Germantown PA [87] (4:30 AM)**; not felt; few or none awakened; rumbling; (addressed to Mr. Poulson).
- Philadelphia PA [173] (4 AM)**; felt; hanging objects swung noticeably; doors/windows open or close. **[173] (4:27.5 AM)**; 1.5 min; rumbling; furniture/barrels rattled.
- Baltimore MD [14] (4:30 AM)**; very sensibly felt.
- Washington DC (4 AM)**; felt; light sleepers awakened; some fall of plaster/stucco; (fall of plaster in only one instance). **(4:08 AM)**; 2 min; sensibly felt; stronger than 1812 1 23; light sleepers awakened. **[217] (4:05 AM)**; several min; stronger than any before. **[217] (4 AM)**; 3-4 min; severe.

Alexandria VA (4 AM); gentle undulation. (4 AM); felt.

Fredericksburg VA [83] (4:05 AM); 2 min; considerable violence; all awakened; furniture/barrels rattled.

Richmond VA [185] (3:55 AM); 1-2 min; "more powerful" than any before; all awakened; rumbling; hanging objects swung noticeably; one chimney fell.

New Bern NC [143] (4 AM); 2 min; strong and alarming.

Raleigh NC (4 AM); felt.

Pinckneyville SC [174] (inferred time); felt; distant thunder; animals disturbed; (state not given, assumed to be SC not GA IL KY MS).

Columbia SC [55] (3:30 AM); 2 min; far more severe than any before; all frightened; all awakened; some fall of plaster/stucco; some damage to chimneys, no mention of falls.

Georgetown SC [86] (4 AM); most severe of any; nausea; many frightened; some difficulty standing; all awakened; heavy creaking of frame structures; rumbling; doors/windows rattle; furniture/barrels rattled.

Charleston SC [33] (4 AM); 3 min; severe; much longer than any earlier; small objects fall off shelves; dishes/crockery rattle.

Beaufort SC [15] (4 AM); 4-5 min; most severe felt; many frightened; slight difficulty walking; all awakened; poor masonry-slight cracking.

Savannah GA [198] (4 AM); 2 min; severe and tremendous; many frightened; rumbling; clocks start or stop; poor masonry-slight cracking.

Augusta GA [10] (3:40 AM); 3-4 min; severe; more severe than any preceding.

New Orleans LA [156] (3:30 AM); felt; "much more strong" than 1812 1 23. [156] (inferred time); slight

Appendix D Intensity Scale Used

In keeping with the style of Richter (1956), an effect is listed at the intensity at which it is most characteristic; effects may sometimes be observed at a lower level, but would not be common. Effects given less weight are in smaller type. Additions to the MM56 scale are in square brackets.

- I** Not felt [detected only by resonant effects such as seiches].
- II** Felt by persons at rest on upper floors or favorably placed.
- III** Felt indoors. Hanging objects [observed to] swing [somewhat]. Duration estimated. May not be recognized as an earthquake. Vibration like passing of light trucks.
- IV** [Long-period motion may cause dizziness or nausea.] [Trees and bushes shaken slightly]. Hanging objects swing [noticeably]. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV, wooden walls and frames creak. Vibration like passing of heavy trucks.
- V** Felt outdoors; direction estimated. Sleepers awakened. [Trees and bushes shaken]. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures, move. [Pictures may fall.] Liquids disturbed, some spilled. Pendulum clocks stop; start, change rate.
- VI** Generally felt; many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc. fall off shelves. Pictures fall off walls. Furniture moves or overturned. Small bells ring (church, school). Trees, bushes sway visibly or are heard to rustle. Weak plaster and masonry D cracked.
- VII** Difficult to stand [because of accelerations rather than dizziness]. Hanging objects quiver; furniture breaks. Large bells ring. Weak chimneys broken off at roof line. Fall of plaster, loose bricks, stones, tiles, cornices, unbraced parapets and architectural ornaments. Damage to masonry D, including cracks. Some cracks in masonry C. Waves on ponds, water turbid with mud. Small slides and caving in along sand and gravel banks.
- VIII** Branches broken from trees. Twisting, fall of chimneys, monuments, towers. Fall of stucco and some masonry walls. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Damage to masonry C and partial collapse. Decayed piling broken off. Cracks in wet ground and on steep slopes. Changes in flow or temperature of springs and wells.
- IX** General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse. General damage to foundations. Frame structures, if not bolted down, shift off foundations. Frames racked. Conspicuous cracks in ground. In alluviated areas sand and mud ejected, earthquake fountains, sand craters.