

PALEONTOLOGICAL RESOURCE INVENTORY AT CHICKASAW NATIONAL RECREATION AREA, OKLAHOMA

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Abstract—Chickasaw National Recreation Area (CHIC), located in south-central Oklahoma east of the Arbuckle Mountains, is best known for its wildlife and water recreation. Few visitors are aware of the important paleontological resources that occur in the park. During the summer of 2016, a comprehensive field inventory of paleontological resources within CHIC was conducted. The inventory process involved primary literature research, an extensive field survey of fossiliferous units, and inventories of collections and repositories. The field survey yielded eight new fossiliferous localities, and eight previously undocumented taxa within CHIC. This is the first discovery of fossils in the Deese Group and Sycamore Limestone within the recreation area. During the 2016 inventory, fossils were documented at all previously known localities within CHIC, except for those localities now submerged under the Lake of the Arbuckles. Collections were made of the representative fauna found within CHIC, and 73 fossil specimens were accessioned into museum collections. This inventory will provide a baseline source of information critical for future research, resource monitoring, and management decisions that may involve paleontological resources at CHIC.

INTRODUCTION

Chickasaw National Recreation Area (CHIC) protects the Lake of the Arbuckles and surrounding areas in Murray County, south-central Oklahoma (Fig. 1) and currently comprises 4,001.87 ha (9,888.83 acres). CHIC and the immediate vicinity preserve an excellent geologic record of the Paleozoic Era, from approximately 500 to 300 Ma (Fig. 2). Fossil invertebrates, vertebrates, plants, and trace fossils are documented from 11 fossiliferous stratigraphic units ranging from Middle–Late Ordovician (460–455 Ma) through the Middle Pennsylvanian (307 Ma).

Prior to the damming of the lake and establishment of the recreation area as an NPS unit, numerous scientific studies have documented the fossils in CHIC. These studies include the description of two type specimens, one an ostracod (*Sansabella unicornis* Girty, 1909) and the other a palynomorph (*Quisquilities buckhornensis* Wilson and Urban, 1963). However, until now, no park-specific inventory has been conducted within CHIC to determine exactly what paleontological resources are present.

The diversity of fossils found in CHIC and the immediate vicinity provides a detailed view into the paleoecology of the area during the Paleozoic Era (Table 1). The quality of preservation is remarkable in many specimens, especially in brachiopods and trilobites from the Viola and Hunton groups. There are a number of localities that have provided abundant fossils in recent years, but are now temporarily under water due to rises in lake elevation. There is high potential for these units to be exposed again in the near future, potentially adding a variety of new information to the already diverse fossil record within CHIC. Having a complete inventory of the paleontological resources at CHIC is essential for the creation of a monitoring and management plan to protect these non-renewable resources.

STRATIGRAPHY OF FOSSILIFEROUS UNITS

Viola Group (Late Ordovician)—the Viola Springs Formation, a white to gray chert-rich limestone interbedded with thin layers of green-gray shale, overlain by the Welling Formation, a coarser gray limestone (Amati and Westrop, 2006; Blome et al., 2013). The two units are mapped as undifferentiated along the southern and eastern boundaries of CHIC.

Hunton Group (Late Ordovician–Devonian)—comprises thin beds of white to light-blue crystalline limestone, thin tan limestone, and marls (Taff, 1904; Amsden, 1958). All five formations in the Hunton Group are exposed along the southern boundary of CHIC and are highly fossiliferous. They are sometimes divided into the Lower and Upper Hunton groups. The Lower Hunton Group consists of the Cochrane, Clarita, and Henryhouse formations, and the Upper Hunton Group consists of Haragan and Bois d'Arc formations (Blome et al.,

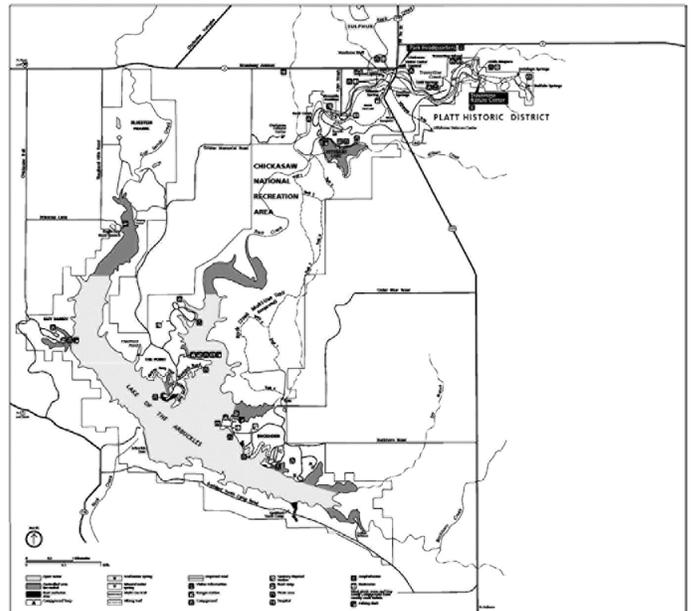


FIGURE 1. Area map of Chickasaw National Recreation Area (4,002 ha) located in south-central Oklahoma (NPS Graphic).

2013).

Woodford Shale (Late Devonian–Early Mississippian)—a formation of dark shale and bedded chert with phosphatic concretions in the lower part (Blome et al., 2013). Within CHIC, the Woodford Shale is mapped undivided from the Welden Limestone and Sycamore Limestone along the southern edge of the Lake of the Arbuckles.

Sycamore Limestone (Early–Middle Mississippian)—mapped as undifferentiated from the Woodford Shale and Sycamore Limestone within CHIC. The Sycamore is fine-grained, silty and cherty limestone with thin layers of dark-gray shale and lime-rich siltstone overlain by dark-gray shale and tan marlstone (Ham, 1969; Blome et al., 2013).

Caney Shale (Middle–Late Mississippian)—composed of dark-gray to black shale with concretions. This unit is mapped in the southeast corner of CHIC (Blome et al., 2013). The only known fossiliferous locality is presently submerged under the Lake of the Arbuckles.

Deese Group (Middle Pennsylvanian)—mapped east of the Arbuckle Dam and in the southeast corner of CHIC, the Deese is

TABLE 1. Summary of CHIC stratigraphy, fossils, and depositional environments listed from youngest to oldest. Modified from Tweet et al. (2015).

Formation	Age	Fossils Within CHIC	Depositional Environment
Quaternary sediments	Pleistocene–Holocene	None to date	Terrestrial/marine
Vanoss Formation	Late Pennsylvanian	None to date	Terrestrial/alluvial
Deese Group	Middle Pennsylvanian	Brachiopods, stalked echinoderms, bryozoans	Terrestrial/marine
Springer Formation	Late Mississippian–Early Pennsylvanian	None to date	Terrestrial/marine
Caney Shale	Middle–Late Mississippian	Brachiopods, ostracods, acanthodians	Marine
Sycamore Limestone	Early–Middle Mississippian	Stalked echinoderms, brachiopods	Marine
Woodford Shale	Late Devonian–Early Mississippian	Acritarchs, algae, ostracods, plant spores	Moderately deep marine
Hunton Group: Bois d’Arc Formation	Early Devonian	Brachiopods, crinoids, trilobites, cephalopods	Shallow marine
Hunton Group: Haragan Formation	Early Devonian	Brachiopods, bryozoans, crinoids, rugose corals, trilobites, conodonts, gastropods	Shallow marine
Hunton Group: Henryhouse Formation	Late Silurian	Brachiopods, bryozoans, corals, ostracods, trilobites, crinoids	Shallow marine
Hunton Group: Clarita Formation	Early–Middle Silurian	Brachiopods, conodonts, foraminifera, stalked echinoderms	Moderately deep marine
Hunton Group: Cochrane Formation	Early Silurian	Conodonts, invertebrate burrows	Deep marine
Sylvan Shale	Late Ordovician	None to date	Deep marine
Viola Group: Welling and Viola Springs formations	Late Ordovician	Brachiopods, bryozoans, burrows, echinoderms, trilobites, ostracods	Deep marine
Simpson Group: Bromide Formation	Middle Ordovician	Potential brachiopods, ostracods	Reworked coastal sediments, then shallow marine
Simpson Group: Tulip Creek Formation	Middle Ordovician	None to date	Reworked coastal sediments, then shallow marine
Simpson Group: McLish, Oil Creek and Joins formation	Middle Ordovician	None to date	Shallow marine

described as having beds of sandstone, conglomerate, limestone, and gray and red shale (Blome et al., 2013). Figure 3 shows the first fossils definitively documented from the Deese Group in CHIC.

METHODS

Preliminary work was conducted by reviewing literature that reported fossiliferous localities within CHIC boundaries. The Southern Plains Network Paleontological Resource and Monitoring report (Tweet et al., 2015) was an important source regarding relevant literature and potential localities. Potentially fossiliferous areas were also determined by using the geologic map by Blome et al. (2013) (Fig. 1). The field survey consisted of visiting these localities, documenting fossil occurrences and collecting samples of the representative fauna within CHIC. Collected fossils were identified using the literature, and

taxonomic classification was verified using Internet databases, such as the PaleoBiology Database. The specimens were then accessioned into CHIC’s museum collections. Each fossiliferous locality, new and previously reported, was given a park-specific name and unique identifying number (CHIC PAL ###) and was documented in the CHIC paleontological resource inventory report (Korn et al., in press, Appendix D). For a full list of taxa documented within CHIC from previous publications, see Korn et al. (in press).

FOSSIL PROTIST INVENTORY

Caney Shale or Deese Group (Mississippian or Pennsylvanian)

Phylum Foraminifera: There were reports of *Fusulina* sp. collected by Taff in the Caney Shale, but the locality may potentially

Time Period	Stratigraphic Unit	
Quaternary	Alluvium and Colluvium	
Permian	Pontotoc Group	Stratford Formation
Pennsylvanian		Vanoss Formation
	Deese Group	
	Atoka and Wapanucka formations	
Mississippian	Springer Formation	
	Caney Shale	
	Sycamore LM, Weldon LM, Woodford Shale	
Devonian	Hunton Group	Upper part
Silurian		Lower part
Upper Ordovician	Sylvan Shale and Viola Group	Sylvan Shale
		Viola Group
Middle Ordovician	Simpson Group	

FIGURE 2. Stratigraphic column with time scale for CHIC. Modified from Blome et al. (2013).

be the Deese Group (Tweet et al., 2015).

Clarita Formation (Lower–Middle Silurian)

Phylum Foraminifera: Arenaceous Foraminifera have been reported (Amsden, 1960).

FOSSIL PLANT INVENTORY

Woodford Shale (Upper Devonian–Lower Mississippian)

Kingdom Plantae: *Tasmanites* algae and the type specimen of the palynomorph *Quisquilites buckhornensis* (SNOMNH OPC 7026-19036) were reported by Wilson and Urban (1963).

Source Unit Unknown

Kingdom Plantae: During the 2016 survey fossilized wood, resembling *Dadoxylon*, was collected as wash up from the lake.

FOSSIL INVERTEBRATE INVENTORY

Viola Group (Upper Ordovician)

Phylum Bryozoa: Glaser (1965) reported bryozoans within CHIC.

Phylum Brachiopoda: Eight brachiopod species were reported by Alberstadt (1967, 1973). During the 2016 fossil survey, *Austinella* sp., *Lepidocyclus cooperi*, and *Lepidocyclus oblongus* were collected, and several poorly preserved brachiopod specimens were observed in the Welling Formation. A lingulid specimen was found on the bank near a Viola Group locality, but the source unit is unknown.

Phylum Arthropoda: Glaser (1965) reported ostracods. There have been reports of abundant trilobites in the Welling Formation by Glaser (1965) and Alberstadt (1967). During the survey, trilobite fragments were collected in the Welling Formation, and *Cryptolithoides ulrichi* specimens were collected from the Viola Springs Formation.

Phylum Mollusca: Cephalopods were reported in the Viola Group by Glaser (1965), and two *Orthoceras* fragments were collected during the 2016 fossil survey.

Phylum Echinodermata: Glaser (1965) and Alberstadt (1967) reported echinoderm crown plates and columnals in the Welling Formation. During the field survey, a stalked echinoderm calyx was observed, and fossiliferous rocks composed primarily of echinoderm columnals were collected (Fig. 4).

Clarita Formation (Lower–Middle Silurian)

Phylum Brachiopoda: Brachiopods were reported by Amsden (1960) but were not identified or collected.

Phylum Echinodermata Stalked echinoderm plates were reported by Amsden (1960).

Henryhouse Formation (Upper Silurian)

Phylum Cnidaria: Two coral species were reported by Sutherland (1965).

Phylum Bryozoa: Bryozoans were reported by Amsden (1960).

Phylum Brachiopoda: Sixteen brachiopod species were collected by Amsden (1960).

Phylum Arthropoda: Campbell (1967) collected four trilobite species and Amsden (1960) collected two taxa.

Henryhouse-Haragan formations (Upper Silurian–Lower Devonian)

During the 2016 fossil survey, the Henryhouse and Haragan formations were not differentiable at some localities, so a combined designation (Henryhouse-Haragan [Upper Silurian–Lower Devonian]) was used.

Phylum Cnidaria: Rugose corals were collected during the 2016 survey.

Phylum Bryozoa: *Cyphotrypa corrugata*, *Stromatorypa* sp., and an unidentified encrusting bryozoan were collected during the field survey.

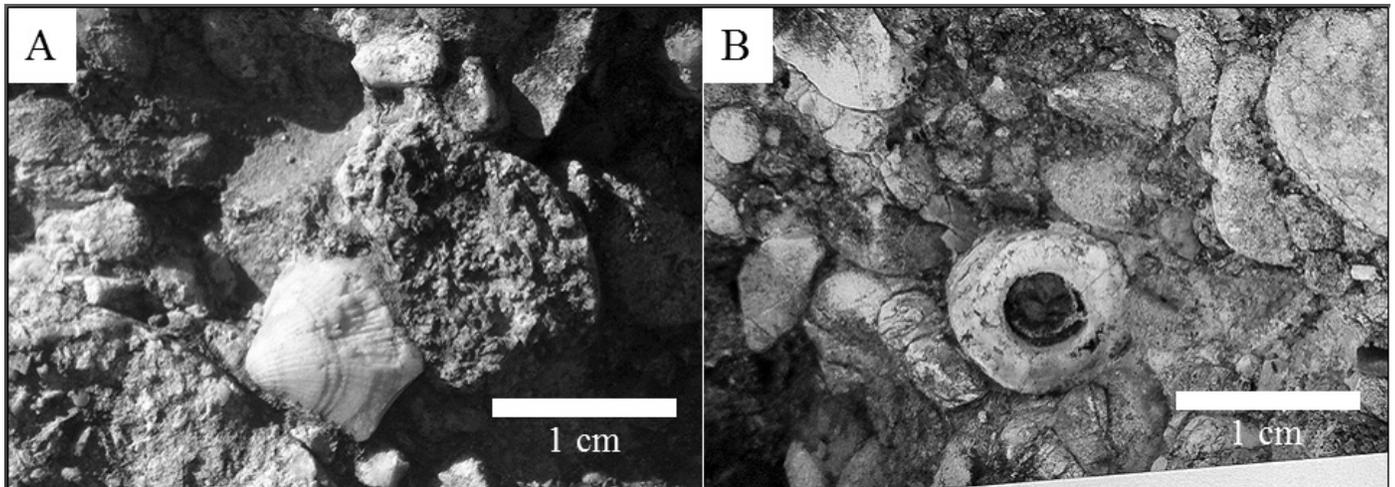


FIGURE 3. Fossils preserved in the matrix of the Deese Group conglomerate facies. **A**, A brachiopod. **B**, An echinoderm stalk (Korn et al., in press).

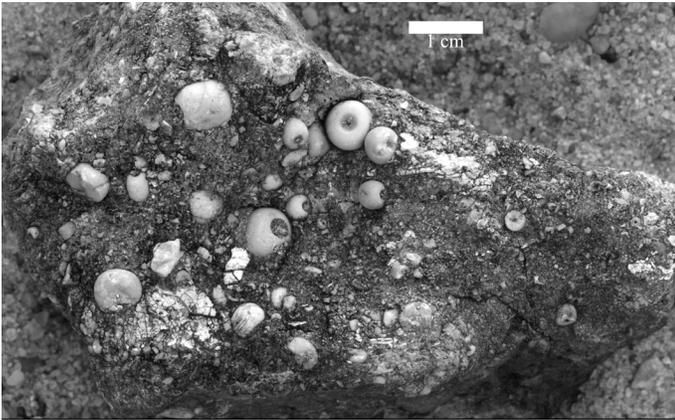


FIGURE 4. Unidentified stalked echinoderm columnals from the Welling Formation of the Viola Group of the “Veterans Lake” echinoderm locality (Korn et al., in press).

Phylum Brachiopoda: *Atrypa oklahomensis*, *Dicoelosia varica*, *Kozlowskiella* (*Megakozlowskiella*) *velata*, *Leptaena acuticuspidata*, *Levena* sp., *Levena subcarinata pumilis*, *Lissostrophia? cooperi*, *Meristella atoka*, *Obturamentella? wadei*, cf. *Orbiculoidea* (Fig. 5), *Orthostrophia strophomenoides*, *Ptychopleurella ?rugiplicata*, *Rhipidomelloides oblata* (synonymized with *Dalejina*), *Rhynchospirina maxwelli*, *Schuchertella attenuata*, and *Sphaerirhynchia? lindenensis* were collected during the 2016 survey.

Phylum Arthropoda: The trilobites *Huntonia* sp., *Kainops raymondi* (previously known as *Paciphacops raymondi*), *Reedops deckeri*, and an unidentifiable thorax were collected during the survey.

Phylum Mollusca: A fragment of the cephalopod *Orthoceras* was collected during the fossil survey.

Phylum Echinodermata: Crinoids have been reported in the Henryhouse and Haragan formations (Stanley, 2001). A calyx fragment and columnals (circular and star-shaped lumens) were collected during the fossil survey.

Haragan Formation (Lower Devonian)

Phylum Cnidaria: Rugose corals were reported (Amsden, 1960). One specimen was collected during the 2016 survey.

Phylum Bryozoa: Eight bryozoan species were reported by Cuffey et al. (1995). During the survey, branching and fenestrate forms were collected.

Phylum Brachiopoda: Amsden (1958, 1960) reported 24 brachiopod species in the Haragan Formation. *Levena subarinata pumilis* and *Sphaerirhynchia lindenensis* were collected during the 2016 survey.

Phylum Arthropoda: Lundin (1968) reported an ostracod species. Amsden (1960) collected ostracods but did not describe the taxa. Many ostracods in this formation are noted as being reworked into the lower Haragan from the Henryhouse (Lundin, 1968). Campbell (1977) collected two trilobite species from the Haragan. During the fossil survey, *Kainops raymondi* and an unidentifiable pygidium were collected.

Phylum Mollusca: Gastropods were reported but not described (Amsden, 1960).

Phylum Echinodermata: Amsden (1960) reported a crinoid species together with disarticulated holdfasts and columnals. Columnals were collected during the 2016 survey.

Bois d’Arc Formation (Lower Devonian)

Phylum Brachiopoda: Six brachiopod species were reported by Amsden (1958, 1960). During the 2016 survey, several brachiopods were observed but not collected.

Phylum Arthropoda: Campbell (1977) reported a trilobite species.

Phylum Echinodermata: During the fossil survey, several echinoderm stems were collected.

Sycamore Limestone (Lower–Middle Mississippian)

Phylum Echinodermata: Echinoderm stalk segments were observed during the 2016 fossil survey.

Caney Shale (Middle–Upper Mississippian)

Phylum Brachiopoda: Girty (1909) reported the brachiopod *Productella hirsutiformis*.

Phylum Arthropoda: *Cytherella* aff. *benniei* and the type specimen of *Entomis unicornis* (USNM PAL 120749) (Girty, 1909; later *Sansabella unicornis* Bassler and Kellett, 1934) were collected from the Ahlso Member.

Caney Shale or Deese Group (Mississippian or Pennsylvanian)

Phylum Brachiopoda: There were reports of *Productus* in the Caney Shale collected by Taff, but the locality is potentially the Deese Group (Tweet et al., 2015).

Deese Group (Middle Pennsylvanian)

Phylum Bryozoa: One unidentified bryozoan was found in the matrix of the conglomerate facies during the 2016 fossil survey.

Phylum Brachiopoda: *Leptaena* sp. and *Orthostrophella? clairensis* were collected during the field survey. Several poorly preserved specimens were also observed but not collected.

Source Unit Unknown

Phylum Brachiopoda: During the survey *Diceromyonia cf. D. tersa* was collected as wash up from the lake.

Phylum Echinodermata: A stalked echinoderm bulb and coquina (predominantly echinoderm pieces with bryozoans and cirripedia plates) were collected during the field survey as wash up from the lake.

FOSSIL VERTEBRATE INVENTORY

Cochrane Formation (Lower Silurian)

Phylum Chordata: Conodonts were reported but not described by Amsden (1960).

Clarita Formation (Lower–Middle Silurian)

Phylum Chordata: Conodonts were reported but not described (Amsden, 1960; Blome et al., 2013).

Haragan Formation (Lower Devonian)

Phylum Chordata: Conodonts were reported but not described (Barrick and Clapper, 1992).

Caney Shale (Middle–Upper Mississippian)

Phylum Chordata: An indeterminate species of acanthodian fish (AMNH 425) was reported by Zidek (1972, 1975).

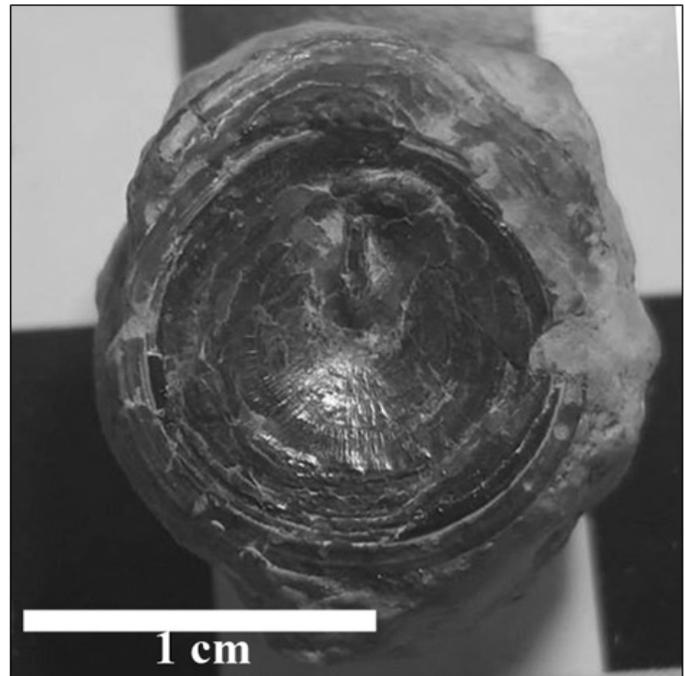


FIGURE 5. One of two specimens of cf. *Orbiculoidea* collected during the 2016 field survey (Korn et al., in press).

TRACE FOSSIL INVENTORY

Viola Formation (Upper Ordovician)

Burrows were collected during the 2016 fossil survey.

Cochrane Formation (Lower Silurian)

Invertebrate burrows were reported by Stanley (2001).

CHIC COLLECTIONS

CHIC has a small museum collection used for storing historical documents, artifacts, and specimens. In the past, CHIC fossil collections included at least 36 catalogued fossil specimens, but these were either deaccessioned by 1988 (Tweet et al., 2015) or lost due to flooding. Following the 2016 fossil survey, 73 lots of fossils were accessioned into the museum collections in order to meet the minimum level of baseline information required in the NPS Servicewide Standards (NPS, 2010). A list of all specimens collected during the 2016 survey can be found in the Appendix.

REPOSITORIES

There are three repositories holding paleontological specimens from CHIC. The Sam Noble Oklahoma Museum of Natural History (SNOMNH; Norman, OK) houses specimens collected from a locality named M10 (see Amsden, 1958; Sutherland, 1965; Campbell, 1977). The Oklahoma Geological Survey (OGS) has also collected specimens that are housed at SNOMNH. The type specimen of the palynomorph *Quisquilites buckhornensis* Wilson and Urban (1963) is stored at SNOMNH as OPC 7026-19036 on slide OPC 7026-19083. The National Museum of Natural History (USNM; Washington D.C.) has the specimens described by Girty (1909), which include the holotype specimen of the ostracod *Sansabella unicornis* (previously known as *Entomis unicornis*) (USNM PAL 120749). It is also probable that specimens collected for the U.S. Geological Survey (USGS) are at USNM. The acanthodian reported by Zidek (1972, 1975) from the Caney Shale is stored at the American Museum of Natural History (AMNH; New York, NY) (AMNH 425). OGS and USGS may have records of collected specimens (Tweet et al., 2015).

INVENTORY IMPORTANCE

Chickasaw National Recreation Area is a very fossiliferous park that preserves dynamic Paleozoic marine communities. Until summer 2016, CHIC did not have an inventory of their paleontological resources. Eight previously unreported taxa were discovered during the fossil survey, and the Sycamore Limestone and Deese Group were found to be fossiliferous within the park. The fossil inventory provides baseline paleontological resource data for developing an effective monitoring plan, future research, and paleontological decisions. Fossils are non-renewable resources important for education and scientific research. Fossil resources are protected on federal land, so it is important for the park to develop a monitoring and management plan to ensure their survival and increase awareness of their importance.

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APPENDIX

List of specimens collected during the fossil survey of summer, 2016 arranged by CHIC catalog number. An asterisk (*) denotes a specimen that has not been previously identified within CHIC.

Catalog #	Formation	Type	Identification	Quantity
2936	Henryhouse-Haragan	brachiopod	<i>Atrypa oklahomensis</i> *	2
2937	Henryhouse-Haragan	brachiopod	<i>Orthostrophia strophomenoides</i>	2
2938	Henryhouse-Haragan	brachiopod	<i>Obturamentella? wadei</i>	1
2939	Henryhouse-Haragan	brachiopod	<i>Dicoelosia varica</i>	1
2940	Henryhouse-Haragan	brachiopod	<i>Cf. Rensselaerina</i>	1
2941	Henryhouse-Haragan	brachiopod	<i>Levenea subcarinata pumilis</i>	3
2942	Henryhouse-Haragan	brachiopod	<i>Rhipidomelloides oblata</i>	3
2943	Henryhouse-Haragan	trilobite	<i>Reedops deckeri</i> (enrolled)	1
2944	Henryhouse-Haragan	trilobite	Thorax, pygidium; gen., sp. unknown	3
2945	Henryhouse-Haragan	bryozoan	<i>Stromatotrypa</i> sp.*	1
2946	Henryhouse-Haragan	bryozoan	<i>Cyphotrypa corrugata</i>	5
2947	Henryhouse-Haragan	bryozoan	<i>Cyphotrypa corrugata</i>	1
2948	Henryhouse-Haragan	bryozoan	<i>Stromatotrypa</i> sp.*	1
2949	Henryhouse-Haragan	bryozoan	Encrusting bryozoan	1
2950	Henryhouse-Haragan	brachiopod	<i>Kozlowskiella (Megakozlowskiella) velata</i>	2
2951	Henryhouse-Haragan	coral	Rugosa	3
2952	Henryhouse-Haragan	echinoderm	Calyx piece	1
2953	Henryhouse-Haragan	echinoderm	Stalked echinoderm columnals	5
2954	Henryhouse-Haragan	brachiopod	<i>Sphaerirhynchia ?lindenensis</i>	2
2955	Henryhouse-Haragan	brachiopod	<i>Leptaena acuticuspidata</i>	5
2956	Henryhouse-Haragan	brachiopod	<i>Meristella atoka</i>	1
2957	Henryhouse-Haragan	brachiopod	<i>Schuchertella attenuata</i> *	1
2958	Haragan	coral	Rugosa	1
2959	Haragan	brachiopod	<i>Sphaerirhynchia lindenensis</i>	2
2960	Haragan	brachiopod	<i>Levenea subcarinata pumilis</i>	1
2961	Haragan	trilobite	<i>Cf. Kainops raymondi</i> (cephalon)	1
2962	Bois d'Arc	echinoderm	Stalked echinoderm columnals*	4
2963	Haragan	trilobite	Pygidium; gen., sp. unknown	1
2964	Haragan	hash	Stalked echinoderm columnals, bryozoan fragments	1
2965	Source unit unknown	echinoderm	Pelmatozoan bulb	1
2966	Deese-Vanoss	brachiopod	<i>Orthostrophella? clarensis</i> *	1
2967	Source unit unknown	plant	Fossilized wood	2
2968	Source unit unknown	hash	Coquina	1
2969	Source unit unknown	brachiopod	<i>Diceromyonia cf. D. tersa</i>	1
2970	Henryhouse-Haragan	brachiopod	<i>Lissostrophia ?cooperi</i>	1
2971	Henryhouse-Haragan	brachiopod	<i>Levenea subcarinata pumilis</i>	5
2972	Henryhouse-Haragan	brachiopod	<i>Kozlowskiella (Megakozlowskiella) velata</i>	2
2973	Henryhouse-Haragan	brachiopod	<i>Rhipidomelloides oblata</i>	1
2974	Henryhouse-Haragan	brachiopod	<i>Cf. Orbiculoidea</i> *	1
2975	Henryhouse-Haragan	brachiopod	<i>Cf. Orbiculoidea</i> *	1
2976	Henryhouse-Haragan	echinoderm	Echinoderm stem fragment	1

Catalog #	Formation	Type	Identification	Quantity
2977	Henryhouse-Haragan	brachiopod	<i>Levenea</i> sp.	1
2978	Henryhouse-Haragan	brachiopod	<i>Ptychopleurella ?rugiplicata</i> *	1
2979	Henryhouse-Haragan	brachiopod	<i>Rhynchospirina maxwelli</i>	2
2980	Henryhouse-Haragan	brachiopod	<i>Meristella atoka</i>	5
2981	Henryhouse-Haragan	brachiopod	<i>Orthostrophia strophomenoides</i>	3
2982	Henryhouse-Haragan	coral	Rugosa	3
2983	Henryhouse-Haragan	bryozoan	<i>Cyphotrypa corrugata</i>	3
2984	Henryhouse-Haragan	bryozoan	<i>Cyphotrypa corrugata</i>	1
2985	Henryhouse-Haragan	bryozoan	<i>Stromatotrypa</i> sp. *	2
2986	Henryhouse-Haragan	trilobite	Pygidium; gen., sp., unknown	2
2987	Henryhouse-Haragan	trilobite	<i>Huntonia</i> sp. (pygidium)	1
2988	Henryhouse-Haragan	trilobite	<i>Kainops raymondi</i> (enrolled)	1
2989	Henryhouse-Haragan	trilobite	<i>Kainops raymondi</i> (cephalon)	1
2990	Henryhouse-Haragan	nautiloid	<i>Orthoceras</i> *	1
2991	Welling	nautiloid	<i>Orthoceras</i> *	1
2992	Welling	echinoderm	Crinoid columnals	1
2993	Viola Springs	trace fossil	Burrows	1
2994	Welling	brachiopod	<i>Lepidocyclus cooperi</i>	1
2995	Welling	brachiopod	<i>Austinella</i> sp.	1
2996	Welling	echinoderm	Crinoidal stem	1
2997	Welling	echinoderm	Crinoid columnals	21
2998	Welling	echinoderm	Crinoidal hash	2
2999	Welling	brachiopod	<i>Austinella</i> sp.	1
3000	Welling	trilobite	Trilobite cephalon; gen. sp. unknown	1
3001	Welling	trilobite	Pygidium; gen. sp. unknown	2
3002	Welling	nautiloid	<i>Orthoceras</i> *	1
3003	Viola Springs	trilobite	<i>Cryptolithoides ulrichi</i> *	5
3004	Welling	brachiopod	<i>Lepidocyclus cooperi</i>	1
3005	Welling	brachiopod	<i>Lepidocyclus cooperi</i>	1
3006	Welling	brachiopod	<i>Lepidocyclus oblongus</i> *	1
3007	Welling	hash	Crinoidal, brachiopodal, possible trilobite hash	1
3008	Source unit unknown	brachiopod	Lingulid	1

