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A Whole New World

By

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I

It lay on the sand beneath the clear still water at the very edge of Lake Huron -- that queer pebble that was to change our lives. Standing with the warm sun on my back, I stared at it for a minute wondering what it could be, then picked it up to get a better look.

Rounded, satin-smooth, grayish, and about an inch across, it might have been unnoticed among the other stones had it not been for the strange design on its upper surface. Two rows of tiny holes were lined up in a wide V-formation; I counted twelve on each side. These holes were the ends of little tubes packed together like organ pipes and radiating from the inside. All of this was embedded in a colorless translucent mineral.

The details were fading as the pebble dried; I dipped it in the water. Now I could see that the fan-shaped structure was framed by a curved two-toned band, dark on its outer edge and white within. Turning the stone, I saw between this band and the tubes a cavity filled with glassy crystals which sparkled in the sunlight.

"Put, what do you think this is?" I asked, handing it to my husband.

He looked it over and shrugged his shoulders. "I've no idea but it's certainly a curiosity. We'll try to find out."

Our two small girls had a variety of guesses, none of them helpful. When we showed it to some of our neighbors one of them suggested the false teeth of a prehistoric fish and we let it go at that.

This was the summer of 1937 -- our first in the cottage we had built south of Grand Bend, Ontario -- and we spent much of it on the beach with the children. The bright-colored stones seemed irresistible to us all and the cottage was full of them -- big heavy stones that were used as doorstops, and small ones

as smooth as marbles that lay concealed in the folds of slipcovers and were nested in many corners.

Our queer pebble was kept in a box on the mantle where it would be safe while we combed the beach for others. We found several gray ones with odd white markings which were put there too, but we never saw another with little holes.

That fall Put and I went to New York and one afternoon, while he attended to his law business, I took the box of stones out to the American Museum of Natural History.

I explained my errand to the first guide I met. He sent me to a distant corridor where I had to explain it to another man, who directed me to a certain office. On its door was lettered: "Dr. Harold E. Vokes, Assistant Curator of Paleontology." By the time I had read all that I was sorry I had come. Surely a person with such a distinguished title would not want to look at beach stones. I could not have been more wrong.

The curator proved to be a young man both friendly and interested. He offered me a chair, which was most welcome after my long walk, and opened my box. On the top were the stones with white marks; glancing at them he said, "These have bits of coral in them."

"Did you say coral? In Ontario?" I asked.

"Yes, fossil coral, you know. There were lots of corals growing in Ontario and Michigan long ago."

"Really? How long ago?"

"Oh, about three hundred million years."

Amazed, I listened while he described what was equally incredible -- a warm, shallow saltwater sea that had once covered a large part of central North America. What we had found, he said, were the

fossil remains of invertebrates which had lived in that sea; probably they had been brought to our beach from northern Michigan in the lake currents or the ice.

My prize pebble was in the bottom of the box, wrapped in tissue. He raised his eyebrows slightly when he saw it. Moistening it in the glass of water on his desk and putting a small lens to one eye, he examined it from every angle.

"Hm-m, very interesting," he said at last. "This pebble contains a Mucrospirifer weathered to show the spiralia of the brachidium."

I confessed that I hadn't the slightest idea what he was talking about; in fact, I knew nothing at all about fossils.

"Many people don't," he said reassuringly, and explained that a Mucrospirifer was a brachiopod, a sort of shellfish. He flipped through the pages of a book till he came to a certain diagram.

"Here's what I mean," he added, pushing the book towards me and pointing to the illustration. "This structure with the two coils called the brachidium supported the animal's breathing apparatus. One rarely gets a chance to see the inside of a Spirifer shell. Now tell me again just where you found this."

I located the cottage on the western shore of Lake Huron with reference to Sarnia and Grand Bend.

"Well," he said enthusiastically, "if you're interested in finding fossils, don't waste your time looking for them on the beach. Inland, I should say only about fifteen or twenty miles from your cottage, there are outcrops of the Middle Devonian rocks containing such beautifully preserved fossils that paleontologists from all over the continent go there to collect. Come -- I'll show you some specimens I brought back recently from that area."

He took me outside his office to a large display case. Under its glass, mounted on black velvet, were perfect fossils -- loose, clean, and of many shapes, all with labels showing their names and the places where they had been found. Many of them were from Thedford or Arkona, Ontario.

"Nice, aren't they?" he asked. "Here's a Mucrospirifer such as yours once was."

"It's beautiful!" I admired the delicate fossil with winglike extensions on either side of the shell. "Would you tell me where we could go to find things like that?"

Back at his desk he wrote down the location of several good collecting places, and he told me of a man who lived in Thedford who knew all about the local fossils -- a Mr. Charles Southworth.

"You ought to look him up sometime; you'd like him."

I came away from the Museum in a daze, my head spinning with unfamiliar names. There were exciting times ahead of us, I could see -- more exciting by far than toasting on the sandy beach. My queer stone that was a brachiopod was safe in my purse; the rest of the fossils were in Dr. Vokes' wastebasket.

When I told Put at dinner about my afternoon at the Museum he was as interested as I knew he would be. He arranged his business so we could go back there together the next day. We found Dr. Vokes in his office and he did not seem to mind being interrupted.

"I understand you are lucky enough to have a cottage quite near the outcrops where we find our wonderful Devonian fossils," he said to Put.

"Yes, it's an unexpected bonus. We built there because we were near the lake. Tell me what you mean by 'Devonian.' Mrs. Wright and I are very ignorant about geological matters."

"Briefly, it's this. Geological time is divided primarily into eras; the one with the earliest recognizable fossils is the Paleozoic Era. It, in turn, is divided into periods. The fourth period is the Devonian -- named for Devon, England, where the rocks of that age were first studied. The fossiliferous beds of the Thedford-Arkona region are Middle Devonian and roughly three hundred million years old."

"Three hundred million years," Put repeated slowly. "It's hard to comprehend such a length of time. Would you show me the picture that explains the pebble Mrs. Wright showed you? Her description was not very informative."

Dr. Vokes smiled as he opened the textbook again to that diagram and set it before Put. While he described the spirals that had supported the animal's breathing equipment, Put and I compared our stone with the picture.

"Now wouldn't you like to see some of our fossils, Mr. Wright?" he asked.

We followed Dr. Vokes out to the showcase of beautiful Ontario fossils and he pointed out the brachiopod labeled Mucrospirifer which had a coiled structure inside like the diagram.

"I found some of the best specimens you see here at a place called 'Hungry Hollow' on the Ausable River," he explained. "You have an Ausable River in Michigan, too, don't you?"

Put nodded. "It's confusing, isn't it? How do there happen to be fossils near the Ontario Ausable?"

"Because that river has cut a sixty-foot gorge into the fossiliferous rocks. The gorge extends for miles along the Ausable but the largest exposure with the most fossils is at Hungry Hollow. You

people ought to go there sometime."

"Sounds like fun, doesn't it, Put?" I asked.

"You bet!" He turned to Dr. Vokes. "Thank you very much for letting us bother you -- and thank you for introducing us to a whole new world. We'll hope to see you up in Ontario someday, perhaps at Hungry Hollow."

As we walked away Put gave the pebble back to

me. "You had better take care of our first fossil, Shorty; it seems to be a good one. If it hadn't been for that we'd never have met Dr. Vokes or learned there are fossils almost in our cottage back yard. Let's go look for them next summer."

We would have been amazed had we known then how many interesting people we were to meet and how many interesting places we were to see as a result of that little pebble.

II

It was two years before we did anything about fossils; we had not forgotten about them but our children were too small to pry off the beach. Besides, there was Put's golf. Ever since I had known him golf had been as much a part of his weekly schedule as church, and he seemed to look forward to being with his foursome as much, if not more, than with the minister.

One Saturday just before school started a chill wind off the lake made beaching and swimming impossible. The last weekend of the summer threatened to be bitterly disappointing until we thought of going on a "fossil hunt."

The two girls were old enough to think it might be fun so, taking a four-quart basket, we drove away from the cottage, through the woods of "the Pinery" and on through farmlands to the village of Thedford. We had carefully saved Dr. Vokes' directions for future reference; consulting them now, Put drove to one of the handiest outcrops.

He parked the car beside the road, then we all climbed under a barbed-wire fence and slid gingerly down the steep embankment of a railway cut. Knowing the morning train had passed, we had nothing to fear from that score; the loose dry shale was skiddy, however, and we were not very sure-footed.

What we saw on that shale made us forget at once about the hazards. The embankment seemed to be covered with fossils like those we had seen in the case at the Museum -- the fossils with the wings which were called "brachiopods." We were all terribly excited and we picked them up as fast as we could, putting them in our big basket.

"Oh, here's a beauty!" one of the girls called.

"I have one, too!"

"Here's a pile of 'em! I'll get 'em all."

It was not long before we had filled our basket to the brim with fossils, all alike, and we were very proud. Warily we climbed up the slippery slope and

under the barbed wire. It felt good to be able to straighten up and to stretch.

"Now let's go and call on that man who's an authority on fossils," Put suggested. "What's his name?"

I looked at my scrap of paper. "Mr. Charles Southworth. Yes, let's show him what we've found. I'll bet he'll be pleased to see how well we did."

We had only to ask directions in Thedford to learn that "Charlie" was well known and well loved. Several bystanders came up to tell us that he'd been uptown a while ago but had gone home. We drove away from the main street and across the tracks; three blocks farther we came to a small gray frame house on a corner. As we stopped in front of it Mr. Southworth came out on the porch followed by his wife. They were middle-aged people, apparently glad to have callers. We introduced ourselves and, with pride, showed them our four quarts of fossils.

Mr. Southworth scowled. "Mucrospirifer thedfordensis -- just where did you get 'em?" he asked, looking over the top of his spectacles.

We explained that we'd been to a place we'd been told was a good one -- a railway cut. He nodded.

"It's been a good one for about seventy-five years but I doubt if it'll ever be good again. Looks to me as if you'd taken every blessed Spirifer on the slope. That's not the way to collect fossils!" he said sternly.

I could feel my cheeks getting very red as my pride vanished; his face softened and he smiled. "I didn't mean to scare you but I was so disgusted. You see, it's just like going into a garden. You wouldn't pick every single flower, would you? Of course not! Now each of you could have brought away a few nice specimens and left the rest for other folks; that would make a handful of Spirifers, not four quarts."

"How about our each taking one of them now and leaving the rest with you, sir?" asked Put.

"That's a fine idea," he replied, taking the

basket. "I'll put these away till somebody wants Mucrospirifers."

"But, Mom," our six-year-old said in a loud whisper, "why is it all right for him to keep them if it's wrong for us?"

"I'll tell you why, my dear," the big man said gently. "Because I'm sort of a clearinghouse for fossils. When paleontologists -- those are people who study fossils -- need certain specimens and can't get up here to collect 'em, they write me and I do their collecting. Now what would you girls do with all these fossils?"

"Take them home," said our girl who was eight, "and put them away in my 'box of useful things.'"

Mr. Southworth laughed. "Just what I thought -- and forget about them. Well, they wouldn't be half as useful to you as they would be to some scientist. You see, paleontologists need many specimens of the fossil they are working on to know what it was like when it was young, middleaged, and old. Perhaps you'd like to see some of my fossils."

Everybody except Mrs. Southworth was enthusiastic; she declined emphatically. We left her sitting on the porch and followed her husband out to the garage and up a steep flight of stairs to the second floor. There were fossils everywhere -- in candy boxes and cartons, on trays, and in heaps on the dusty floor -- fossils of all shapes and sizes.

"I spend most of my time collecting," Mr. Southworth explained. "Packing and shipping 'em too, of course. Just had an order today for a hundred cup corals -- a man at one of the universities."

"What's this one with the face?" asked our younger girl.

"It's a trilobite and a good one."

"And look at these flat round ones, kids -- almost like buttons. What are they, sir?" Put asked.

"A kind of coral. Would you folks like to take a few fossils home with you? I thought so."

He selected eight specimens for us, one of them a flattened, bent little trilobite. Then we went back to the porch where I sat on the top step beside Mr. Southworth and made a quick sketch of each of our fossils.

"How come you can draw?" he asked, leaning over to get a better look.

"Oh, I went to Art School before I was married. It helps in a time like this. Now will you tell me their names, please?"

"Glad to. This little button-shaped coral is Microcyclus thedfordensis; named, of course, after

our village. The trilobite is Phacops rana -- P-h-a-c-o-p-s r-a-n-a," he spelled.

"What's this?" I pointed to a whitish one.

"It's a brachiopod like the Spirifers only another genus. It's called Stropheodonta naerea; looks like a toenail, doesn't it? And I call these little ones 'apple seeds'; they're really pelecypods -- you know, like clams. Their name is Leda rostellata."

Patently he spelled out the names of the rest of the fossils he had given us and had just finished the last one when the noon whistle of the sawmill across the road blew loudly. Mrs. Southworth rose.

"Dinnertime," she announced. "We must eat. Charlie has a job to do this afternoon."

"And we must be on our way," I said. "Thank you ever so much for our fossil collection. Would you take us with you sometime to look for them, Mr. Southworth?"

"Indeed I will if you'll call me 'Charlie'; hardly anybody calls me 'Mister.' Tell you what you do -- you go home and read a book. If you do any more collecting the way you did today you're going to waste a lot of good fossils as well as a lot of good time. You read up on 'em, then come back and see me next summer."

He gave us the name of a book that would help us and we drove off feeling very ignorant and very humble. I looked back as we turned the corner. Our new friend Charlie was standing by his wife, Annie, his arm around her waist and a grin upon his face. They were both waving to us.

The title of the book Charlie had told us about was Handbook of Paleontology for Beginners and Amateurs; we ordered a copy of its "Part One, The Fossils" as soon as we got home to Detroit. Since its author, Dr. Winifred Goldring, was at that time Assistant State Paleontologist of New York, we knew it would be scholarly. We were relieved to find it was not too scholarly for people like us who had scant scientific backgrounds.

The Handbook was a small paperback volume with lots of illustrations; one of these was the same diagram of a brachiopod's breathing apparatus Dr. Vokes had shown us at the Museum. Put and I decided to read the book piecemeal, whenever we could find extra time.

We had been awed that day in Thedford by the way Charlie had rattled off the names of the fossils he gave us. Their names seemed less formidable when we read an explanation of the binomial system. The first word in the name denoted the genus and was derived from the Greek, the second denoted the species and had a Latin ending.

"Very helpful," Put said, glancing at the list of our fossils. "Take this Microcyclus thedfordensis,

for instance. Micro plus cyclus -- two Greek words meaning 'small' and 'circle'; 'Thedford' plus the Latin ending ensis, which means 'belonging to.' That will help us remember it."

The book was full of interesting information about the preservation, significance, and collection of fossils. A classification of animals followed. Then fossil invertebrates beginning with the simplest forms were discussed. The description of the brachiopods I read with special attention.

Looking at one of those we had found at the railway cut, I could see that its two valves were unequal in size and equilateral as the text pointed out. It described the structure we could see within our queer pebble as "two thin, spirally coiled ribbons."

"And listen to this, Put. 'Because of the large number of species and great abundance of the brachiopods, the beginner will meet them frequently in his fossil collecting.' That's encouraging, isn't it?"

Put and I were too involved in war activities during the next few years to think much about fossils. We did stop one day after visiting the military encampment near Thedford to look over the high bare slope in a recent road cut. The children were with us and were terribly disappointed not to find it covered, as the railway cut had been, with what they called "brachiopines." After crawling around on the dirt for a long time and finding nothing but rounded pebbles, we gave up.

That was the extent of our collecting until 1943 when our two girls, bored with the beach and with parents, went off to camp in northern Ontario. Then, having no responsibilities for the first time since we had had children, our vacation was our own. Now we would get that nice Mr. Southworth to take us fossiling.

With a little difficulty I located the small box of fossils he had given us, the sheet of yellow paper on which I had sketched and labeled them, and the Goldring Handbook which Put was waiting to pack. I watched him as he arranged them in the already full carton. His hair, snowy white after a long siege of pneumonia, seemed to emphasize the blueness of his eyes and the youngness of his ruddy face. It was going to be fun to spend a month playing with him, I was very sure.

On the first Saturday after we arrived at the cottage we were coming out of the Thedford bakery with a warm loaf of fresh-baked bread when we met Charlie going in. I was suddenly tongue-tied,

"You bet! I only hope we'll know they're brachiopods. What comes next?"

I turned the page and answered:

"Pelecypods. This says the valves of their shells are mirror images of each other."

"True, I'm sure I could never forget that with all the clams I've eaten."

"Or all the blue mussel shells I've brought back from Nova Scotia."

Put groaned. "I know -- boxes of them. I shudder to think how many fossils you may bring back from Ontario."

We read and tried to remember the Handbook as far as the part about vertebrates, which seemed like a good place to stop. My mending had piled up to discouraging heights and my desk was covered with unanswered mail. I hid both the book and our fossils where they would not distract us.

III

recalling his reaction to our basketful of brachiopods. Put, however, greeted Charlie in his usual friendly manner and a date was quickly set. We were to call for him and his wife the next morning at nine o'clock, prepared to spend the day at some outcrop; he looked as pleased with the arrangement as we were. Driving back to the cottage, Put and I decided we must brush up on our fossils, particularly on their dreadful names.

The weather was perfect Sunday morning and, although we pulled up before the little gray house a few minutes early, the Southworths were on the porch watching for us. Charlie picked up their lunch basket and some things lying beside it, then hustled Annie into the car.

"Where to?" Put asked.

"To Hungry Hollow. Take the highway out of Thedford to Arkona and I'll tell you the rest from there."

"We've wanted to go to Hungry Hollow ever since Dr. Vokes told us about it," I remarked.

"Nice fellow -- Vokes," Charlie said enthusiastically. "I collected with him around here a few years ago; he sent a lot of stuff back to the Museum."

The road was swinging to the south in a great curve about a mile beyond Thedford. Charlie leaned forward. "See those rocks? When they built this new highway they cut right through them and exposed a lot of fossils."

By this time we had come to the crossroad and I pointed out the place which, with the children, we had looked over.

"We hunted for quite a while," I said, "but we didn't find any fossils at all."

"Of course not!" Charlie said. "The glacier made that hill and it's full of glacial boulders and pebbles, not fossils."

"But how do you know whether you'll find fossils or stones? The dirt's about the same color as in the railway cut."

His voice was patient. "You'll learn, girl. There's a great difference -- and fossils occur in shale, not plain dirt."

The country through which we were riding was gently rolling, with neat farms on both sides of the road. Charlie said he had lived around Theford for most of his sixty-two years and had hunted fossils since he was a small boy. His schoolmaster and the Presbyterian minister, both collectors, had encouraged him in this. He had had to quit school and go to work when he was fourteen, he said, but he had never quit collecting fossils.

We turned left in Arkona and left again about two miles farther onto a narrow winding dirt road which led downhill to an old iron bridge.

"That's Hungry Hollow ahead!" Charlie pointed excitedly as we got nearer the river. "Turn off here, Put, in the shade of this big tree. We'll leave the lunches in the car and come back to eat. Come, Annie!"

He helped her out of the car, slammed the door, and they started off towards the bridge. Annie was walking cautiously on the rough gravel, flicking stones out of the way with a long-handled fork. They were a sturdy pair and seemed remarkably spry for being over sixty -- terribly old, we thought then, being in our forties.

While Put locked the car, I looked over at the farm beside which we were parked. The large weather-beaten barn was built of upright planks, its shingled roof sagging in the middle. The house was set back from the road; nearer us a rooster and his harem busied themselves in the barnyard, and a little dog yipped loudly.

The Southworths were waiting for us on the bridge and when we joined them I could see why Hungry Hollow was a favorite place. The riverbank beyond the bridge was crowned with hardwood trees; not far from the top there were rock ledges lying parallel to the river, above bluish-gray shale that extended down to the water. Some distance downstream the river swung sharply to the right and disappeared behind a point of land.

Charlie was smiling. "I thought you'd like it!

Now this is a good place to tell you about the rocks. That thick ledge you see up there is the Encrinal Limestone and above it is the Coral Zone -- about three feet thick and just crowded with fossils. Together they make up the Hungry Hollow Formation." He pointed to the shale beneath it. "That's the Arkona Shale; its fossils are very different from those in the higher beds."

"What's above the Hungry Hollow Formation?" asked Put.

"The bottom part of the Widder Beds. I'll tell you about them some other time -- right now I want to hunt fossils. Come along."

We followed the Southworths down through a mass of sumac bushes onto the shale near the river. Charlie stopped and looked about him. "This gray shale's a good place to find crinoids," he said.

"Like *Arthroacantha*?" I asked hesitantly. "You gave us one called that."

"That's it exactly," he beamed. "Say, did you people ever read that book I told you about?"

"Yes, sir," Put answered, "most of it, though we didn't understand it all. At any rate, we know more than we did the day we came to call on you."

"Well, that's good! I'll just test you -- what's this?" and he picked up a round fossil about the size of a dime.

"Oh, you gave us one of those," I said, trying to remember what it could be. "It's a mollusk -- a cephalopod -- and its name is *Turn*. . . ."

"You're almost right. *Tornoceras*, related to the 'Chambered Nautilus.' It lived in the last chamber, too. Here, take it; I'll find myself another."

I put our new specimen in the cardboard tomato basket I had brought for our fossils; it seemed ideal for the purpose, better than the cotton bag Annie was carrying. Put and I both found lots to drop into it -- we were not very particular as long as they looked like fossils.

Annie was plodding along beside me, occasionally flipping something away from a boulder with her fork -- something that usually turned out to be a good specimen. She told us she had brought the fork with her from Jersey and that Charlie had made its long wooden handle so she could use it for a cane as well as to loosen fossils.

The scenery was lovely. Thick evergreens on the far bank grew almost to the river which rushed along, kicking up spray as it tumbled over rocks in its bed. And the birdsong matched the scenery. There was a song sparrow in the trees above us and a wood thrush sang in the distance.

After we had hunted on the shale for some time Charlie led the way up the bank towards the rock

ledges. The ground below them was strewn with fossils which, he told us, had rolled down from above. We picked up several that he called "cup corals" -- Heliophyllum halli; we ought to remember that name, he said, as they were typical of the Hungry Hollow Formation. I wrote it down as he spelled it.

Charlie kept up a running conversation about fossils, fossil hunting, and fossil hunters he knew, but he kept his eyes on the ground, spotting fossils under our very feet. The morning ended when he pulled a big watch from his pocket.

"Just as I thought -- dinnertime. We'll hunt some more after we eat."

We had our picnic across the road from the car in an old apple orchard. Put had fixed our lunch while I tidied up the cottage; it was substantial but not dressy. The Southworths ate in style, however. They had a folding table and two folding stools, which they set on flat ground. From their big basket they produced a table cover, a quart jar of tea kept warm under a tea cozy, cold meat, buns, and fruit; this was their dinner.

It was refreshing sitting on the cool grass under the trees for we had grown hot on that sun-baked riverbank. As we ate we learned more about our new friends. Annie, a widow, had come from the Isle of Jersey in 1924 to keep house on a trial basis for Charlie, a recent widower. Only a short trial was necessary. They were both lonely and they enjoyed each other's company; they were married in Thedford's Anglican Church.

"I'd never seen a fossil before that," Annie told us, "but Charlie was off collecting so much I decided I'd better look for them, too."

"And you've found some beauties, my dear," her husband said graciously. "Annie seems to know just where to use that magic fork of hers. Now let's see what you folks found this morning."

We handed him our basket. He identified everything in it -- everything that was worth keeping -- and he threw out most of our specimens. He could tell at a glance which Mucrospirifers we had found low on the bank and which had come from the higher beds.

"See how much wider this one is, with longer wings and narrower striations?" he asked. "Well, that's the Spirifer from the Arkona Shale -- Mucrospirifer arkonensis. Now this," and he took a fat one from the basket, "doesn't have those wings -- not much more than ears at the ends of its hinge. And it's coarser and more robust. This is Mucrospirifer thedfordensis from the Coral Zone or the Widder; it's like you got at the railway cut."

"I'll never forget that day," I murmured.

"I'll bet you won't! Wrap this one with the pointed wings carefully; you'll not find many as

perfect as it is. Let's see how many brachiopods you have?" He lined them up on the table before him. "Five Mucrospirifers, four of the tiny Camarotoechia thedfordensis . . ."

"How do you spell that?" I interrupted, pencil in hand.

He spelled it and the names of two other brachiopods we had picked up; he said they were common ones from the Coral Zone we ought to know. At first their names seemed like tongue twisters but as we practiced they became quite musical -- Leiorhynchus laura and Nucleospira concinna.

"Where did you learn so much about fossils, Charlie?" Put asked.

"Oh, I read a book," he replied with a wink. Then he grew serious. "Well, I'll tell you -- I've been lucky in meeting a lot of geologists who've been very kind to me. I've gone collecting with them and each time I've learned something. Then they've written to me and sent me books and some papers about our local fossils. That all helped."

"You told us this morning you stopped school at fourteen."

"Yes, I did, but you don't have to stop learning just because you're out of school. I got a job at the tileyard -- it was the brickyard then -- and during lunchtime I hunted fossils in the pit. Read about 'em at night." He rose. "Time to get busy -- no telling what we'll find this afternoon."

Put locked the picnic things in the trunk of the car, then we all walked on through the orchard together.

"There are a few patches of Arkona Shale on this side of the river," Charlie explained, "and they're worth looking over occasionally. Here's where we go down." He had stopped beneath a maple tree at the top of the slope. "Better take my hand, Annie; these roots might trip you. Watch your step, folks. The path's nothing to boast of."

I could see what he meant. The dirt had been washed away, leaving some of the tree's roots exposed. We had to step up and over them before ducking under a tangle of sumac bushes.

At the very edge of the river the path turned to the right. I walked awkwardly behind the others, climbing over rocks and hanging onto the bushes where the ground was wet; Put was not much more agile. By the time we reached the first outcrop of shale, Charlie was down on his knees examining it.

"The fossils show up well when the shale's damp like this," he said, without glancing up. "Just picked up a pretty little clam."

"Did you say a clam?" asked Put.

"Yes -- Leiopteria; they occur low in this formation."

"Look! I've a little trilobite's head but it doesn't have a body. Why's that, Charlie?"

"Let's see it." He took it from me. "You're right -- it's a baby Phacops. I'll tell you why -- because trilobites molted like crustaceans do today. You'll often find a head or a tail but seldom a whole one."

"Well, that's what I've just found -- a whole one!" Annie's voice was triumphant. "It was right where you were kneeling, Charlie, and you missed it. Wash it and see if it's a good one."

Charlie took it to the river and carefully rubbed the clay off under the water. "Yes, it's a beauty all right. Show it to the Wrights so they'll know what to look for." Proudly, she held it out to us.

"It's rolled into a ball," Put remarked, "not flat like the one you once gave us. What made that?"

Charlie chuckled. "I'm afraid you didn't read that book very well after all. Most trilobites you'll find are enrolled. You see, a trilobite's back was hard and flexible but its front was soft so when it was in danger it did this to protect its tender stomach," and Charlie folded his arms across his own ample stomach and bent over to look as much like a ball as possible.

"Thanks for the demonstration," Put said with a laugh. "As a matter of fact, there was a picture of an enrolled trilobite in the Handbook but it wasn't animated."

"I hope I'll find one like Annie's with its tail under its chin," I said, laying my fragment in our almost empty fossil basket.

"Well, keep looking!" Charlie advised. "It's the only way you will."

When the afternoon shadows had lengthened Annie said we should be starting back. It would be time for supper when they got home.

"And time for a swim when we get to the cottage," remarked Put. "That lake's going to feel extra good today. How soon can we all do this again?"

Annie spoke up: "Tomorrow we have to do our washing, and Tuesday we're going to put down some cherries."

"How about Wednesday?" I asked.

"Wednesday, right after dinner," said Charlie very quickly as though trying to ward off further domestic chores. "Make it one o'clock -- we'll be ready!"

IV

We arrived at the Southworths Wednesday before Annie had taken off her kitchen apron. Charlie came to the door waving a dish towel. "Be right there!" he called, and in a matter of minutes they were in the back seat.

"Where are we going today?" I asked.

"To 'Ungry 'Ollow," replied Annie. "We're going on to the 'igh banks."

"The high banks?" Put directed his question to Charlie.

"Yes. It's downstream from where we were Sunday morning. Say, there's not a soul on the main street. They don't close the stores in Grand Bend for the Wednesday half holiday, do they?"

"No," Put answered. "The town's too full of vacationers and business is too good. Jean, show Charlie that pebble you brought along."

I handed him the queer stone I had once found on the beach. "This is what started our interest in fossils. I took it to the American Museum and met Dr. Vokes; he told us about the railway cut and you."

But Charlie was only half-listening; he was

studying the pebble through his hand lens. "Well, now, that is a curiosity," he said, giving it another lick to make the details more clear. "I never saw anything like that except in pictures. My guess is that it's the interior of a Spirifer shell; am I right?"

"Exactly right!" we assured him.

"Well, hang onto it. You'll never find another -- I'd bet my last dollar on that!"

Arkona was deserted also on this Wednesday afternoon. Charlie said there'd be a lot of folks at Rock Glen but nobody where we were going.

Put parked the car where he had on Sunday and again we walked across the bridge.

"Looks as though people have used this for a long time, Charlie," I said, noting the splintery planks.

"Yes, and people have been hunting fossils here longer than that. James Hall collected here in 1855; do you know who he was?"

"No, sir."

"Well, you should. He was one of the greatest paleontologists ever and he gave the names to many

of our fossils.

He helped Annie down the path, then walked on briskly, urging us not to look for fossils until we got to the high banks. Beyond the first bend in the river everything seemed quite different. The woods on the far side were thicker and we were walking on stones instead of shale. The air was fragrant with mint growing between those stones -- delicious-tasting wild mint.

"I see a strip of gray shale over there," Put said. "Would there be fossils on it?"

"Yes," Charlie said, "but except when the Ausable's very low it's hard to get across. The boulders are far apart and the current's swift. Now you'll notice up ahead the river swings to the left; the high banks aren't far from there. It's kind of marshy this side of the bend so watch your step.

We walked a little faster, trying to keep up with him.

"Well, here we are, folks!" he said at last. "Who's going to find the first good fossil?"

The bank was high indeed -- high and very steep, a bare expanse of shale and limestone framed by cedar woods. Charlie pointed up to the ledges of the Hungry Hollow Formation and to many feet of the Widder Beds above that.

"What a queer name!" Put remarked. "Why do they call them 'Widder'?"

"They're named for a prosperous little village once located about a mile east of Thedford. Remember the big curve in the highway where I showed you some rocks? That's where Widder was. Quite a place -- three hotels, a sawmill, tannery, and other industries."

"What happened to it?"

"Well, about 1860 the Grand Trunk Railway laid its tracks north of Widder and built its station down the line at what is now Thedford. Gradually the people of Widder moved to the new settlement, and the old village just shriveled up -- only a few houses left."

He stooped, snatched something from beside my foot, and held it out for us to see. "I judge you didn't care for it," he said grinning at me, "though it's as fine an *Arthroacantha* as I've seen in a long time -- shows the arms nicely. You know, these arms once had feathery extensions which waved about in the water so food particles would drift into the mouth."

"Is that a snail on top of it?" I asked.

"Yes. An *Arthroacantha* almost always has a snail attached; they lived together more or less like partners. Crinoids are also called 'sea lilies' because the cup was at one end of a long stem which had roots at the other. The stem disintegrated;

you'll seldom find more than separate plates, called columnals."

He looked about on the shale and picked up several small flat things -- one round, one with points, and one shaped like a miniature ship's wheel. All of them had holes in the center or showed where holes had been. He explained that originally there was a fleshy tube in the center of the stem. "But of course you know all this as you read that book."

"We read it, all right, but there was too much to remember," I said. "It's a help to have you tell us."

Put was gazing up at the high bank. "Charlie, I suppose the fossils in these layers of rock must differ in age."

"You're right. It took an awfully long time for sediments to drift down to the bottom of the sea and cover all the shells that had accumulated in forty to fifty feet. Maybe a million years, maybe more."

"So the invertebrates that lived in the upper part are descendants of those in the lower, aren't they?"

"Sure -- and show evolution. That's why it's important to know what formation your fossils come from."

"Gosh! There's a lot more to this fossil hunting than I thought."

"That's why it's so interesting." Charlie's voice rose on the last word. "If it were just a matter of looking for fossils it wouldn't be any more important than looking for Easter eggs."

Annie had walked on, not at all concerned with such things as evolution. Charlie stood watching her, confessing that he was worried about her eyes. He told us that she was having great difficulty sewing nowadays and that she could only see good-sized fossils.

"I don't suppose this is a fossil, is it?" I asked hesitantly, putting something in his hand -- something dark and flat, with tiny bumps on one surface. He touched it with the tip of his tongue.

"Yep, just what I thought -- a piece of fish plate. Fish teeth and fish plate always stick to your tongue. Try it."

It certainly stuck.

"What kind of a fish?" asked Put, after he had tested it.

Charlie said there were armored fish in the Devonian Sea, some of them twenty to thirty feet long. "What you found is just a very small piece of armor plate. I've read they're called the 'terriers of the Devonian' because they could rip anything to shreds. Nothing in Goldring's book about them?"

"Probably, but we stopped reading when we finished the invertebrates," I said.

Charlie was looking at a fossil he had just picked up. "Here's one you people ought to recognize," he said, showing us a flat round object about the size of a quarter. "It's a cephalopod from the Widder -- slid down from up above. See how thin it is, 'specially at the edge? Now look at this little Tornoceras from the Arkona Shale," and he took one out of his pocket. "You'll notice they're similar, yet not alike -- this one's rounded on the edge. Take 'em, Put, and compare them."

We examined the two fossils, trying to register their differences. Charlie went on: "There's another Tornoceras to keep in mind; it occurs also in the Arkona Shale, mostly at the tileyard. It's a big gray fellow -- more than an inch in diameter -- but it's so scarce that if you even find a piece of one you'll be lucky."

"Where is this tileyard, Charlie?" asked Put.

"It's just a short distance north of Thedford -- and handy to my house. Quite often in the mornings, after I go uptown for the groceries and mail," he said, lowering his voice, "I slip over there and have a little look around before I'm supposed to be home."

"We might happen to meet you there some morning," said Put.

"Good -- but don't ever mention it, will you? It just might get me into a little trouble."

He and Put started up the slope to collect fossils from the higher beds and I sat down on a fallen log to enjoy the place -- wild and remote and relaxing. I could see Annie quite a distance beyond us now. What a surprising pair these Southworths were! I was quite sure it was Annie, not long from a farm in Jersey, who had seen that their Sunday picnic was nicely served instead of the way Put and I had had ours, and I could hear Charlie explaining something technical to Put with the patience of a good schoolmaster. He could not have had pupils who knew much less about his pet subject than we did.

My reverie ended when Put called: "Hey, Shorty, come on up here! At last I've found something Charlie says is a keeper."

I scrambled up the bank and took the fossil from him. It was smooth, shiny, and dark brown, about the size and shape of my little fingernail.

"What is it?"

Charlie answered. "It's a Lingula -- an unusually good specimen because it's almost all there."

"Just what is a Lingula?" I asked.

"A kind of brachiopod but, as you can see, its shell is horny, not calcareous like the others; it's made of chitin -- c-h-i-t-i-n. A Lingula is one of the few Devonian brachiopods still living today and it

looks about the same as its ancestors did. I saw a picture of a modern one not long ago from the Pacific. It had a fleshy stalk called a pedicle that came through an opening at the pointed end of the shell. They burrow into the mud on the shore, their shells suspended on the top of their pedicles."

"You know all about fossils, don't you, Charlie?" I said, as I watched Put wrap his little brachiopod carefully before adding it to the assortment in our basket.

"No, I should say not! I often pick up a specimen I don't recognize; then I send it to the person who can identify it for me."

"Who, for instance?"

"Different people. You see, paleontology today is much like medicine; it's such a big field that paleontologists usually specialize. I send lots of fossils to Dr. Cooper in Washington; sometimes he gives me the answers and sometimes he passes the specimens on to somebody else. He's most interested in brachiopods in general while Dr. Cloud at Harvard specializes in brachiopods with a punctate shell called terebratuloids."

"Goodness!" I exclaimed. "It sounds awfully complicated."

"Well, you don't have to learn it all at once; I've been at it for fifty years. And you'll find the big paleontologists are all awfully kind about helping you -- and awfully pleased to get hold of a new fossil. If it's a new species, it gets a paper written about it and is given a name."

"How exciting! And then sent back to you?"

"No, not if it's been described. Then it becomes the type specimen and is kept in the museum collection."

"Much better than keeping it at home if it's that good," observed Put.

"Oh, all rare fossils belong in museums, and that's the place to send any you can't identify -- unless you know who's the authority on that kind of fossil."

Annie's voice from below was full of disgust. "You're still talking, Charlie!"

"Did you find anything special, my dear?" he called.

"No, I didn't! Time past I'd have found a lot of 'em. Let's go home."

V

Not long after our afternoon at the high banks we met Charlie on the main street in Thedford, his arms full of groceries.

"Would this be a good time to show us where the tileyard is?" asked Put.

Charlie consulted his watch. "Couldn't be better. I'll drive ahead of you."

He stowed his parcels in his car and started off with a burst of speed. We followed him, turning right near the bakery, crossed the railroad tracks, and passed the sawmill. A short distance farther he angled off onto a narrow road, the entrance to the tileyard; we could see its big red shed beyond the open space where Charlie was already parking his car. He hopped out and came over to us as we stopped, his geologist's hammer in his hand.

"I keep this in my car, just in case I need it," he explained casually. "Come along -- no time to waste. I have to be home by eleven-thirty."

He walked us quickly into the shed -- dark and cool and pungent with wood smoke from the great round ovens -- and out the far side; we could see rows and rows of gray drain tiles standing on edge, waiting to be baked. As we came out into the sunshine again we found Mr. Eric Coultis, the owner of the tileyard, and Charlie introduced us.

"I'm always glad to meet friends of my old friend Charlie," he said as we shook hands. "Glad to have you people come here any time for fossils. Charlie, you seem to be in a rush."

"I am. It's getting on to dinnertime."

He hurried us down a path into the pit, explaining that all this shale was the Arkona Shale, and that the wall of shale across the pit was topped by the Encrinal Limestone which we had seen at Hungry Hollow. He told us, too, that the shale was relatively free of fossils here and that made it good for tiles. The men scooped it up with a machine, took it to the shed and screened it, dumping the fossils onto a pile outside the building.

"But I do find things sometimes here in the pit," he said, pausing beside a heap of shale, and proved it by picking a few Microcyclus, the button-shaped coral, off the surface.

"Now those big gray Tornoceras I was telling you about the other day," he continued, "they occur part way up that steep slope over there. But it's not worth your spending time looking for 'em; I've only found a few fragments of them in all my collecting. We'll go up to the Hungry Hollow Formation now, out of the way of the workmen."

We went up a path to a comparatively flat place above the pit; great blocks of stone were strewn about

in a haphazard fashion.

"Encrinal Limestone," Charlie explained.

"They were lifted off the top of the Arkona Shale and dumped here. Don't go near the edge, will you? It might crumble."

He turned his attention to the fossil-packed Coral Zone before us, his hand moving rapidly as he put fossils into his pockets. Occasionally he mentioned what he had just found but time was too precious to show it to us. Almost everything Put and I picked up was unfamiliar; we put all our fossils in the basket we carried until some time when Charlie could identify them.

It did not seem long before he straightened up and looked at his watch. "Sorry I have to leave," he said sadly, "but Annie needs me. She's never figured out how to work the can opener."

Put and I burst into laughter. "Pretty smart of her! Well, we'll be seeing you soon," I called, as he disappeared down the path. "You know, Put, it seems a shame to leave all these good fossils."

"Indeed it does. Why don't we go into Thedford and get some things for a picnic? Then we can hang around here as long as we like."

With no difficulty whatsoever we bought the makings of a quick lunch at the general store. Eating it overlooking the pit, we could imagine young Charlie sitting as we were on a rock, eager to finish his sandwich so he could hunt fossils until it was time to go back to work.

Often that summer, and every summer afterwards, we went over to the tileyard to collect. It was almost ten miles nearer the cottage than Hungry Hollow and took considerably less time on the road.

Charlie found us there one afternoon. He was carrying an empty lard pail and said he was going for thimbleberries near a little outcrop down the creek. Why not come along?

We climbed under a wire fence and followed a footpath up and over a rise of land, trying to walk nonchalantly by a large settlement of beehives, and eventually came out on a slope above the creek. First of all, Charlie decided, we ought to check on the berries and he walked down through the long grass towards the creek bed. We found him dejected. The ground around the bushes was trampled down, the bushes mauled and stripped clean; Charlie could tell from the footprints that a bear had beat him to it. We went back to the outcrop and hunted fossils but though Charlie found several good specimens, he showed little pleasure. Fruit was expensive at the store and his mouth had been watering for that dish of thimbleberries.

On another afternoon Put and I stopped at the Southworths' house to find Charlie tiptoeing off the porch. He said Annie was napping and he was on his way to Jim Bell's quarry. Would we like to join him?

"You know we would!" Put said. "Hop in."

Charlie directed us to an overgrown field on the lower side of what he called the "ridge road" east of Thedford. Here he managed to find a number of fossils among the weeds -- fossils unlike any we had seen elsewhere. He told us we were "in the Widder Beds," that he had been born in the little house across the road, and that this had been a quarry then.

The afternoon being young, we went from there to two other small outcrops Charlie wanted to look over, collecting a few fossils at each place.

"I don't understand, Charlie," Put said at last. "You've told us we were in the Widder Beds at all three of these outcrops, yet the fossils have been quite different. How come?"

"Well," Charlie replied, "the Widder is hard to explain and its faunal deposits are very irregular. You see, the Widder Beds are so high in the section that when the glacier came along it scraped the top off them in some places; in others it covered them with so much drift you can't get down to the fossils. I don't know that anybody really understands the Widder."

The Widder might be puzzling but it did not bother us. We were too busy those summers hunting fossils and trying to find out what we had found. After each excursion we would wash our fossils, throw out the poor ones, and try to identify the keepers with the aid of our fine new book Index Fossils of North America by Shimer and Shrock. Even if failed us at times. Then we would put our unnamed specimens in the box labeled "Ask Charlie's," ready for our next trip to Thedford.

Fossil hunting became increasingly fascinating each summer. We spent so much time inland where it was hot that some of our cottage neighbors thought we were crazy and they were right; we were crazy about fossils. We did not get as even a suntan as they did, baking methodically between dips in the lake, but we liked our occupation better.

And we became smarter about seeing fossils than we had been at first. The only way we could hope to remember all their names was to write them down. To simplify matters, we began to keep a "fossil notebook" in July, 1945; this was a loose-leaf, with a page devoted to each day's collecting. The fossils found were listed beneath the name of the outcrop and the date.

We hated to have our vacation over that year. We were having such fun fossiling, there was no chance of our getting back in August on account of gasoline rationing, and September seemed so far away.

Sadly we packed the car and had our last swim. Even more sadly on Tuesday morning, the thirty-first of July, we turned the key in the cottage door and drove off. We were going home by way of Thedford to say good-bye to Charlie and Annie.

As we stopped before their house, they both came out to the car in obvious excitement.

"Say, we have news!" Charlie said. "Sunday afternoon we took a little drive down to the Hollow and walked down to have a look at the shale just below the bridge. I just happened to notice a piece of crinoid stem and then another and another -- and some bits of arms -- really a trail of them. I followed 'em up the bank about three feet where they ended. There I began to dig -- very carefully, you understand, and I looked over each chunk of shale as I pulled it out."

"What did you find?" I asked.

"That's what I'm telling you. Well, my hammer hit something hard and when I pulled it out I found it was a fine Arthroacantha cup. And say, it's a gold mine!" he exclaimed, his eyes dancing. "I dug out nine of 'em before Annie made me stop. You folks ought to go and try your luck before somebody else finds that hole."

"Yes!" we said together.

"Though we haven't anything to dig them out with," I added. "We left our fossil things at the cottage."

"That's easy," said Put. "We'll go to the hardware store; we can't miss a chance like this."

"You'd be fools if you did." Charlie's tone was emphatic. "I'll get you a carton and some newspapers; you're bound to find some." He returned from the garage in a minute with an armload; I opened the car door and took it from him.

"Good luck!" he said, giving the door a bang.

"Oh!" I cried, for, thinking only of crinoids, I had stupidly left my thumb in the way. The pain was excruciating.

"Should we go right home?" Put asked anxiously.

"And leave those crinoids for somebody else?" I said.

"Then you'd better go see our doc," decided Charlie. "He's liable to be at his drugstore now. You know where that is."

We nodded. Often after fossiling, we had gone there for the biggest, best chocolate sodas we had met anywhere.

"See you in September!" we called as Put drove on.

The doctor, learning it would be late in the day before we would be home, shook his head. "Well, then, the only suggestion I can offer is that you keep

your hand elevated. I'm sure the bone's not broken but I'm also sure you'll lose that nail."

While Put went into the hardware store I sat in the car elevating my hand though it seemed to have little effect. He came out shortly with a big shiny axe.

"That's pretty drastic treatment for my poor thumb," I called.

He grinned. "Believe it or not, this is the best thing I could buy for digging fossils. Not a very handy size but it will do."

We drove fast to Hungry Hollow and parked near the barnyard gate. Put made sure the car was locked tight. It was loaded with everything we had had at the cottage -- everything but field clothes; we were dressed like city folks but we were washable. From the bridge we could see the hole Charlie had made and we hurried down to it.

We agreed on our modus operandi. Put was to wield the axe and do the two-handed work, I to sit nearby with my right forearm upright, putting whatever treasures he unearthed into the carton. I was also the photographer and, for once, I did not jiggle the camera. One of the pictures I took shows him sitting beside the hole surrounded by clay he had dug out of it. He is wearing a Panama hat, white trousers, and white shirt, with a necktie he never took time to remove.

We spent two hours there -- thrilling hours. The axe worked surprisingly well as a tool to dig into the hard damp clay and loosen a chunk. When that chunk was pulled apart it opened along its weakest plane -- the plane in which a fossil lay.

One of those opened slabs we took home intact. It shows a large Arthroacantha cup attached to about two and a half inches of stem; outstretched in the shale like a fan are several of the branching arms with their feathery pinnules. The crinoid's companion snail is in place at the top of the cup.

But what we saw when Put split another chunk made us gasp. On the clay lay a perfect tiny brittle-star -- barely an inch across from tip to tip. We had never heard Charlie speak of one from these beds and we could hardly wait to show it to him when we

came back in September. Put set the top part of the chunk gently in place onto the bottom so the delicate fossil would not move, then wrapped the whole thing in paper.

At the end of those two hours our carton was full. According to our field notes, we found 13 Arthroacanthas, a beautifully ornamented crinoid we later learned was Corocrinus calypso, and some pelecypods which Put recognized as Leiopteria and Actinopteria. My thumb had swollen to double its size and throbbled violently but that mattered little.

There is a sad sequel to this story. We spent the Labor Day weekend at the cottage and one day drove over to the Southworths.

"Let's see the thumb," Charlie said, as he let us in. After examining it he looked up, an impish grin on his face. "Say, I learned uptown one day that you folks hunted fossils with an axe. First time I ever heard of a paleontologist using one."

"Well, it worked," Put said, "and we've brought you most of our haul. By the way, do you get many brittle-stars in that shale?"

"Brittle-stars!" Charlie almost exploded. "I should say not; they don't occur around here. Why?"

"Because I found one." Put laid a package on the kitchen table.

"No! I can't believe it!" and Charlie reached for the precious chunk. We did not act quickly enough for as he lifted the top clay, now very dry, some of the minute plates of the brittle-star's arms and body were loosened and dropped to the kitchen floor. Put, Charlie, and I all searched for them but they were too small to see.

This taught us a great lesson -- never let anybody handle your fragile specimens. As Charlie had often told us, rare fossils should be sent to a museum. We did that -- but too late. It was stored away at the Museum of Paleontology in Ann Arbor with the hope that another specimen might turn up. None was reported. Nearly twenty-five years later, in January, 1970, Dr. Robert V. Kesling of that Museum published a paper describing Put's little brittle-star. It was a new species and he named it Drepanaster wrighti.

VI

We put the girls on the camp train in June, 1946, with less of a wrench than in previous years for, with wartime restrictions eased, we were going to visit them about a month later. In the meantime, we would be fossiling at the cottage.

Early in July we went to Rock Glen with the

Southworths for the day. Annie had been yearning to look over the Arkona Shale on the west side of the Ausable for more specimens of the crinoid Gennaeocrinus mourantae named for her; at that time it had been found at no other outcrop.

Since Annie never waded the river, the only

way to get there was to drive through a furrowed field after the grain had been cut, leave the car at the edge of the woods, and walk down towards the river. Then it was necessary to crawl down the steep bank, trying not to touch the poison ivy carpeting the slope. Neither Charlie nor Annie were ever bothered by it; Put and I just hoped for the best.

While nobody saw a *mourantae* that day, everyone did very well. Put found four trilobites in recognizable condition and I a pretty little fossil nobody could identify. It was about the size of a pea and ornamented with relatively broad plications.

"Twisted, isn't it?" remarked Charlie as he scrutinized it. "Well, all I can say is it's a brachiopod but I don't know more than that. Send it to Dr. Cooper sometime, why don't you?"

Put placed it in his tin box for safekeeping and we all went on looking. Most things we took home that day seemed to be small.

That was not always the case when we went collecting. One afternoon Put and I went alone to Hungry Hollow. As we were crossing the bridge we saw two people digging in the shale some distance downstream from the place we had dug out so many *Arthroacantha* heads the year before. We decided the first thing to do was see what they were getting.

They were young men, we could tell as we got near, and too absorbed in what they were doing to notice us till we spoke. After introducing ourselves they told us they were brothers -- Kopf, by name -- from Buffalo, and showed us excitedly the little snails attached to the crinoids they had, and went on with their digging.

We watched them for some time during which we learned that they had hunted fossils since boyhood with their father, a collector, and that they were now on an extensive field trip -- roughing it; they had slept last night in a field beside their car.

"How about spending tonight with us at the cottage?" Put suggested.

"Yes, do," I urged. "We've extra beds, a big steak in the refrigerator, and Lake Huron in our front yard."

They accepted at once. Put gave them directions and we wandered on to do a little fossil hunting of our own.

The evening was a pleasant one; Put and I enjoyed having a family, even a temporary one, quite as much as they seemed to enjoy having a cottage. The next morning, after a hearty breakfast, they set forth for northern Michigan.

Years later the older brother, Rudy, co-authored a paper on those Hungry Hollow snails. Today, he is with the United States Geological Survey in the West; the younger brother is a distinguished physician in the East.

Towards the end of July we drove up to see our girls at camp in northern Ontario. The place was all we had hoped, our children what we should have expected -- happy, healthy, and too busy being campers to be excited about mere parents. We left feeling sure they were never homesick.

The high point of our trip back to the cottage was to be a stop at an outcrop of the Collingwood Shale we had heard about. It was on the shore of Nottawasaga Bay at the southern end of Georgian Bay and was supposed to contain wonderful Ordovician fossils, about a hundred million years older than the Devonian ones we hunted with Charlie.

With little difficulty we located the outcrop not far from Craigeleith and close to the road which skirted the bay. The dark thin-bedded shale slanted gently into the water; the fossils on its upper surface were even better than we had imagined. Big flattened trilobites were lying within easy reach.

Put took off his shoes and socks, rolled up his trousers, and got out his pocket knife. Ankle-deep in the water, he found that the shale yielded to slight pressure and was able to pry up pieces with beautiful fossils, some with almost complete trilobites. They were very different from any we had seen before.

"What fun!" Put said as we drove away, a carton of fossils in our car. "In a way we owe this, too, to that pebble you found and took to Dr. Vokes."

"Yes. One thing seems to lead to another, doesn't it? Who knows where we'll hear of fossils next?"

"We've an awful lot to learn about them, Shorty!"

We took our Collingwood fossils over to the Southworths as soon as possible -- more "Ask Charlie's" than we had ever produced before. Charlie was stumped.

"I never saw anything like those trilobites. Why, they're three inches across and over four inches long! I'm getting off a box to Dr. Cooper soon; would you like me to put these in? He'll know what they are."

"By all means," Put answered. "And let us know as soon as you hear, won't you?"

With our vacation over, Put back at the office, and our girls not due from camp for several weeks, I departed for Nova Scotia. It seemed the perfect time to visit my relatives whom I had not seen since the beginning of the war.

The long train trip gave me an opportunity to do a lot of reading and thinking -- and I had plenty to think about. What, for instance, were we going to do with all the fossils we were accumulating? They were crowding us out of our bedroom. Not only had they taken over part of my bureau but they lay exposed in

boxes of every description on the tops of two card tables. Friends asked us why we did not keep them downstairs in the family playroom but we did not dare; too many inquisitive young visitors kept the room busy.

I had not thought of a solution by the time we got to Truro forty-eight hours later. Aunt Etta -- round and bouncy -- and Uncle John -- tall, thin, and silver-haired -- were waving to me as the train pulled slowly in and stopped. We drove the rest of the way to New Glasgow, forty miles over the Mt. Thom road, in the early evening light. Our old friend Rachel was waiting at the house and so was supper.

So much had happened to us all in seven years, too much to cover in letters, that we had lots to talk about. When asked what Put and I had been doing this summer I told about our fossil hunting, particularly of our recent experience on the edge of Georgian Bay.

"You ought to go see Dr. Cox, Jean," said Uncle John. "He has a house full of fossils, many of them from around here."

"Fossils around here?" I asked in astonishment, for though I had been in Pictou County many times since I was a child, I had never heard fossils mentioned before.

"Yes, not far from here." He excused himself to make a phone call, and returned saying that we were going calling the next day.

As we walked over to High Street in mid-morning, Uncle John told me that Dr. Cox was a retired oculist and considered an authority on both shells and fossils. He must have been watching for us; the door opened as we went up the front steps. He was thin, wiry, and seventy-five. His daughter who joined us was also a fossil enthusiast.

He took us at once into a room lined with bookshelves and tiers of old spool cabinets. I found my eyes straying to them as we talked.

"Now I'll show you some of my fossils," he said, going over to one of the cabinets.

"These are just what we need for our collection," I said. "Where can I get some, Dr. Cox?"

"They're harder to find nowadays than the fossils so I can't give you much hope. Every little country shop used to have one or two but not any more." He pulled out a drawer containing some fine specimens.

"They're beautiful! Tell me where you find fossils near here."

"The handiest place," he replied, "is a small brook this side of the river on the way to Stellarton. As you'd expect with coal so near, there are lots of Carboniferous fossils in the New Glasgow district -- plant life, fish remains, and some mollusks, too."

I felt very stupid. Somehow I had never connected the coal with geology, only with history; the local mines had had an important part in the development of Pictou County.

"But there are much better places to find fossils in Nova Scotia than that brook, aren't there?" asked Uncle John.

"Yes, indeed," Dr. Cox replied. "The Province is very interesting from a geological point of view. Now there's Arisaig not far from Cape George; the cliffs lining the shore are full of Silurian fossils. You must go there sometime."

"I'd like to -- and where else?"

"Well, of course, there's Joggins over in Cumberland County. You must have seen pictures of the fossil trees embedded in the cliffs; that's one of the finest sections of Carboniferous rocks in the world. Do you know Sir William Dawson's Acadian Geology?"

When I shook my head he handed me a book. "Dawson has a splendid account of Joggins as well as of our Pictou County coal beds. The book is very scarce; you should keep your eyes open for one. Dawson, you know, was born in Pictou -- picked up fossils around there as a boy. He was one of Canada's greatest geologists before he became the head of McGill."

My astonishment increased. I had spent one whole summer in Pictou and another across the harbor at Rustico but I had never been conscious of fossils.

"Enough of Nova Scotia," Dr. Cox said firmly. "I want to hear about your collecting in Ontario. What age are the beds and what fossils do you find?"

He listened attentively to all I could tell him, plying me with questions. I promised to send him a box of our fossils so he could see for himself. We stayed a long time talking about the pleasures of collecting, and he seemed loath to have us go.

"A remarkable person, isn't he?" asked Uncle John as we walked down the Kirk Hill. "He has a great reputation as an eye and ear specialist. At the time of the Halifax explosion he performed countless operations; as you remember, so many people were blinded then by flying glass. He's renowned also as a naturalist. He's had at least one fossil named coxi for him, and he's contributed specimens to the British Museum, the Smithsonian, and many other museums."

I was reminded of Charlie Southworth, not much younger in age. Their backgrounds were very different but they had the same keen enthusiasm for fossils. Furthermore, they had both given fossils to the museums and had been honored by having new species named for them.

Uncle John admitted that he himself had read quite a bit about geology; this did not surprise me in the least. He was an omnivorous reader, constantly reaching out into new fields.

When we got back to the house, he handed me a book. "Here's an old-timer -- Hugh Miller's The Testimony of the Rocks, published in 1857; it's been read almost to pieces. Would you like to have it?"

"I'd love it! Thank you!"

The book opened naturally at a page of illustrations and there before me was a picture of a brachiopod similar to those we had been finding at Hungry Hollow! How strange to see it here in New Glasgow!

So much had been planned for every day that it was hard to fit anything extra into the schedule. Just before leaving, however, I managed to go up the brook Dr. Cox had mentioned; there I saw enough fossils in the rocks to wish I had time to do some collecting.

The train that took me from New Glasgow was unhurried. I watched familiar places slide by and thought about my visit; it had been full of surprises. I had always associated Nova Scotia with peaceful inter-vales, wooded hills, and the shore. Now I knew it had other features I had never suspected -- rugged cliffs full of wonderful fossils, and I had met people who knew all about them.

Having several hours between trains in Montreal, I went to an old bookstore where Put and I had browsed on previous occasions. There I had another surprise. I found a third edition of Dawson's Acadian Geology, a presentation copy inscribed "To Dr. Spencer with regards of the author."

Put met me the next morning and while we breakfasted I told him about my trip. We agreed that as soon as possible we must go to Nova Scotia together and see those rocks with Dr. Cox to guide us. We must also start hunting spool cabinets; perhaps they were more plentiful in Ontario than in Nova Scotia.

The girls came home from camp late in August

and went with us to the cottage for the long Labor Day weekend. The Southworths joined us Monday on an excursion to Lot 8, an outcrop where they seldom went because it involved so much walking. Even Annie felt it worth the effort that day for the fossils were unusually plentiful. Put found a strange brachiopod even Charlie could not identify. It was large and smooth, nearly an inch-and-a-half in length and oval in outline.

"There's only one thing to do," he said. "Send it to Dr. Cooper. By the way, did you send him that little crooked brachiopod Jean found at Rock Glen?"

"Not yet," Put replied. "I'll mail them both to him after I get this one cleaned. What about those fossils from the Collingwood Shale?"

"I've never heard from him but he's a very busy man."

About a month later Charlie wrote us, enclosing a copy of part of Dr. Cooper's letter; it said that the "dark shale is apparently from low in the Collingwood shale and represents the Ogygites zone." He identified the big trilobite as Ogygites latimarginatus and named all the other fossils we had found at that time. Then he added this paragraph:

"If it is possible and Jean Wright can spare it, I would like to have one or two specimens of the complete trilobites from the Collingwood. I noticed to my astonishment that we do not have a first rate specimen in the Museum. Consequently, I would be most grateful for a complete Ogygites."

"That's really exciting, isn't it, Put?" I asked. "We never dreamed that day that we were collecting for the National Museum. I'll write and tell him to keep all he wants."

"Yes, all of them as far as I'm concerned," he said emphatically. "The Thedford-Arkona fossils are more than I want in our bedroom. Which reminds me -- we ought to send him my big brachiopod from Lot 8 and the little one you found at Rock Glen. I'll pack them tonight."

VII

Put wrapped our two unidentified brachiopods and four other puzzling specimens in much tissue and packed them in a carton for their trip to Washington. Once they were in the mail we waited impatiently for Dr. Cooper's diagnoses. His letter was prompt and full of information, some of it exciting; I watched Put's face that evening as he read it.

First of all, the big smooth brachiopod Put had found was a Camarospira. Dr. Cooper wrote that it was "almost certainly a new species. . . . Your

specimen is quite unusual and I wonder if you could be induced to add it to the National Museum's collection."

"Why, of course! I'd love to," Put said, and he read on about my little fossil from Rock Glen. "It's not a brachiopod at all! A pelecypod -- Buchiola speciosa; Charlie will be surprised, won't he?"

"Surprised to say the least; I dread telling him."

Put continued reading Dr. Cooper's comments

on the other four fossils. One, a little brachiopod, was a Cranaena, and he wrote: "These small shells are in great need of careful study but nobody has sufficiently large collections to do an intelligent job on them."

He looked up. "I wonder how large a collection; I believe I'll write and ask. Hey, listen to this: 'The Museum is returning all your specimens and I have enclosed a frank for your use in the event that you are willing to part with the fine Camarospira.' Gosh! I must have found something pretty good or he wouldn't want it so badly. He's welcome to it. Let's look up that Buchiola in our Index Fossils."

We found there a picture, greatly enlarged, of my little fossil; it was so unmistakably a pelecypod that we wondered at our stupidity.

While Put was writing Dr. Cooper, I wrote Charlie, quoting from the letter as the best way to break the news. His answer must have taken the next train out of Thedford. He congratulated Put on finding a new species, saying that he "had been at this game for many years" before he had found a new one. He continued: "Regarding your little specimen from Rock Glen: I can not help thinking that Cooper is mistaken about this being a pelecypod. It is true I did not examine it through a glass but even then I don't see how I could have made such a mistake."

He remained unconvinced until we went up there in the spring with both the fossil and the picture.

Dr. Cooper's second letter was dated December 5, 1946, and it was a long one. He wrote Put that he was pleased to get "the lovely Camarospira" for the Museum, and he spoke warmly of the pleasant occasions when he had been with the Southworths. "Collecting is so completely a part of their life," he remarked, "that a visit to the various collecting localities is not complete without them."

Then he turned to the question of "a sufficiently large collection." He said it was necessary to study many specimens of a species "to see what its growth form is, what the young ones are like, and a number of other features." With little shells like Cranaena, he said, one or more specimens had to be destroyed by grinding away the beak end in order to determine the internal structure. "It is an odd fact," he wrote, "that many genera with widely differing internal characters have the same external form and this can be detected only through the study of considerable material." He added that Dr. Cloud at Harvard was much interested in small shells like Cranaena.

"What a wonderful letter!" Put said to me as he slipped it back in the envelope, "and how kind of him to take the time to answer in such detail. You know, I've been slightly confused about how many fossils one was justified in taking, ever since Charlie scolded us for that basketful of Mucrospirifers. I see that the number depends on the purpose."

"And on the person, Put. Dr. Cloud or Dr. Cooper would make good use of a large quantity in their research while you and I would only be increasing the size of our collection."

"Yes, this makes it clear. We'll make a point of picking up all the terebratuloids we see for Dr. Cloud."

Not long after this some friends of ours, the Kerrs, told us they had fallen heir to a large set of oversize books, the Natural History of New York, published in the early and middle 1800's.

"A lot of them are about fossils," Mary said, "and written by a man named James Hall. Would you like them?"

Would we! It was almost like offering a First Folio to a Shakespearean. Charlie had spoken so often of Hall's work on the Devonian fossils that we knew they would be invaluable to us. We drove home that evening with fourteen volumes by Hall and several written by other early geologists.

Learning of this, Charlie wrote excitedly: "You were indeed lucky to get those books by James Hall. I wonder if you know how lucky you were. If they are in good condition they are almost priceless. Please bring them with you when you come next spring."

Size made that impossible but we took the volume about brachiopods which we knew would interest him most. He opened it with reverence, then begged to borrow it for the weekend.

"Did you know I once went collecting with James Hall?" he asked.

"No, Charlie! When?"

"Well, I was thirteen or fourteen -- still going to school -- when Professor Hall came to Thedford. The Reverend Mr. Currie and my schoolteacher, Mr. Kearney, took him to some of the outcrops and they let me go along to carry his bag of fossils. He was the State Paleontologist of New York then."

"What was he like?"

"He was a picturesque old fellow with white hair and beard, and although he was over eighty years of age, he was as excited about every good specimen as if he'd been a boy. Say, Jean, I've a present for you."

He laid the book down and went into the front room, returning with a new geologist's hammer which he handed to me. "Someday you'll miss something good unless you have a hammer. It's even better than an axe, Put," he added with a grin.

We went collecting with the Southworths the next day and Charlie made a point of showing us how a hammer should be used. "You can ruin a fine fossil very easily if you don't handle it right," he warned us

as we stood beside a block of Encrinal Limestone having a coral on its upper surface. "See, you hit here -- and here -- and here, being careful not to hit the fossil. If you're lucky, it'll pop off like this. Here's the Odontophyllum."

He put it in his pocket and reached for a small chunk of shale. "Now if you hit the end of the shale with the chisel end of your hammer it will split -- like this." And it had, into several layers.

Both Put and I found my hammer so handy that we wondered how we had ever managed without it, and very soon Put got one of his own. We found them indispensable in climbing a steep shale slope. Charlie showed us how to dig the hammer hard into the ground above one's head, then pull oneself up to it. Repeating this again and again, one reached the top far better than when depending on bushes or low tree branches which might break off under one's weight.

Perhaps the hammers contributed to our success that summer for we found twenty-one fossils that were new to our collection. These included an undescribed nautiloid which we sent to Dr. Flower in Albany and, best of all, a piece of that large gray Tornoceras at the tileyard that Charlie had said was so rare.

Our older daughter had graduated from the Country Day School in June and shortly before she left for Wellesley in September, Put and I made a quick trip up to the cottage. A friend of the Southworths -- Mr. Reimann of the Buffalo Museum -- and a friend of his, Dr. Loeblich of the Smithsonian, were coming from the East for a day's collecting with them. Charlie had urged us to join them.

We were at the Southworths' house early Thursday morning, just after the men arrived.

"It's such a fine sunny day I suggest we go to Lot 8," said Charlie.

"You name it," Mr. Reimann replied. "All we care about is finding good fossils. Let's get started."

With the Southworths in the back seat of our car we led the way, taking the back road to a certain lane and driving up that lane to a field at the top of a hill. There we left the cars.

Charlie and the two paleontologists walked rapidly down the hill while Annie, Put, and I followed slowly. At the bottom the path was lost in a swale that was all but dry; it emerged again on the far side to climb a second, steeper hill. Part way up this one we stopped for a few minutes so Annie could rest.

"It's something, this 'ill, isn't it?" she groaned, fanning herself. "We may as well go on, though, and get it over with."

By the time we reached the top and had taken the cowpath down the other side, the men were out of sight.

"They've probably gone on to that high slope," said Put.

"Yes, up to the Hungry Hollow Formation for Irv Reimann's blastoids. I'd rather stay here to collect, wouldn't you, Annie?"

"Oo, la -- yes! I've had enough walking already."

She poked around the stones with her fork and we looked over the patch of Arkona Shale. Put picked up a number of small slabs of limestone with interesting fossils which he put in our cardboard tomato basket.

"This is getting pretty heavy," I said, as he added another one.

"A cloth bag's much better for fossils." Annie's tone was positive.

"Well, a basket does have some advantages, Annie," Put remarked. "It holds more, it's easier. Why, it's sprinkling! I didn't realize it had clouded over."

"Nor I -- but it'll only be a shower."

But it wasn't. The heavens opened and the rain came down in a white sheet, soaking us to the skin and turning the shale into a soft slick clay.

"Come on, Shorty -- back to the car!" yelled Put. "No more fossiling today!"

He gave Annie a hand; her dress was plastered to her back and her straw hat limp. I was struggling up the slippery cowpath when my basket suddenly became weightless. Looking down, I found I was carrying just the handle; the cardboard had dissolved.

"Oh look, Put!"

I stooped to pick up some of his precious slabs, lost my balance and fell flat. Put pulled me to my feet.

"What a mess!" I said, trying to scrape the sticky clay off my front.

"That's an understatement if I ever heard one," he laughed. "Nothing's going to improve your looks but the washtub."

"And all our fossils are gone!" I mourned.

"Now you see why real geologists carry cotton bags as Annie said."

The men had come up behind us. "What happened to the weather, Charlie?" asked Put, as we let them pass.

"I'd like to know," he said sadly. "This isn't at all what the radio promised. Come, Annie, I'll help you," and they trudged on slowly ahead of us.

The rain continued to beat down upon us as we slogged up the path to the top of the hill and slithered

down it to the swale, now full of black water. Between them, the four men found enough old boards and branches in the woods to lay end to end so we could get across. The climb up to the cars was a hard one and we arrived filthy and shivering.

"Better come over to our cottage after you're dry," Put told the others. "I'll have a fire going."

"Yes, and plan to stay for dinner. We'll get food on the way."

When the Southworths and the two men arrived somewhat later we had a hot lunch ready. It and the warming fire were poor substitutes for what we had all been counting on. Mr. Reimann and Dr. Loeblich had driven a long way to collect in

Ontario. After such a heavy rain the shale would be too wet to walk on for days, too long to fit into their tight schedule.

Much of the talk that afternoon, of course, was about fossils. Occasionally I jotted down bits of information in our notebook which, on a page headed "9/11/47 -- (Loeblich and Reimann)" has these two comments:

Pelecypods of this locality need collecting and study.

Mr. Hibbard's collection well housed. See it if possible.

They had a direct influence upon our lives.

VIII

On St. Patrick's Day, 1948, Put wrote Charlie proposing a partnership. He suggested that if Charlie would get a lease on the field that had been Jim Bell's quarry and have it ploughed, we would foot the bill.

"It would be worth quite a lot to me," his letter said, "to be able to get out in a nice sunny field, merely parking the car alongside, and to step out to go fossil hunting. The alternative seems to be -- for early spring -- either wading that cold river at Rock Glen in order to get the spring crop of mourantaes or else taking that long, long walk through the fields and thistles.

"We really are beginning to be able to smell the fossils in the spring air," he continued. "It was particularly noticeable today as I drove home in a little drizzle and heard my first robin giving his rain call. The first fossil ought not to be far behind the first robin. These things seem to me to become more and more exciting each year -- and practicing law seems to become less and less important. (I talk this way and then when Jean says 'Come on, let's go here and there', I seem to take my law seriously again and find that I can't leave it with that sang froid that my above remarks should carry with them.)"

Charlie kept that letter. He thought the idea of ploughing the land a good one and had it done; however, the cost was modest and he declined a partner. He now had a private outcrop where he could stop on his way home from almost anywhere, arriving early enough so the time of his arrival was not checked. It was well worth the investment.

We made frequent trips to the field ourselves that summer but found little. It is quite possible that Charlie kept the cream skimmed off the top.

With Put's enthusiasm now equaling mine, we covered a lot of ground. According to our notes we collected at thirteen outcrops from the thirtieth of May until November fourteenth when we closed the cottage for the winter.

Charlie often referred to us as his pupils; we could not have had a more delightful teacher. He taught us much about the local fossils and rock formations, and about many other things. We learned, for instance, that a drop from a milkweed stem applied to a wart would make it disappear; he cured several on Annie's fingers in that way. And we learned where one should dig a well. One Sunday while we were picnicking near the bridge at Hungry Hollow he mentioned the fact that during the past week he had located a well for one of his neighbors.

"How?" we asked.

"Why, with a forked stick, of course. I'll show you."

Cutting the proper kind of branch from an apple tree and holding it in the proper manner, he walked onto the bridge. Sure enough, the end of the stick pointed down as soon as he was above the river.

"See? Nothing to it," he said.

But though we all tried, no one could do as well. We begged for an explanation but he shook his head.

"Time we were back hunting fossils," he said, reaching for his hammer, and that ended the discussion.

We always hoped to find a blastoid at Hungry Hollow. The chance of finding them was greater there than at other outcrops simply because there was more rock exposed; they were scarce everywhere. Some of these small fossils are budlike in appearance, one

looks a bit like a hickory nut, all of them are beautiful.

Irv Reimann specialized in blastoids and had written several papers describing new species. He and his wife Georgine moved to Ann Arbor not long after that disappointing cloudburst at Lot 8, Irv as Prefect of Exhibits of the University Museums. This gave Put and me a chance to see them on a number of occasions; we all looked forward to the coming summer when we could go collecting together.

Early in August they drove up to the cottage for the weekend and on Sunday morning we went over to Hungry Hollow; the Southworths were unable to join us on account of Annie's health. The day became a scorcher. When we met for lunch in the relative coolness of the apple orchard Irv had the only blastoid -- a poor squashed affair.

In the afternoon he left us to try a place upstream where he thought he might do better. Put decided on a nap under the trees, and Georgine and I sauntered across the bridge to a shady spot by the river where we sat and talked; it was much too hot to move about.

Glancing at the ground beside me, I noticed something peculiar about a small stone. I examined it with my lens and could hardly believe my eyes. There, on that bit of limestone not an inch across, were five tiny blastoids!

Georgine counted them too, as amazed as I was.

When we rendezvoused later in the orchard, Irv was discouraged for he had found nothing. I handed him my slab and watched him as he examined it.

"Nice, all right," he said, handing it back to me. "Pentremitidea filosa -- five infants."

"Would you like it?" I asked with some hesitation.

"No, you'd better keep it. They wouldn't help me -- really."

The Reimanns returned to Ann Arbor without them. The next time we saw the Southworths I showed Charlie my baby blastoids. "I suppose I should have been generous enough to insist on Irv's taking them," I said.

"Why, I should say not!" he replied. "There's no living paleontologist who would have given them away. Would you give up either of your children?"

By September our fossil hunting was limited to weekends and Charlie's to Sundays; he had become Thedford's librarian and was busy all day Saturday. Calling for them one Sunday morning, we found that Charlie had decided we should go to the Frasers' farm beyond Hungry Hollow, always a favorite place to collect.

We stopped at the house to ask if we might go down to the river.

"Of course you may!" Mr. Fraser said. "Drive through the chicken yard and through the gate beyond; just be sure it's closed behind you."

After leaving the car where he suggested, we walked down to the fringe of woods bordering the river; through the trees the water glistened in the sunlight. The Ausable is comparatively narrow there and the woods grow close to the water on both sides of the stream. It is a lovely place at all seasons; with no sounds of traffic or other people, one might be a hundred miles from anywhere. The exposures of Arkona Shale are small and vary from year to year. Occasionally landslides open up raw surfaces, which may be covered with fossils or may be completely barren.

We had hardly arrived that morning when Charlie took a quick look at the river, then at his wife.

"Annie," he said, "you won't mind if I go across the river to Crinoid Hill, will you? I haven't been over all summer and there's no telling what may be lying around. Will you Wrights come too?"

Annie frowned. She liked to visit much better than hunt fossils. Charlie, however, was already on his way and Put came to a brave decision.

"I think Jean and I will go with him, Annie. We'll try to be back soon. Hope you find something good," and we left her, eager to see that outcrop we had heard so much about.

Crinoid Hill had earned its name years before when Charlie had taken a Texas geologist over there to collect. They found the shale dotted with crinoid heads and before they left they had picked up thirty-one specimens between them. The story became widely circulated and the name stuck.

We found Charlie now standing in the river, his trousers rolled to his knees.

"Good gracious, you're slow!" he called. "Hurry up!"

"You go on -- but don't pick up all the good ones."

We took off our sneakers and socks, and rolled up our pant legs. "Better give me your hand," Put said. "The water's cold today and the current swift."

I was glad to hang on as we crossed. The soft mud seemed to suck my feet into it and the water swirled about my legs. When we were again shod we pushed through the thicket, eyes all but closed on account of the brambles. The ground was spring-fed in spots and the going slow.

"What luck, Charlie?" Put called as we came out in the open.

"Good. I've found a nice clam and two fine brachiopods. No crinoids, though."

We all did so well during the morning that nobody tried to hurry back to Annie. Charlie found the crinoids he wanted, Put an assortment of fossils, and I the arm of a starfish -- my first. It was almost lunchtime when Put called: "Not many blastoids in the Arkona Shale, are there, Charlie?"

"Well, I should say not! Blastoids in the Arkona are as rare as icebergs in Hell. Why do you ask?"

"Because I've just found one. Want to see it?"

Charlie's look of skepticism changed to one of utter amazement as he examined it.

"Why, I'll be switched! I'd never have believed it if I hadn't seen it with my own two eyes!" he said slowly.

The next time Put and I went to Ann Arbor we showed it to Irv Reimann. He told us it was like one he had described from the Arkona Shale and that it was indeed as rare as Charlie had said.

IX

Ever since I had seen all Dr. Cox's little old spool cabinets in Nova Scotia Put and I had been on the lookout for some of our own. By dint of stopping at countless country stores, we had acquired two of them. At first their shallow drawers seemed to provide luxurious space but by the fall of 1948 they were full. The problem of storing our ever-increasing stock of fossils had again become acute.

Discussing the matter one evening, we remembered that either Irv Reimann or Dr. Loeblich had spoken of how "well housed" Mr. Hibbard's collection was. Perhaps we could fix ours the same way.

Charlie had often mentioned his old friend, Mr. Raymond R. Hibbard of Buffalo. We knew that he was a Research Associate in Invertebrate Paleontology at the Buffalo Society of Natural Sciences, and that he was an authority on Bryozoa, about which we knew less than nothing. Even with the help of our books and Charlie, we had not been able to identify those we had found.

"It seems to me," Put said, "that Mr. Hibbard is just the person we ought to see. Suppose you write him and ask if we may come to call some Saturday evening soon, bringing our bryozoans. That will kill two birds with one stone; we'll not only find out the names of our specimens but what to do with our whole collection."

Mr. Hibbard's reply was very prompt.

"Just a few lines to acknowledge receipt of your letter of October 18th," he wrote, "and to say that I will be very much pleased to see you and Mr. Wright as well as your collection of Bryozoa, this coming Saturday evening at 8 o'clock. However, if you can arrive a little earlier, so much the better. I have so much material to show you and subjects I wish to talk on, all of which will take considerable time.

"I think your trip to Buffalo Saturday is going to be well worthwhile for both you and Mr. Wright and until then"

We packed our bryozoans in a little box and drove to Buffalo, arriving at the house not quite on the dot of eight, having lost our way after leaving the hotel. However, Mr. and Mrs. Hibbard were forgiving as well as gracious and they took us at once out to the new fireproof building in the back yard where the microfossils were kept. It was a wonderful place. The building had been designed, lighted, and heated expressly for the benefit of the fossils and Mr. Hibbard, and he was justly proud of it.

Mr. Hibbard was as precise in his conversation as he was in everything else; his mind clicked so fast that we had to listen attentively or miss something valuable.

When he told us that his bryozoan collection was the second largest in the world we could readily believe it. We admired what seemed to be millions of bryozoans arranged in neat trays, with neat labels, and stored in neat cabinets, all of which he had made for them. He identified our twenty-odd specimens with no difficulty whatsoever, spelling out each name as we wrote it.

Then he showed us his collections of conodonts which he explained were the teeth of small soft-bodied fishes, of scolecodonts -- the jaws of some kind of marine worms -- and of ostracods -- tiny two-valved crustaceans. They numbered in the hundreds of thousands and he could name every one of them. Many of these microfossils we examined under his high-power microscope and were amazed at their delicate forms.

In another part of the building he showed us where he printed his labels and how he made thin sections. His profession as a lens grinder with an optical company had taught him valuable techniques.

"How do you find such tiny fossils?" I asked.

"Well, of course, one doesn't find them individually," he replied. "Do you see all the bags lined up on this shelf, each with a locality written on it? They're full of weathered shale that I haven't looked over yet."

"Just how do you go about it, sir?" asked Put.

Apparently Mr. Hibbard was pleased to explain the procedure for he did so with enthusiasm. "I take one of these sacks and dump it into a large pan, cover it with water, and pour in a generous amount of common washing soda. I let it stand for a day or two, by which time the shale has further disintegrated and the water is muddy. I pour off this dirty water, add clean water, stir it around, and pour off that water, continuing the process until the water is quite clear. Then I drain it off and spread the shaly material left in the pan on newspapers to dry, after which I sift it through my sieves."

He showed us a series of United States Standard sieves with different meshes which permitted him to sort the residue according to size. He showed us also how he picked up an individual microfossil on the tip of a moist, very fine sable-hair brush and placed it in the cavity of a special type of slide.

"Of course everything must be done with exceeding care," he said. "The container in which the shale is collected must be absolutely clean -- either a freshly laundered cotton sack or a new paper bag -- so that there is no danger of the sample being contaminated by shale from some other outcrop."

"We've helped Charlie sometimes when he was getting shale for you," Put said, "and he always uses

new paper bags from Hilborn's store. He gets the Widder Shale at an outcrop about a mile east of Thedford."

"Yes, that's a splendid place for microfossils. Most of my collection is from localities in western New York but I have specimens from all over the world."

We were awed that he knew so much about so many different fossils and that he was skillful in doing so many things, all of them requiring infinite patience and meticulous care.

Mrs. Hibbard had said very little during the evening but had listened as we had. She had a delicious supper ready when we went back to the house and the conversation then became more general. Mr. Hibbard told us that as a boy he had spent many hours looking at the exhibits at the Buffalo Museum which had inspired his interest in fossils. It was at the suggestion of Dr. Bassler and Dr. Ulrich at the Smithsonian that he specialized years later in micro-paleontology.

Put and I came away late that night both impressed and depressed. We knew there was no possibility of our replacing our spool cabinets and cartons with what Mr. Hibbard had devised for his great collection, and that we would never understand microfossils as he did. But we would never forget the pleasant evening we had spent with a man who was clearly a genius and with his wife whose hospitality equalled her pride in his accomplishments.

Mr. Hibbard had said in his letter: "I think your trip to Buffalo Saturday is going to be well worthwhile for both you and Mr. Wright. . . ." It most certainly was.

X

By February, 1949, Put and I realized we must get professional help soon. So much that we read about geology was over our heads, so many questions remained unanswered. How, for instance, did there happen to be a Devonian Sea at one time in Ontario and what became of it? Then we had heard Charlie say on more than one occasion: "The glacier's been here"; we wished we knew more about it.

Just in the nick of time we heard that an evening extension course -- "Geologic Events of the Past" -- was about to start at Detroit's Rackham Building, to be given by a friend of ours, Dr. Erwin C. Stumm of The University of Michigan. We signed up at once. With the rest of the class we sat spell-bound from the first two-hour session through the last in early June.

Win, a tall substantially built young man with

an irrepressible twinkle in his eyes, lectured seemingly without notes and he spoke so graphically that the earth seemed to change as we listened. Being ambidextrous, he illustrated much that he said with diagrams on the blackboard, a piece of chalk in each hand. We watched mountains form, river valleys cut, and lava intrude into the rock formations. We lived through more than a billion years unforgettably.

During the first few weeks Win summarized the fundamentals of physical geology; then he turned to historical geology, primarily that of North America. We were amazed to learn that the continent had rocked from side to side, letting in ocean water and letting it out again, and that pressures within the earth had been strong enough to push the continent up to great heights and to crumple it. While we realized that such motion was incredibly slow, transpiring over

incredibly long periods of time, it was still hard to comprehend.

He described the events of the Precambrian eras fully enough to explain North America as it was at the beginning of the Cambrian, the first period of the Paleozoic Era which he said was approximately 500 million years ago.

"A cross section of the continent then would look something like this," he said, drawing a straight line on the board. "Imagine this as most of North America -- Precambrian granite, part of the Canadian Shield. In both the west and the east there was a depression called a 'geosyncline,' with a landmass of the same granite beyond each depression, and the ocean beyond each landmass."

He drew a broad U at each end of the straight line and a high mound on the far side of each depression, saying that the landmass in the east was called "Appalachia," that in the west "Cascadia."

"At different times during the Paleozoic these two depressions became inland seas," he continued, "and sediments eroded from the landmasses were deposited in them. These sediments hardened to form sedimentary rocks and eventually, when the geosynclines became filled, they were folded to form mountains."

He described the physical history of the Cambrian Period, saying that in the Upper Cambrian the whole of North America dropped several hundreds of feet, causing the waters in both troughs to overflow and form a single sea. Then, due to vertical uplift, the sea was driven out.

"How come the continent moved up and down when it's steady now?" someone asked.

"But it's not," Win replied. "The northern part of North America is rising as a result of the melting back of Ice Age glaciers. Part of Hudson Bay is rising about twelve inches a year, much faster than the area around it; eventually this bay will be drained. The land around the Baltic and North Seas is also rising and the time will come when the British Isles will again be joined to the continent of Europe."

He said then that although Precambrian rocks are almost devoid of fossils, Cambrian rocks abound in most forms of invertebrate life. Strangely enough, the most highly developed of the invertebrates, the trilobites, were dominant during the entire period. They ranged in size from some about a quarter of an inch in length to Paradoxides that measured eighteen inches.

"How do you explain the sudden appearance of such a complex animal?" asked Put.

"I can't -- unless trilobites were the first to develop hard parts. They might have lived before the Cambrian without a hard covering."

Put and I did considerable homework every free evening, to our high school daughter's disgust; she could think of so many pleasanter ways to spend time. We had to, however. The course moved swiftly and we were taking it for credit.

The discussion of the next two periods, the Ordovician and Silurian, was equally interesting but it was the fourth period, the Devonian, that for us was the high point of the course. We knew that Win shared our enthusiasm for the Middle Devonian; he had written important papers on its stratigraphy and fossils.

During the Lower Devonian, he said, there had been a slight depression of the land so the sea had entered from the south; then with slight uplift, the sea moved out.

"At the beginning of the Middle Devonian," he continued, "there was a pronounced depression of the continent and the entire Mississippi Valley was again covered by the sea. Limestones and dolomites -- the Onondaga Group -- were laid down.

"Then came a distinct change. Appalachia was rising in the east and erosion muddied the waters, with the result that calcareous shales and some limestones -- the Hamilton Group -- were deposited in western New York, southwestern Ontario, Michigan, and as far west as Illinois. The farther west, the less shale and the more limestone, because the effect of the uplift was felt less there."

Put raised his hand. "This Hamilton Group includes the Thedford-Arkona beds?"

"Yes," Win replied, "and the rocks near Alpena, Michigan, at Sylvania, Ohio, and other places not too far from here." He went on: "At the beginning of the Upper Devonian Appalachia was uplifted so much that coarser materials -- sandstones -- were deposited over the region. Then the sea outlet was plugged. The water in the landlocked sea became stagnant, sulphur was precipitated, and black mud formed on the bottom. This accounts for the black Kettle Point Shale."

"Why is it practically unfossiliferous?" I asked.

"Because when there's little oxygen almost no life is possible. There are no fossils in black shale except for those forms which floated in, died, and fell into the mire at the bottom."

After describing the mountain building in eastern North America at the close of the period he said: "Life in the Devonian was much like that in the Silurian except that there were fewer trilobites and more corals. Because of the many fossil coral reefs in Middle Devonian rocks it is thought that the sea then was warm and shallow. Reef-building corals today do not live in water colder than 64 degrees Fahrenheit or deeper than 150 feet, although there are some species that can tolerate colder tempera-

tures and greater depths.

"Two groups -- the vertebrates and the land plants -- had 'evolutionary explosions' in the Devonian. Joining the Ostracoderms which had appeared in the Ordovician were the first true sharks, the armored fish called *Arthroires*, and the first lung-fish; the last of these had swim bladders which permitted them to stay out of the water for a while. It was only a step from there to the development of land animals -- but it was a big step."

He paused a moment, then he said: "Before vertebrates could live entirely on land they had to have certain features not needed in the sea: eyelids, a different type of ears, a pore system, and muscles to turn the head. All of these developed during the Devonian, hence the arrival then of the earliest amphibians -- low, sprawling animals with smooth skins called *Stegocephalia*. These amphibians had to protect themselves from too much exposure to dry air and they returned to the water to lay their eggs."

After discussing the land plants of the Devonian, Win went on to the two succeeding periods, the Mississippian and the Pennsylvanian. These, he said, were so closely related that in Canada and Europe they are considered one, the Carboniferous. Conditions were very different then. A landmass called *Llanoria* in the south rose until it joined *Appalachia*; together they formed a high sickle-shaped landmass which curved to the east, north and west from Texas to the Great Lakes region, enclosing the *Mississippi Valley*.

"This basin," Win said, "was flooded by the sea entering from the *Rio Grande*. Fifty times the land tilted to the east and to the west, back and forth, leaving alternate marine and terrestrial deposits. The climate was warm and humid, the vegetation in the swamps lush; it decayed to form peat which in time became coal."

He told us that both plants and animals then grew to great size and that a fossil dragonfly had been found with a wingspread of 29 inches.

"In the Permian, the last period of the Paleozoic," he continued, "the climate became increasingly hot and dry; red beds, salt, and gypsum were formed. Then tremendous pressure from the east folded the sedimentary rocks in the *Appalachian trough*, nearly five miles thick, into the *Appalachian Mountains*. This ended the era. Now there'll be a little test next Monday to see how much you've learned in the last eight weeks. Class dismissed."

The examination was comprehensive. Put and I were glad we had done a lot of extra studying.

Once the papers were handed in Win began to lecture again; he had 200 million years to cover and the weeks were flying. He said that two eras followed the Paleozoic -- the Mesozoic and the Cenozoic.

Most of the physical changes in the Mesozoic

Era took place in the west; these included the formation of the bright-colored rocks of the *Grand Canyon* and the *Painted Desert*, and the gold that caused the *Gold Rush of '49*. Later, when the land extending from *Alaska* to *Central America* was buckled, the first generation of *Rockies*, the *Laramide Mountains*, were formed as the result of folding and thrusting on a gigantic scale.

Equally dynamic were the changes in life. Dinosaurs appeared and ruled the universe for a hundred million years.

"At first," Win said, "these dinosaurs were relatively small -- about six feet long. Then, midway through the Mesozoic they grew to enormous size. There was *Brontosaurus*, for example; he was 65 feet long and weighed fifty tons. His weight was such a burden that he lived in swamps where the water buoyed up his body and his huge long tail.

"And there was *Stegosaurus* -- thirty feet long and armored, with elevated bony plates running in two lines along his back, and a tail on which there were two-foot spikes. He had two brains; one, the size of a baseball, in his head, and another in his rear to look after rear action. These large four-footed creatures were all herbivorous; the carnivores walked on their hind legs and became fast runners."

"How do you know what they ate?" somebody asked.

"It's really quite simple -- a matter of teeth. The vegetarians had flat teeth while the meat eaters' teeth were sharp and pointed. Two of the great reptiles returned to the sea about this time: the *Plesiosaurs* which were turtlelike and whose legs became flippers -- they looked like a long-necked rowboat with two banks of oars -- and the *Ichthyosaurs* which developed a fishlike form and bore their young like mammals."

Win seemed to be enjoying this as much as we were and he was speaking slowly enough so we could take full notes.

"There were flying reptiles also; they were called *Pterosaurs* or *Pterodactyls*," he continued. "They had hollow bones which were extremely light and fragile; they glided, without very good control. Apparently some of them glided out over a great inland sea and fell helplessly in for their fossil remains are found in marine deposits.

"In the latter part of the Mesozoic Era there were three great dinosaurs whose names begin with T: *Triceratops*, a clumsy beast three times the size of a rhinoceros; he had an armored head, nine feet long, on which grew three horns and a bony frill. Then there was *Trachodon*, a vegetarian, who was duck-billed, walked on two feet, and had two thousand teeth in his big mouth. The third one was *Tyrannosaurus rex*, the most powerful meat-eating beast of all time; he was 47 feet long and stood twenty feet

tall on his hind legs. There were other strange reptiles in this period: a sea serpent, 45 feet long, called Mosasaur; Archelon, a giant marine turtle; and Hesperornis, a diving bird with no wings. But the most important animal living then was none of these but a little creature only about six inches long -- the very first mammal. For while the dinosaurs had been masters of the earth, sea, and air for a million centuries, suddenly at the end of the Mesozoic they vanished completely."

"Why?" we asked.

"It's impossible to say," he replied. "Perhaps it was the change of climate. Temperatures dropped so much that glaciers formed out west where these heat-loving giants had flourished."

The Cenozoic Era, the era in which we are living, followed the Mesozoic. Win divided it into two periods -- the Tertiary and the Quaternary.

"The western part of North America was the scene of most physical changes in the Tertiary," he said. "The sea had deposited 45 to 50 thousand feet of sediments on the Pacific Coastal Plain when pressure from the east began to fold them into mountains, the Coast Range. That pressure is still continuing; Mt. Hamilton is rising at the rate of one to four inches a year. That's what causes the earthquakes out there. Faults and volcanic activity always occur in an active area.

"This Cascadian Revolution lasted for a very long time; it began in the latter half of the Tertiary and continued into the Ice Age. It was a time of vertical uplift and colossal vulcanism. In the Ame-thyst Cliffs of Yellowstone Park there are eighteen forests one above the other; each forest grew up, then was buried by volcanic ash."

"Did you say eighteen?" asked somebody.

"Yes, eighteen, in a section two thousand feet high -- more than a third of a mile. Now you will remember that the dinosaurs became extinct at the end of the Mesozoic and that only the mammals survived."

"How could mammals live if dinosaurs couldn't?"

"That's a good question," Win replied. "Several things may have contributed to it: their higher intelligence, their metabolism, and the way they were born and cared for as they were growing up. Mammals evolved rapidly during the Tertiary, their development affected by their environment. As the climate became very dry, the timber in the forests died and the first prairies appeared. Some animals remained in the forest but others became adapted to living in the open and running on the plains. A land bridge across the Bering Straits throughout most of the Tertiary permitted migration of animals between North America and Eurasia. Many groups evolved in

North America including the mammoth, the mastodon, the camel, the horse, and the sabre-tooth tiger."

Lack of time necessitated only a brief summary of the development of man -- enough, however, to make us anxious to know more.

"I'll begin on the glaciers next week," he said as the closing bell rang.

Put turned to me. "Too bad Charlie can't hear that one, isn't it?"

On the following Monday evening Win prefaced his lecture by saying that the Quaternary Period was subdivided into two epochs -- the Pleistocene or Ice Age which began about a million years ago, and the postglacial or Recent.

"The Pleistocene put the finishing touches on the world as we know it today," he said. "No one is sure what caused such widespread glaciation but the temperature in the northern hemisphere stayed consistently below the freezing point. Since precipitation was abundant, ice sheets formed over much of North America, Greenland, Europe, and Siberia, as well as in Antarctica."

He explained that an ice sheet moves radially from its center and that in North America there were two great epicenters -- Keewatin west of Hudson Bay, and Labrador.

"Four times in the last million years the ice advanced for great distances and then melted back. Always ahead of the glaciers as they advanced, and behind them as they retreated by melting, moved all living things. Feeling their icy breath, plants died and animals fled farther and farther to the south. Then, as the ice melted and warm weather returned, plants and animals crept northward again."

One of the girls raised her hand. "You said 'all living things'; do you mean man, too?"

"At times -- yes," Win answered. "The first trace of human remains dates from the first interglacial period -- nearly a million years ago; this was Pithecanthropus erectus or 'Java man.' He was not very intelligent, since his skull shows a brain of only about 900 cubic centimeters; modern man's brain averages 1350. 'Peking man' was perhaps as old; his skull indicates that he was somewhat smarter than 'Java man'; his brain measured about 1000 cubic centimeters.

"'Neanderthal man' came along considerably later -- in the warm interval just before the last glacial stage, about 150 thousand years ago. He was a short fellow, about 5 feet 2 inches in height. He had a receding chin and forehead, his head was thrown forward, and he walked with a slouch.

"'Cro-Magnon man' -- Homo sapiens -- was the modern type; he was six feet tall and probably handsome, with a high forehead and an erect carriage.

He developed in eastern Asia and came into Europe at the end of the last glacial stage -- about 25,000 years ago. He and his relatives were skillful both in making stone implements and in using them. They exterminated the Neanderthals and possibly the woolly mammoth, the sabre-tooth tiger, and some of the other animals whose pictures they painted on the walls of their caves."

"Did any of these live in North America?"

"Probably none I've mentioned but it's thought that the makers of the Folsom points found in New Mexico and of the Yuma artifacts of Colorado lived during the latter part of the fourth glaciation, about the time the Cro-Magnon race was living in Europe. It is believed that early man came to North America from Asia across the Bering Straits; certainly the Eskimos show traces of the Orientals. You'll find many interesting books on the evolution of man; new discoveries are being made all the time."

He paused briefly, then he continued: "I mentioned four ice sheets. It was the fourth one known as the Wisconsin which so greatly affected the Great Lakes region. Two glaciers, the accumulation of ice on both epicenters, converged and met in the Mississippi Valley, covering the entire Great Lakes region with ice, in some places four miles thick. The advancing ice pushed down river valleys, gouging them out to form the Great Lakes. It moved on as far as southern Ohio, Indiana, and Illinois where the climate was warm enough to melt its front edge. Then very gradually it retreated to the north. The ice left Lake Erie only about 25,000 years ago."

"The interglacial intervals were much longer

than the periods of glaciation, and warmer than the present. We're probably still in this last interglacial period. The ice covering Greenland and Antarctica today is part of that Wisconsin ice sheet and when all that ice melts, the oceans will rise about 70 feet. That will inundate the coastal plains, almost obliterate Florida, and destroy large parts of New York, Boston, and other cities along the East coast."

"Really?" somebody asked in amazement.

"Yes, really -- unless, of course, the land has risen in the meantime."

Everyone was sorry when the course was over. It had given us a geologic timetable which put the events of earth history in their proper order; it had left us with a sense of awe.

For Win had talked about force that had shaken the land like a rattle and folded it into mountain ranges. He had told us about time too long for comprehension, and about ice miles thick that had traveled over hills and valleys. He had described small complex animals living in the seas a half billion years ago, and others of gigantic size that had controlled the world for a hundred million years and then vanished. He had traced evolution from those first invertebrates to Man who, comparatively recently, was still living in a cave. What did the future hold? We wondered.

The story of geology has changed in some respects since 1949 and early man dates much farther into the past. Win's course enabled us to read of these developments with greater understanding than would have been possible without such a background.

XI

In May, while our course in geology was still in progress, Put and I were invited to join the Wayne University field trip at Arkona. Dr. John T. Sanford, the professor who taught invertebrate paleontology at Wayne, suggested it, thinking we might help the students identify whatever fossils they found. Of course we accepted, pleased to have an excuse for a weekend of fossiling.

We could hear the group before we saw it. Arkona's main street, normally empty and silent on a Sunday morning, was lined with cars and swarming with students who were fortifying themselves with ice-cream cones or pop. Professor Willard H. Parsons, the head of the Geology Department, was easy to spot; he was taller than average and colorful, wearing a red flannel shirt and a ten-gallon hat. Dr. Sanford's friendly grin put us at ease immediately; he introduced us to his family and Dr. Parson's, who had

come for the fun of an all-day outing.

When the students had been corralled we led the cavalcade to Rock Glen. There John Sanford kept the group together long enough to explain the rock section. The creek, he said, tumbled over a hard limestone of the Widder Formation, plunged about forty feet into the gorge, and hit the Encrinal Limestone of the Hungry Hollow Formation, forming a smaller waterfall. From there the creek ran on through the glen over the Arkona Shale until it joined the Ausable River not far beyond.

As he said the last word the young people departed on the run. Most of them raced down the path and jumped the creek, to climb the steep shale bank on the far side; almost immediately the sound of their voices and of rocks thrown into the water echoed in the glen.

While the two professors had heard of Charlie Southworth, neither of them had heard of his measuring the section here. We told them the story as we walked down the path.

In 1901, when Charlie was about twenty years old, the two distinguished geologists, Hervey W. Shimer and Amadeus W. Grabau, came to Thedford to study the area's rocks. They were taken about to various outcrops by the local schoolmaster, another man, and Charlie. At Rock Glen, where they decided to measure the rock section, they lowered Charlie, youngest of the party, over the waterfall with a rope tied about his waist and a tape to measure the different units. Later Shimer and Grabau published the results of their field trip in a paper entitled, "The Hamilton Group of Thedford, Ontario"; Charlie is mentioned in its introduction.

"That's very interesting," John remarked. "I'd like to meet Charlie Southworth sometime."

"You will this afternoon when you go to Hungry Hollow," Put assured him. "He and his wife are there for the day."

Fortunately nobody found anything at Rock Glen then that Put and I could not identify. It was the Sanfords' small son, David, who had the best luck; he picked up a complete trilobite and even more scarce, an Indian arrowhead. By two o'clock the Wayne group had bags full of fossils and was ready to move on to Hungry Hollow. We wished them luck and headed back to Detroit.

The long Memorial Day weekend gave us another chance to get up to the cottage. We made the most of that Sunday by going to the Frasers' with the Southworths; the weather was ideal. Stopping at the farmhouse only long enough to see how they had fared over the winter and to admire some fossils Mrs. Fraser had found while fishing recently, we hurried on down to the riverbank.

It was a perfect May morning. The sky was never more blue, the birdsong never lovelier, and the fossils were lying on top of the shale much like nuts on a frosted cake. Even Annie, whose eyes were clouded by cataracts, managed to see large fossils the rest of us had missed. By the time we stopped for lunch, each of us had a bagful.

We ate on a place flat enough for the Southworths' folding stools; they had given up the folding table, tablecloth, and style some years ago.

"Why don't we ever go upstream to collect, Charlie?" Put asked, as he finished the last of the cookies.

"Because there's nothing to collect," he answered with some impatience. "I've told you before, the glacier's been there and covered up all the fossils."

"We ought to look at it anyway, Shorty. After Win's lecture, I'd like to see what the glacier did."

We had walked that way often in the past but had never given it a thought. Now we realized that Charlie's glacier had left a low rocky moraine, and that the boulders were granite, their edges rounded by the grinding of the ice. Rough grass and scrubby bushes had grown up among the stones heaped on the ground; the Ausable rippled over those in its course, dropping some five feet onto the Arkona Shale before continuing towards the west. Wading the river, we always walked in the lee of those boulders.

Put and I went far enough to be sure there was no exposure of shale before we turned back.

"How much Win has taught us!" I said.

"Yes, and how much more interesting everything outdoors is because of that course."

Charlie had heard us talking and looked up as we came closer. "Find any fossils up that way, Put?" he called.

"No, but I'm still glad we went. How about yourself?"

"I've done so well there's not much left for you. Just found the nicest trilobite you ever saw."

"And I found one of those big Stropheodontas," said Annie, gloating.

Put was looking at a small slab he had picked up. "Well, here's a pelecypod neither of you saw," he said, putting it in his bag. "A very good specimen of Leiopteria that I'm glad to have."

I was sitting down in the midst of a lot of fossils where I could look them over and enjoy the conversation. There seemed to be more than usual of the little spiny brachiopod called Strophalosia and I was picking up the best ones when my eyes lit on something startling -- a crinoid different from any I knew. Its arms and their pinnules were beautifully preserved, branching up from its calyx almost like a tiny bush.

"Oh, come quickly!" I called. "Look at this! It's a beautiful little crinoid!"

"Let's see it." Charlie had hurried down the slope and was reaching for it; I laid my prize carefully in his hand.

"Say, that is a beauty!" he said as he examined it through his glass. "I never saw one that had arms like this one. I think you've found a new crinoid, girl."

"Now let me see it," said Put, taking it from Charlie. "It's very different, isn't it, with all those pinnules on the arms? Better keep it in my tin box."

"And send it to Dr. Goldring; she ought to see it," directed Charlie.

I nodded; she was the leading authority on crinoids and State Paleontologist of New York, as well as the author of our Handbook.

"It's terribly exciting, isn't it, Put?" I sat

down again and watched him wrap it in tissue.

"You bet it is! Did you find it here?"

"Yes, right where I'm sitting."

And looking down, I saw a second crinoid like it! It was too poorly preserved to be of any value except to prove that it was the same species. Charlie came over and the three of us looked over every inch of the shale near me in case there were others, but we could find no more.

The afternoon went fast and we were all sorry when it was time to leave. As we walked slowly up the hill to the car, Charlie remarked in a quiet voice: "It's been an enchanted day! We'll never get a better one."

It summed up the occasion perfectly, and I wrote it in our notebook below the date "May 29, 1949." The list of fossils Put and I collected then takes up the rest of the page for we had had almost unbelievable success. Besides my crinoid, we found six different pelecypods (fourteen specimens in all), two starfish arms, ten different brachiopods, three other crinoids, and three trilobites. As Charlie said, the day was indeed enchanted.

June was such a busy month -- with our final examination, our younger daughter's graduation from Country Day School, our older daughter's return from Wellesley plus many other things -- that we could do nothing about sending the crinoid to Albany. We put it safely away in one of the spool cabinets until we had time to attend to it.

Since both girls would be away at college next year, we hoped to have them with us in July. That would mean less fossiling since neither of them thought it much fun, but we felt the pleasure of being a complete family again would more than compensate us. The sacrifice was not called for; both girls made other plans.

Our older girl told us she had arranged to go out to the University of Colorado to summer school; she would only be gone a month, making up the course she had had to drop while she was in the Wellesley infirmary. Obviously, this was a sensible thing to do.

Then our younger girl said she wanted to help with the crippled children at the "Hospital School"; she would live there while we were at the cottage. How could we veto a project that sounded so philanthropic? We made a few firm ground rules and gave in.

We spent our month's vacation, therefore, by ourselves except for occasional guests, and we went fossil hunting just as often as we wished.

Two of our guests were two of our friends from The University of Michigan -- Professor George M. Ehlers, Curator of Paleozoic Invertebrates at the Museum of Paleontology, and our teacher, Win Stumm. Put and I were very fond of "Jim" Ehlers and admired

him tremendously. He was a little older than we were, with a keen mind and a remarkably retentive memory. Their visit had been carefully planned to include trips to two rather inaccessible outcrops where they were anxious to collect.

They arrived in what was probably the hottest part of that summer, too limp after their long drive to care about fossils anywhere. After some cold well water, they revived enough to be driven to an outcrop not far away and on the lake shore. The breeze off the water made collecting relatively attractive and we filled a small carton with specimens for the Museum. Then we returned to the cottage for a swim and to talk, cool drinks in hand.

Visiting with them that afternoon, Put and I realized how very little we really knew about fossils. To be sure, thanks to Charlie, we could recognize most of the common varieties in the local beds but that was not enough. We knew nothing of the internal structure of any of the fossils nor the terms used to describe them. This was doubly disturbing because both Jim and Win, like all the paleontologists with whom we corresponded, assumed that we did.

When we had a chance to talk this over in private, Put and I decided that something must be done about our inadequate knowledge and done soon. In the meantime, all we could do was hope for a change in the weather.

But the next day was even hotter. We stopped for Charlie early in the morning and went on to Rock Glen, choosing an exposure of the Arkona Shale down by the river where we would be in the shade. Even there no one did much collecting. Jim took some kodachromes of the rest of us sitting on the riverbank; the faces are scarlet and the exhaustion very evident. As soon as the lunch was eaten and the thermos bottles of cold water drained, the professors gave up and drove back to Ann Arbor.

When the wind shifted to the north some days later we became hospitable again. For several years we had been sending our strange cephalopods to Dr. Rousseau H. Flower, the expert in such fossils and the Assistant to Dr. Goldring, then State Paleontologist of New York. We knew from his letters that he had never collected in our part of Ontario and would like to. We knew also that we would like him, so we wrote, inviting him to the cottage for a weekend and suggesting that he bring his wife if he had one; he could set the date.

He could not make it in July but he quickly accepted for August: ". . . it is just possible that I may be able to head your way for the 12th to the 14th of August. There is no Mrs. Flower to join me in your kind invitation. Right now, today being what it is, I am more tempted by being in some lake up to my neck than by all the fossils in the Devonian. . . ."

Put and I drove up to the cottage that Friday

afternoon, the twelfth, to get things in order. Then, with dinner ready except for the steak, we sat down to wait for our guest. What would he be like? we wondered. Old or young? Thin or fat? It was a gamble for him too, of course, for he had no idea what he was getting into.

From time to time we looked at our watches;

Dr. Flower was younger than we were and thinner, and he had an engaging smile. He was tanned the color of mahogany, tall, and dark-haired. The reason he was so late, he said apologetically, was that he had come through Ontario by way of Formosa -- not a very direct route from Buffalo, he realized. No, I thought, that made it a triangle.

The reef structure at Formosa was so interesting, he added, that he had forgotten all about time. This made us like him all the more for we had forgotten the clock sometimes, too. We suggested that he try out our lake and he needed no urging.

That evening the weather was unusually balmy for August, with no chill, dampness, nor mosquitoes, and the three of us sat on the grass in front of the cottage. The stars were enormous and brilliant against the inky sky; only the faintest swish of little waves came from the beach below.

Both Put and Dr. Flower knew the constellations by name. I listened as the talk shifted from mythology to astronomy and to a discussion of what there might be in space beyond those countless stars. Then the conversation turned to the earth and to that fascinating fossil reef at Formosa.

"It seems strange, doesn't it?" Put remarked, "that corals grew in this latitude in Devonian times when today they live only in the tropics. I wonder why the climate was so different then."

"There are several theories," Dr. Flower said, "the most interesting one being Wegener's theory of continental drift. He believed there was once a single huge continent he called Gondwanaland. One evidence he gave was the present coastline of the continents and the position of the mountain ranges; another, the unusual fossil plant *Glossopteris* found in the rocks of India, Africa, Brazil, and Australia. This great continent broke up into several pieces which drifted away from each other, some to different latitudes; hence, fossil corals in the Arctic and the reef at Formosa."

"We must read more about that, Shorty," said Put.

he was quite late.

"Perhaps he's lost his way," Put said. "Or maybe he decided not to come after all and hasn't been able to let us know."

Then we heard the crunch of gravel. A car was coming up the driveway.

XII

"You people might enjoy a book I read not long ago -- Grabau's Rhythm of the Ages."

We listened intently as he went on. According to Grabau, the primitive earth was made up of concentric shells which increased in specific gravity inwards towards the iron-nickel core. Nearer the surface there was a thick shell of basaltic rock upon which floated a thin shell of granite -- the crust. Outside this crust there was water -- the hydrosphere -- and outside that the atmosphere.

Eons ago, Grabau conjectured, a powerful star or other celestial body approached the earth with such attraction that it drew the crust from the northern part of the globe, concentrating it, intensely wrinkled, near the South Pole. This caused the water surrounding the earth to fill the space left empty and form one great ocean.

The concentration of land which Grabau called the Pangea was probably anchored at some point by an igneous intrusion. From time to time this Pangea drifted slightly as a boat drifts on its anchor's line, the direction of its drifting influenced by the earth's rotation. In this way some parts of the landmass came nearer the equator and became warmer; other parts being nearer the pole were glaciated.

We listened entranced. The stars above looked so big anything seemed possible.

The title of Grabau's book, The Rhythm of the Ages, Dr. Flower explained, referred to a rhythmic pulsation of the sea -- his "pulsation theory." Expansion of the ocean floor due to heat generated by radioactive rocks caused the sea water to invade the land; contraction of the ocean floor caused it to withdraw. This periodic advance and retreat of the ocean accounted for the shallow seas in the geosynclines and for the changes in invertebrate life.

"How long did that single continent last?" I asked.

"According to Grabau, it was intact throughout the Paleozoic, and the continents as we know them were not formed all at once. Grabau thinks the break came first in the South Atlantic -- in the early part of

the Cretaceous -- at which time Africa and South America became separated. South America remained attached to Antarctica until the Late Pleistocene. The Atlantic rift continued to grow wider throughout the Cretaceous, the Tertiary, and the Quaternary. The separation of North America is comparatively recent."

"It's amazing, yet it sounds logical as you describe it," Put said thoughtfully. "I'd like to get a copy of that book. Is it available?"

"Yes, but scarce. It's worth a try."

We ended the conversation with regret; it had grown late and chilly. We dragged ourselves indoors and said good night.

The next morning Dr. Flower looked over all our cephalopods which we had brought from home. He was interested to see many specimens of what he considered a new species and we gave him all that he wanted. Then we showed him the beautiful crinoid from Frasers' and the fragment of a queer one we had recently found at Hungry Hollow. He could not identify them and said he would tell Dr. Goldring about them when he got back to Albany.

Driving over to Thedford a little later he confessed that he longed to have another look at that fossil reef.

"Why don't we all drive up to Formosa tomorrow morning?" suggested Put. "I'm sure Charlie and Annie would like to go too; Charlie's always interested in new places and Annie'd go just for the ride."

We went first to the Southworths'. As we had suspected, the trip to Formosa appealed to them both.

"We'll drive over to your cottage first thing in the morning, bringing our lunches," said Charlie excitedly.

"Oh, don't bother about lunches," Dr. Flower said. "There's a place to eat in Formosa -- good food."

"Well, that's great," said Put. "We'll get off that much earlier; I figure it's about a seventy-mile drive."

We took Dr. Flower then to Hungry Hollow, the tileyard, and to several other outcrops he had heard about where we found a number of typical cephalopods for his Museum.

Sunday morning we set off for Formosa as soon as the Southworths arrived, all of us in our car. Put drove up along the lake to Bayfield where, just beyond the old bridge, he turned to the right onto the "snake road," a narrow road that follows the course of the river. It was flanked on both sides by thick woods.

"We're running on limestone," observed Dr. Flower.

"How on earth can you tell that?" I asked.

"Because of all the cedars in these woods; cedar trees prefer a limy soil. Those were limestones we saw from the bridge, I'm sure."

Formosa proved to be a pretty little village. We looked over a small outcrop beside the main street while Put went to make reservations for dinner. He came back almost immediately to report that the restaurant was closed on Sundays.

"What will we do for lunch?" I asked.

"Charlie and I have to eat!" Annie's tone was desperate.

"I know you do, Annie," Put said soothingly, "and we're all going to -- somehow. The only trouble is that everything seems to be shut up tighter than a drum."

"Look, there's a man going into that store!"

"I'll go ask him if he has any suggestions." Put hurried away.

This time he was gone a long time. When he emerged from the store he was carrying a carton that bulged with parcels; he had had wonderful luck. He told us that the man he had seen was the owner of the store. Unexpected company had arrived for the day so he had come down to lay in enough food; he finished slicing cold ham for his household, then sliced a generous amount for us. Put had bought bread, butter, cheese, pickles, and goodness knows what else to go with it.

With the carton stowed in the trunk, we drove on to the reef, a few miles beyond the village. At first it looked only like a very small hill, one we would certainly have driven by if Dr. Flower had not pointed it out.

Climbing around on it, however, we found it was made up of fossils, principally corals and stromatoporoids, with many other invertebrates that had dwelt on the reef. Dr. Flower explained to us that it appeared to be a true reef because of its tilted structure, and that its age had not been determined. It was Devonian, older than the rocks near Thedford and Arkona but how much older he was not prepared to say. It was our first experience on a reef of any type.

We spent most of the day on its slopes, stopping at noon for lunch; characteristically, Put had provided an over-abundant feast. We found a lot of different fossils which we put in the empty carton for Dr. Flower to take back with him.

Put and I were sorry when the weekend was over. It had cemented a friendship born of correspondence and it had given us new vistas. The letter we received soon showed that Dr. Flower had enjoyed it too: "I want first of all to thank you for a beautiful weekend, lake, fossils, food and fun. Perhaps I put

the lake first because I needed it most; certainly it has one advantage over the fossils in that it doesn't have to be taken back, unwrapped, labeled, prepared, probably photographed natural size, then described. I am so glad that you lured me into making the trip; it is something I would never have missed. . . .

"Now I have two things to beg of you. The first is to keep an eye on Formosa in the fall. You could have guessed that, almost. The second is quite different. Can you collect some assorted tabulate corals (Favositidae) from around Theford and send them to me express collect?"

About the same time we had another letter, this one from Dr. Goldring. She said she would like very much to see the unusual crinoids Dr. Flower had told her about.

We sent them at once. The crinoid from Frasers' turned out to be a new species which she eventually described as *Decadocrinus wrightae*; its description with photographs was included in her paper "Devonian Crinoids, New and Old, II," published in 1954.

It was impossible for us to carry out either of Dr. Flower's requests for some time as life grew too thick at home. Our older girl had written the preceding July from Colorado that summer school was even better than she had expected and that she

would like to stay the second month; okay? Okay, we had replied as we knew from other letters she was not again overworking.

She was radiant when she came home towards the end of August. To our surprise, she had arranged to transfer from Wellesley to the University of Colorado which had so many advantages, she said. It was only a matter of days before one of the advantages arrived for a visit. He was a very attractive young man who had been in her first class; certainly he was more than Wellesley could offer.

About mid-September one girl left for college in the West, the other for college in the East, just in time for me to start to college at Wayne University. For Put and I had thought of a way to learn more about fossils. If I were to take a course in invertebrate paleontology, he could get it secondhand.

Drs. Parsons and Sanford were consulted and said I might do so if the Dean gave his permission. The Dean was cooperative. He would overlook the fact that I had not had the required courses in geology, zoology, and chemistry because I was not working for a degree. I must realize, however, that that was a handicap. I thanked him and registered with alacrity.

Relief was in sight.

XIII

As the class in invertebrate paleontology began to assemble for the first meeting I began to have butterflies. Perhaps I could never keep up with these smart young people, all juniors and seniors. Yes, I thought as I watched more tall young men come in and take seats, it was a crazy idea, this going back to school at my age.

We sized each other up. The atmosphere was uncertain when our professor, John Sanford, arrived. He at any rate seemed glad to see me and he explained to the others that I was just a fossil hunter who didn't know enough about fossils. The butterflies departed when he started to lecture; I could see that he was going to teach all the things that Put and I had been unable to teach ourselves.

His lectures were tremendous. The subject matter was highly technical and the pace rapid. I took voluminous notes on the classification, structure, and life history of all the invertebrates from the simple one-celled animals to the most complex; since with each group John dictated pages of vocabulary with definitions, I could never again complain that I did not know the terminology.

In addition to the lectures we had lengthy lab sessions each week when we studied the fossils under microscopes. Here my early training at Art School paid off as the neatness of our drawings and the lettering were considered in the grades. My familiarity with fossils came in handy, too, and I was able to help some of the students who had helped me with other problems.

One of the early lectures was on the bryozoans, those minute colonial fossils Put and I had never been able to understand or identify. John explained them so clearly that at last I could recognize different species. When he mentioned Dr. Bassler and Mr. Hibbard as the leading American authorities on Bryozoa, I could well believe it, recalling the evening we had spent in Mr. Hibbard's micro-museum.

Anxious not to miss the last of the good weather, we went up to Ontario several times that fall, collecting with Charlie and Annie. As Dr. Flower had hoped, we spent one day on the Formosa reef, sending him more fossils from there. With Charlie's help, we also shipped him the corals he wanted for some research at Cornell.

Not long after that starry evening at the cottage when Dr. Flower had discussed some of the theories in The Rhythm of the Ages we put in an order for a copy of the book; it came late in the fall. It had been published in Peking in 1940 while Grabau was Chief Paleontologist of the Geological Survey of China; ours was a first edition, one of 800 copies. We found it slow reading but as interesting as Dr. Flower had intimated. It was clearly the work of a man with a vast fund of geological knowledge, imagination, and the courage of his convictions.

The dust cover stated that Grabau was "the author of 275 books, monographs, and shorter articles." He was also the man who had measured the section at Rock Glen by lowering young Charlie Southworth on a long, strong rope.

All of this was extracurricular, yet it tied in very well with the course at Wayne. The lectures grew more fascinating as John discussed fossils such as brachiopods, corals, and crinoids with which I was more familiar. Because Put had already begun to specialize, he managed to hear John's talk on pelecypods.

In November we went to Washington together and spent a rewarding hour at the Smithsonian with Dr. Cooper, then Curator of Paleontology and Paleobotany, whose letters had helped us so much. He took us into his laboratory where, in tanks full of an acid solution, he was soaking blocks of Permian limestone brought from the Glass Mountains in West Texas.

"It's full of the most beautiful silicified brachiopods," he explained. "Come -- I'll show you some I've already etched out."

Put and I had never even imagined brachiopods as fantastic as those lying on the tray. They were covered with long fragile spines no greater in diameter than a needle.

"How on earth can you get them free of matrix, sir?" Put asked. "They're so perfect and so clean."

"By leaving them in that dilute hydrochloric acid for a while. It eats away the limestone and leaves the fossil intact. Of course that wouldn't work with calcareous fossils such as you find in Ontario."

Put knew much more about chemistry than I did and understood the formula Dr. Cooper wrote in explanation. I was content to marvel at the exquisite brachiopods before me and at his ability to get them out of the rock in such perfect condition.

Dr. Cooper took us to meet Dr. Bassler and later we had a brief visit with Dr. Loeblich. We owed a great deal to all these men for their help of one kind or another. Talking to them and seeing their work at the Museum made us more anxious than ever to do something worthwhile with our fossils; we came home truly inspired.

The course in paleontology was paying dividends for us both; we were acquiring important knowl-

edge and a necessary vocabulary. As the semester progressed I realized I need not have had such qualms on that first day, and that it is never foolish for a housewife to go back to school, provided she is willing to work hard. A scant academic background is offset to some degree by maturity and years of reading; the fact that she is taking a course because she wants to and not because she must is a real asset.

When the lectures ended my notebook contained over a hundred pages of material that we would consult often in the coming years. I turned in my examination paper sure that now my school days were over. I would stay home and apply what I had learned to our fossils.

John Sanford thought otherwise. He urged me to go on with the class and take the course in stratigraphy. Put and I talked it over. That course would help us figure out the rock structures in the Thedford-Arkona region which we were wondering about. Yes, I ought to take it.

"Well, then," John said when I told him, "if you're going to be here for one course, why not make it two?"

He suggested that I take his "research course" and work on a project he had in mind -- the evolution of the graptolites. I hesitated. I knew nothing about graptolites except what I had learned in class and frankly I was not interested in them. However, his enthusiasm for them won me over and I signed up for both courses.

The lectures on stratigraphy supplemented the material in Win's course we had had the year before. The discussion of the Devonian formations of Ontario and those with which they are correlated in Michigan, New York, and other states was particularly important in our work.

Meanwhile, I was steeping myself in literature about the graptolites, most of it written by Dr. Ruedemann, formerly State Paleontologist of New York. When I wrote Charlie about this research, he replied in dismay.

"I don't know much about the graptolites but what little I do know makes me wonder how you ever got the notion to specialize in them," he wrote: "It seems so out of our usual line that it surprises me. Can you get any original material for study? If you make a success of it I hereby put in a claim for a copy of your work. I almost agree with Ruedemann about the lack of graptolites in this part of the Devonian but not altogether. One time I was out collecting with Dr. Galloway at the tileyard and found a fine specimen. I could scarcely believe that it was a graptolite but Galloway identified it as such. He very much wanted the specimen so I gave it to him."

This surprised me. I had never heard that even one specimen had been found up there.

John Sanford had a fine lot of graptolites for me to study and I grew genuinely interested in them and their probable lines of descent. They are strange little fossils and get their name from the fact that they look a bit like pencil marks on the rock. They are very small and always colonial, the individuals having lived in pits or cups along a slender stem. Some floated or drifted about, some were attached to seaweed.

To illustrate my conclusions, I drew three charts showing their evolution -- based on Dr. Ruedemann's Graptolites of North America, the outstanding book on the subject. Before inking them, I wrote Dr. Flower to ask what he thought of my submitting them to Dr. Ruedemann. His reply was definite: "Dr. Ruedemann is 85 and extremely absent-minded and I would not recommend sending him your graptolite drawings."

The charts were subsequently reproduced on notebook-sized sheets and are still used as an aid in teaching paleontology and historical geology at Wayne, now Wayne State University.

On more than one occasion Put and I had heard the Sanfords mention their friends Dr. W. Taylor Thom, Chairman of the Department of Geological Engineering at Princeton, and his wife Rachel, saying they hoped sometime we might meet them. When we learned in April that Dr. Thom would be in Detroit for a few days, we suggested that John bring him downtown to have lunch with us.

We liked the gray-haired professor with the gentle manner and the friendly smile at once. During the course of the leisurely meal he told us about the geology camp of which he was in charge. Known as

the Beartooth Research Camp, it was located in the Beartooth Mountains, more than a thousand feet above the town of Red Lodge, Montana.

There was a main lodge, Dr. Thom explained, with a library building, shower house, and about a dozen sleeping cabins. He said he and his wife had quite a family there during the summers -- geology students working on research projects in the mountains or the Elk Basin oilfield not far away.

"The view is magnificent," remarked John, "and so is the food -- good home cooking."

Dr. Thom turned to us. "Why don't you come out there this summer?"

Put and I looked at each other, surprised. We had never thought of doing anything during our vacation but spend it at the cottage, fossil hunting as usual -- but why not? We had not seen that part of the West and we would be seeing it under such ideal circumstances.

"Sold!" said Put almost at once. "We'll be there in July."

"And bring your girls," Dr. Thom added with a smile. "I think they'd have a lot of fun."

We thought so too.

After the semester ended we were able to get up to the cottage several times before leaving for the West. Charlie could not understand why we would want to go so far away when there were so many fossils lying around nearby. We promised to come back and look for them with him on August weekends.

Both of our daughters preferred to do something else so we went to Red Lodge alone.

XIV

We made the most of that trip to Montana. Since Put had never been West and I only once in my youth when my interests had been nongeologic, we were determined to see as much as possible. We went by train to Denver, transferred our belongings to the car a thoughtful client had offered us, and drove away with the excitement of Lewis and Clark. It was Saturday morning, the weather was ideal, and the Rockies magnificent and near.

Our immediate destination was Boulder where our older daughter was again at summer school. We had arranged to spend the weekend with her, meeting the people and seeing the places she was so enthusiastic about; we found everyone and everything as she had described them -- "Wonderful."

"Now I understand why she's taking more

courses when she doesn't need the credits," Put said as we left Boulder Monday morning. "The combination of the mountains and that young man would captivate any girl."

"Sure, and explain why going to a geology camp with Mom and Dad didn't appeal."

Put laughed. "I'm just as glad, Shorty. We can gaze at rocks and pick up fossils as much as we wish without boring anybody. Now look at our notes and tell me what we see first."

The route we had chosen took us diagonally across Wyoming from Cheyenne in the southeast to Yellowstone Park in the northwest corner. The road followed the curve of the Laramie Mountains the first day and was relatively uneventful; this was just as

well for it introduced us gradually to unfamiliar scenery and mountain driving. We spent that night in Casper where Put compiled a detailed road log from various sources. While I did the driving the next morning he read from it -- such tidbits as "Outcrop of Cody Shale to left" and "Contact Mesa Verde and Cody Formations." They were only interesting until he read: "'Enter Hell's Half Acre -- badland erosion in Wind River Formation.' Gosh! look at that!"

The badlands were even more fantastic than we had expected -- layers of varicolored rocks weathered into the most extraordinary shapes.

"To think all that was started by rain," Put said slowly. "Rain made little channels in the shale which widened into gullies. It must have been quite a rain."

"Maybe rains were harder in prehistoric days," I suggested.

"Maybe; let's hope so."

The mountains grew much closer as we went westward; by the time we turned north at Shoshoni they were very close indeed. The road, we could see from the map, was taking us through the Wind River Canyon. Put took over the driving and I the notes.

The canyon, I read, is a mile deep, the walls sheer. We could see places where molten lava had been forced up through great fractures. According to our notes, the Wind River Canyon has one of the most complete sections of Paleozoic formations to be found anywhere; except for the Devonian, there are rocks from the Permian down to the Cambrian, the latter resting on Precambrian granite.

"Just think -- from before the time of the first invertebrates through the time of the first big reptiles."

"Yes, and it's that little river down there that's carved out this canyon a bit at a time. Another proof of the power of water."

Six miles farther we came to Thermopolis and its steaming hot springs, with terraces extending down to the Big Horn River. Their colors, Put reminded me, were the result of algae in the hot water.

"Good for you; I'd forgotten that. How much better we'd have understood Win's course if we'd already seen what we've seen today."

"That's true -- but how much better we can understand all these things now because we've had a little geology."

Perhaps we had had our fill of natural wonders that day for we made no further stops until we got to the small attractive lodge where we had reservations for the night. We had read about it in our Duncan Hines' Lodging for a Night; the rate for two in a log

cabin with private bath was four dollars and a quarter.

The next morning we drove on to Yellowstone Park, sixteen miles to the west. We were most anxious to see the geysers, particularly Old Faithful; it was hard to believe it could operate on a regular schedule.

"Seven minutes to wait," Put reported after checking. "That gives me time to finish my chapter," and taking a small book from his pocket, he was immediately lost in it.

Why did Old Faithful explode every sixty-four minutes? I wondered. I consulted our book and learned that it required just that long to sufficiently heat the water accumulated on the boiling lava within the earth to send it to the surface. With that it let go -- precisely on the minute. Put's book closed with a bang, and we watched the great column of hot water and steam shooting high into the air and splashing down on the travertine terraces.

"And it does this hour after hour, day after day, year after year," I said at last.

"And has since the Ice Age," Put added. "I read last night there are glacial boulders in the travertine of Terrace Mountain not far from here. Let's go see something else."

It was early afternoon when we drove out the north gate onto the Red Lodge - Cooke City Highway -- the last lap of our trip to the camp. Nothing in our pasts had prepared us for what lay ahead.

Put was at the wheel, I reading snatches from the road log. We stopped long enough to take a picture of Pilot Peak rising above the other snow-covered mountains, then went on. I pointed to such things as Table Mountain, Beartooth Lake far below us, and Beartooth Butte above it. Put nodded but made no comments. He was busy driving.

The road wound up and up. I stopped looking at the log and at times stopped looking at anything. We passed the timberline and saw Alpine flowers growing where nothing ought to grow. There were snowfields in every direction.

"We're coming to Beartooth Pass -- 11,000 feet above sea level," I announced, "and look! we're running into a snowstorm!"

My heart was in my mouth. Where Put's was he did not say. He was very calm but very silent. He had never driven over a mountain pass. I could not help thinking that when we met a car we would have to get still closer to the outside edge; fortunately, there were few coming the other way.

The snowstorm was a brief one, the ride downhill breathtaking. The road had four hairpin turns and seemed to hang on the side of the mountain.

At last we turned off the highway onto the camp road; it crossed a little bridge, then climbed part

way up Mount Maurice. Put stopped near some log buildings and almost immediately Dr. and Mrs. Thom were welcoming us as if we were old friends. Behind them came Mrs. Walter Bucher and Mrs. Henri Bader who were staying at the camp while their husbands were off doing field work.

While we visited Put and I kept looking over at the mountain we had just come down. Dr. Thom must have noticed this for he said: "That's the northern face of the Beartooth Range. Having come over 'the top,' you can understand why the Plains Indians called this part of Montana 'The Land of Shining Mountains,' can't you?"

I nodded; those snowy peaks were unforgettable.

"And this building is the lodge," his wife was saying. "Taylor will take you over to your cabin; it's among those trees. You've had quite a drive, haven't you?"

"Yes," Put answered, "and that's quite a road. I think Jean was afraid we'd never get here."

Mrs. Thom smiled. "I know. I haven't forgotten my first trip over that new highway."

Her husband pointed to the "shower house" where he said there was always lots of hot water, then he took us to our log cabin. It clung to the slope and looked over at that towering mountain.

"Come over to the lodge when you're ready, won't you?" he said. "We have dinner after the boys get back; you'll hear the station wagons come up the hill."

The bed -- level and not moving -- looked very good to me. "I'd love a nap," I said to Put, trying to shake the wrinkles out of a dress that had been in my suitcase. "I seem to be quite tired."

Put chuckled. "No wonder you are. You drove much harder over that road than I did. Your foot was on an imaginary brake the whole time."

We heard the history of Beartooth Research Camp later. It had been built in 1935 to house the Yellowstone - Bighorn Research Association, a group of geologists and geophysicists from more than thirty universities and colleges. Dr. Thom and Dr. Bucher with two other professors had conceived the idea of joint research five years earlier. At the time of our visit to the camp, both Taylor Thom and Dr. Parsons of Wayne University were officers of the Association.

The camp site of 120 acres stretched out on the northern side of Mount Maurice at an altitude of well over a mile. The region under investigation covering more than 50,000 square miles extended from Yellowstone Park to the eastern side of the Bighorn Mountains and included six mountain ranges.

The camp itself had been well planned and was simply but comfortably furnished. The main lodge --

a low log and stone building -- hugged the ground on one side. The porch across the other side jutted out over space and was reached by a flight of steps at one end. Inside, the chairs were grouped about the fireplace, the card tables ready for a game, and a piano looked inviting. Beyond these, long tables were set for the next meal.

Rachel and Taylor Thom ran this camp so well that seven years later, in 1957, they were awarded jointly the John Fleming Medal by the American Institute of Geonomy and Natural Resources. The citation states that "in this endeavor to run a camp, instruct students and do his own research on regional structure Taylor Thom was ably assisted by Rachel Thom. Much of the hard work of keeping the camp going fell to her and for much of the success of the operation she deserves the credit."

The Thoms were Quakers -- kindly, gentle people, each with a delightful sense of humor. Put and I considered it a privilege to be with them at camp for two weeks.

After dinner one evening we all walked up the slope behind the lodge to what was called "the Point." High above the Rock Creek valley, the view was spectacular. Taylor named the surrounding mountains for us -- the Pryor Mountains on the east, the Big Snowies far to the north. "And of course, that's the Beartooth Front over there," he added. "The 'palisades' we're looking at were formed by overturned Paleozoic limestones, the older ones lying on the younger."

"Think of force strong enough to push those tremendous rocks over backwards," I said to Put.

He nodded. "'And the strength of the hills is His also.' Are there Devonian rocks in the palisades?" he asked Taylor.

"Yes -- the Jefferson Limestone. You can see some of it not far from the camp."

We went there one day and picked up a coral and a brachiopod somewhat like those we found in the Devonian beds of Ontario; these we took home to Charlie as souvenirs of Montana.

Another evening -- a chilly one -- we visited with the Thoms, Mrs. Bucher, and Mrs. Beder in the lodge. The students had departed to do the paper work that finished each day's assignment.

"Tomorrow might be a good day to drive you over to the Elk Basin oilfield," Taylor said. "Then you can see where the boys are doing their mapping."

Rachel leaned forward. "It would be a very good day, Taylor, for you to take us all to lunch in Cody. We can go to see Mrs. Allen. She's Buffalo Bill's niece," she explained to us, "and a dear person."

The plans were completed and, sleepy from the warmth of the fire, we broke up early, getting our hot bricks waiting in the kitchen stove. They worked

wonders on icy sheets.

Put and I lingered on the porch to admire the view of Red Lodge, four miles away and a quarter of a mile down, a mass of twinkling lights. Taylor had told us the town once had had a thriving coal mining industry. The air was cold, the stars enormous; we hurried over to our cabin with our hot heavy bricks.

Standing the next morning on the rim of the Elk Basin oilfield, we looked down into a depression so vast that the oil rigs, buildings, and roads looked like miniatures. We picked up a few Cretaceous fossils and a piece of yellowish sandstone with ripple marks; the preservation of delicate ridges left by ripples in the sea seemed even more remarkable than that of the hard-shelled animals.

Later at the little museum in Cody, Mrs. Mary Jester Allen took us back into another past, one that was almost yesterday in comparison with geologic dates. She spoke vividly of her life in the days of Buffalo Bill and the Indians in what was then a very Wild West.

One morning early Put and I went with Taylor to the Horse Center structure not far from Cody. There we saw the Triassic Chugwater red beds, and in a Jurassic bed found a piece of belemnite, that strange mollusk that looks a bit like a half cigar. In the Thermopolis Shale (Cretaceous) Put picked up our first vertebrate fossils -- bone fragments of a turtle and of the sea serpent Mosasaur.

Taylor pointed out a lens of bentonite, the white clay rock that swells as much as ten times its volume when wet. He told us about being trapped on a remote location when bentonite, swollen in a sudden downpour, made driving temporarily impossible.

We learned that he had worked in north-central Montana since 1914 when he had come there as a rookie geologist. That accounted for his knowing the names of all its mountain ranges and of all the rock formations and fossils.

One of his graduate students, Bill McMannis, came from Bozeman one weekend while we were at the lodge and showed us a beautiful brachiopod he had found on the top of Bridger Mountain where he was doing his research.

"It's hard to realize that a sea bottom could be pushed up to such a height, isn't it?" remarked Put.

"Hard to believe but true," Taylor said. "You see, Montana was under water in the Mississippian when that brachiopod was alive. Very much later, during the Laramide Revolution -- a time of violent volcanic eruptions -- the sea bottom was pushed up with terrific pressure to form these Rockies. The seashells landed on the mountain tops."

"I'd like to go up there and find one," I said. "Could we?"

No, we were told. It was a long climb from the place the jeep had to be left -- too rugged for anyone not accustomed to such terrain. "But there are other, more accessible places to collect fossils near Bozeman," said Taylor. "Why don't you people drive over there? It's only two hundred miles and you'll find fossils ranging in age from the Cambrian to the Cretaceous. We've some students there who'll take you to the localities."

"Why don't we?" said Put. "How do we go?"

"Bill will give you the directions. Take your field clothes and be sure to wear high boots with your pant legs tucked in; there are lots of rattlesnakes where you'll be going."

Put turned to me. "We'll buy you some boots in Bozeman. Now let's see a map."

We found our way with no difficulty and after checking in at the hotel, spent the rest of that afternoon in shoe stores. Nowhere could we find high boots my size, either feminine or masculine.

The next morning when we joined the students at breakfast, I noticed they were all wearing high boots with their pants tucked in. We went with them to two localities near Bozeman and to Nixon Gulch near Manhattan, looking for fossils and listening for snakes.

"What fun that was!" Put said as we drove back to Red Lodge the next day. "It would have been a shame to miss it. I was worried about your meeting a rattler; the kids told me they're plentiful."

"But not hungry, thank goodness! What fossils from there are you most pleased to have?"

Put thought a minute. "Well, of course, I'm glad to have those two Triassic pelecypods I found in Rocky Canyon but those little Cambrian agnostids we dug out of the shale at Nixon Gulch are prizes. What strange crustaceans they were -- the same at both ends. How do you suppose they knew which end was the front?"

"Or where they were going without any eyes? They must have managed, though, or they wouldn't have survived in such numbers. Yes, they're prizes but I'm most glad to have that beautiful brachiopod Bill McMannis gave us."

We rode for a long time in silence, with so much to think about. Finally I said: "I'm sorry we have to start for home next week, aren't you?"

"Yes, indeed. Still I find myself thinking about the office."

That sounded familiar. I could see we had had enough vacation.

A terrific clap of thunder woke me very early the following Sunday morning. In the lightning's dazzling whiteness I dashed to the window and shut it

just as the heavens opened. Back in bed I shuddered as the storm crashed around us. This being in the middle of an electric storm was very different from being below it, I thought, when a jagged streak of lightning pierced the sky. The thunder seemed to shake the whole mountain and the rain sounded like bullets on our roof.

"Do you think the cabin will hold up, Put?" I asked.

"Sure, it's fine," and his voice trailed off in sleep again. I lay awake, trembling with the cabin, until the storm moved on to another mountain.

When we woke next the sun was shining and the sky blue and innocent. We dressed quickly and picked our way through the dripping grass towards the lodge.

Taylor was coming up the hill and walked along with us. "We're isolated -- our road was washed out in the rain."

"Why, that's the way the badlands started," I said.

"Yes, geology in the making," observed Put. "Then we've lots of time for breakfast and it smells awfully good!"

XV

On a Saturday afternoon in August, 1951, Put and I swept up wedding cake crumbs and paper rose petals for the second time in less than a year. The house was suddenly very empty and very still. We locked the doors and took off for a week at the cottage.

Our older daughter had been married not long after our return from Red Lodge the September before to that attractive young man from Colorado. They had returned to the university for their senior year, had graduated in June; and were now living in California. Our younger girl had graduated that same June from a junior college. She and her brand new husband had just departed for a home in the East leaving Put and me, a pair of old-fashioned parents, somewhat stunned. Tired, too, for the pace of the past ten days had been exhausting.

A few days at the cottage did wonders and we revived enough to think about fossils. It was a sunny afternoon, with puffy clouds racing across the sky on a breeze off the lake, and we drove up the Blue Water Highway to investigate an outcrop we had heard about.

We located the place at last. It was in a rocky field some distance from the road and appeared to have been either a quarry or a lime kiln. The farmer's wife readily gave us permission to look it over, and the sheep did not seem to mind our intrusion. Wandering about, we found a few poorly preserved, unfamiliar fossils embedded in limestone -- such uninteresting fossils that my thoughts kept returning to the situation at home. Without any child to look after, I wondered what I was going to do with my time.

"Well," I said finally, "I suppose I'll find enough odd jobs to keep me busy -- dig out the house, ship the wedding presents, write to the girls. . . ."

Put interrupted me. "Sure -- but I've another idea. Not having the kids home is going to give us more time to work on our fossils and you know both Jim and Win keep telling us we've some new ones we

ought to describe."

"I'm afraid we don't know enough to do anything with them, Put."

His suggestion was interesting even though impractical and it showed that his thoughts were running in the same channel as mine. How lucky we were to have this joint hobby at a time like this! What did people do if the only interest they shared was their children?

It would have been hard not to think about Put's idea during the next few days because he mentioned it often. "As a matter of fact, Jim says we've material for several papers," he said one morning.

"Yes, but Put, do you really think we know enough to write them?"

He hesitated before he answered: "No, to tell the truth, I don't. We're really just rank amateurs -- an enthusiastic lawyer and an energetic housewife. So why don't you go to Wayne full time and get a degree in geology? That would help both of us."

"Put!" It was a fantastic suggestion. One way and another, I had accumulated the equivalent of three years' college work but I needed many courses before I could get a bachelor's degree. "I doubt if I could carry a full schedule," I said soberly. "It would be very different from taking only one or two courses at a time. There'd be an awful lot of homework and, as you said yourself, I'm first of all a housewife."

"Yes, but it's an opportunity."

"And a challenge. Well, I'll consider it."

I did, for about ten days. Then I had a conference with Dr. Parsons, Chairman of Wayne's Geology Department. He looked over my records from Wayne, The University of Michigan, and the University of Chicago where I had gone before I was married. An A. B. in geology, he said at last, required a number of

courses I had not had; if I wanted to work hard I could get that degree in a year's time. I told him I did.

The following Tuesday I registered for four courses and left the campus with an ID card and a feeling of unreality. Was I a fool? I wondered as I drove home. Would I have the energy after going to classes all day and doing homework, not to mention cooking, cleaning, and other housework, to live as we always had -- seeing our friends, doing a little entertaining, sometimes going on a little trip? It sounded like a good deal -- in fact, too much.

What if I were able to find someone who would keep things running smoothly at home while I was at Wayne?

I stopped at the office of the local newspaper and inserted a small ad: "WANTED -- Housekeeper for middle-aged couple -- no children" et cetera. When I told Put about it at dinner he agreed it could do no harm. We had never had a housekeeper but this was a good time to try one.

The next evening two women who had seen the ad phoned. The first one asked: "How much do you pay? How much time off?" The second woman had a pleasant voice with a Canadian accent; she asked if she might come to see me Friday afternoon.

When I answered the front door bell that day it was evident that the neatly dressed little woman who stood on the other side of the screen door was as uncertain about the coming interview as I was. We talked in the living room for a few minutes, then she said: "The middle-aged couple who advertised -- where are they?"

Her surprise when I told her I was the middle-aged woman was flattering. Perhaps the wedding had not made me as old as I felt.

Our visit was most satisfactory. I liked her, she liked the house and the proposition, and she said she could start next week Thursday. We decided to try it for a week, then talk the matter over.

Classes began on Monday and as my first one was at nine, I left early each morning. And the days were long; it was often five o'clock when I got home. By Thursday afternoon when Mrs. Reed moved in I was awfully glad to see her. It was going to be wonderful to have someone look after breakfasts and dinners, the dishes and dusting, and all the other things that need attention in a home.

Mrs. Reed kept the house in perfect order, everything she cooked was delicious, and she seemed to belong to us. When the week was up we extended the trial period to a month; when the month ended we postponed the decision for a year.

Two lab courses -- chemistry and zoology -- made my schedule a heavy one; I doubt if I could have managed it and the household as well. With a little planning Put and I led much the same life we had

always led except that we played over the weekends. Somehow my homework always got done.

The Paleontological Society, of which Charlie Southworth, Put, and I were members, was holding its joint Annual Meeting with the Geological Society of America in Detroit early in November, 1951. Drs. Ehlers, Stumm, and Kesling of The University of Michigan were in charge of an all-day field trip to cover the Devonian rocks of southeastern Michigan and northwestern Ohio; Put and I were helping with other preparations. The Southworths were coming from Theford to a room we had engaged at the Statler Hotel, headquarters of the convention; two geologists and their wives were staying with us. Everything was under control but the weather.

It began to snow on Tuesday afternoon, the day before the field trip -- a heavy wet snow that packed as it fell. My drive home from Wayne and Put's from his office each took two hours instead of the usual thirty minutes. We decided at dinner that we ought to let Charlie know about the storm. Reluctantly we phoned him; reluctantly he concluded that they should not attempt to drive down. His disappointment was hard to forget.

The field trip was a dismal failure. The busses had difficulties on the road, the geologists had difficulties everywhere, and the Devonian outcrops were buried deep beneath snow and slush.

Aside from that, the 1951 Meeting was a great success. Figuratively speaking, the Wayne Geology Department adjourned to the Statler. Consequently, I was able to hear many of the papers given during the three days, to attend the luncheon for women geologists, and to enjoy the musical skit written and acted by Ann Arbor friends at the tea for visiting geologists' wives.

Put and I had heard so much about the Devonian formations considered to be the equivalent of those in Ontario that we were anxious to see them. One evening in late March, 1952, Put brought home a letter from Win Stumm, urging us to join him and four graduate students on a field trip to southern Indiana. He wrote that they would be staying at a small inn overlooking the Ohio River and that "the most complete outcrop in the entire region, running along the highway for about a mile and ranging from Upper Ordovician to Middle Silurian is within sight of the inn's front door. . . . Will be looking forward to seeing you bright and early on April 5."

"What do you think about it?" Put asked as I finished the letter.

"I think we should go if you can get away."

"That's what I thought and I looked at my calendar. We can take the night train Friday to Cincinnati, rent a car there, and drive over Saturday morning to meet the others. We'll have to come home before it's over but we'll have three days with them.

I'll phone Win tonight."

During those three days we saw not only Ordovician and Silurian formations but Devonian rocks correlated with our Hungry Hollow Formation and with the black Kettle Point Shale.

Then in May Put and I had an opportunity to see Devonian formations in New York State. We went with John and Aletha Sanford and some of the advanced students on the Wayne Stratigraphy Field Trip; it covered the area from Hamilton, Ontario, eastward to Canandaigua Lake, and the fossiliferous rocks from the Early Silurian to those of the Middle Devonian. As both Aletha and John had grown up in that part of New York, they knew many lovely places off the beaten path to find fossils -- such places as wooded gullies and

hidden glens in the Finger Lakes region. Once, beside a creek in a meadow blue with violets, we found specimens of a beautiful Silurian cystoid.

Of course Put and I were most interested in the formations of the Middle Devonian Hamilton Group which yielded fossils similar to those occurring in our favorite outcrops near Thedford and Arkona. Our trip climaxed at Eighteen Mile Creek, the famous locality where James Hall, Grabau, and so many other early geologists had collected.

On the evening of June twelfth I wore my cap and gown with a feeling of deep gratitude. Wayne University had granted me that much wanted Bachelor of Arts degree in geology, and Put was tremendously pleased. My college career had ended -- so I thought.

XVI

With Commencement over life seemed utterly carefree. No classes, no homework, no schedule; instead, a month's vacation at the cottage with a lot of fossiling. The friends we had invited to visit us were those who would enjoy it too.

First of these were our dear friends, Mabel and Jim Ehlers. When we had first met Jim years ago we had been in awe of him; he was the senior professor of invertebrate paleontology at The University of Michigan and we knew so little. We soon perceived that he was not at all in awe of himself. He was glad to discuss any geological problem and to answer any questions; he was glad also to play cribbage. His wife, Mabel, was pretty, clever, and quick-witted, with an uncanny way of picking up fine fossils.

Due to persistent rain we did not do as much fossil hunting as we had hoped during their visit but the conversation never lagged. Jim tossed a bombshell into it one day when he asked why I didn't come out to Ann Arbor in September and begin work on my master's degree.

"Master's!" I gasped.

"Sure. A bachelor's degree is good but a master's is better. You could write up some of the new fossils you've found for your thesis."

I looked over at Put; he was grinning at me and nodding his head. I promised Jim I'd think about it sometime but not now.

The Stumms came a few days after the Ehlers departed and the rain which had spoiled collecting for Jim and Mabel improved it for Win. We went to Rock Glen one morning and waded the river to the far side. While Betty sketched the old dam, Win, Put, and I looked over the still damp shale of the riverbank. It

was not long before we had picked up two specimens of the crinoid named for Annie. Two at one time -- could there be more?

Carefully we traced bits of mourantae calyx and stem up the bank to what appeared a likely spot. Even more carefully we dug into it. Between the three of us we found several more of them as well as some of the less rare Arthroacanthas.

Then we took Win up to a place known as the "miniature bed." Its fossils are typical of the Arkona Shale but only a fraction of their normal size; crinoid heads usually the size of a crabapple are only the size of a pea.

Win was much interested in this "dwarf fauna." He said it occurred also in the Devonian of New York State and that there were several theories as to its cause. One theory seemed to apply to this bed -- that a pool of water had been cut off from circulation causing hydrogen sulphide to form and retard growth. This would explain the fact that the specimens found here are often pyritized and accompanied by small pyrite nodules.

We spent another day looking at outcrops of the Ipperwash Formation and the black Kettle Point Shale, unable to do much collecting, however, because of the high lake level. On the way back to the cottage Win said he hoped I was going to go on and get a master's degree. Again I replied that I'd think about it.

I had little time to do so in the weeks ahead. Our younger daughter and her husband moved back from the East and our older girl and her husband came from the West for a long visit. We had much to consider besides geology.

Early that September Put and I went to a dinner

party at the Sanfords' in honor of the Thoms, who were on their way home from Red Lodge. Bill Parsons and his wife Alice were there too. During the evening both John and Bill urged me to enroll in the Wayne Graduate School; it was a pity, they said, to stop with an A. B. Taylor Thom agreed with them. I listened, more confused than ever.

"What do you think I should do, Put?" I asked as we drove home.

"I think you should go to Wayne. I've thought a lot about your getting a master's ever since Jim spoke of it at the cottage and I believe they're right. The research we want to do together would have more authority if you had a graduate degree."

"Well, if that's the case, Wayne's the place to go. It would be too hard to commute to Ann Arbor. I wonder if Mrs. Reed would stay another year."

"Ask her tomorrow."

She'd love to -- indefinitely, she said after breakfast, so on Registration Day I signed up for two courses, the first step toward that degree. The fall of 1952 promised to be a full one.

Because our younger girl had taken the furnishings from her old bedroom to put in her new home, our fossils now had a room of their own. We set about making it both efficient and comfortable; it needed redecorating and it needed furniture.

We had two large chests of shallow drawers made -- one for Put's pelecypods and one for my brachiopods; that left the six spool cabinets we had collected for the rest of the fossils. With a long work table, two captain's chairs, and a bookcase for reference books we were ready for business.

"Gosh, it'll be a relief not to have fossils in our bedroom!" Put exclaimed, as he stacked the last carton in the closet to await sorting. "No more stumbling over them in the dark."

"And a relief to have a safe place for our microscope. Now to get all the specimens in their proper place. Maybe we can start this weekend; right now I must study for the test tomorrow."

Slowly, species by species, we got the fossils in the new trays with the new labels Put had had printed -- labels which gave the name of the fossil, formation, the locality where it had been found, and the collector. With a geological map of North America on the largest wall and appropriate pictures on the others, the workroom was all we could wish. We kept it locked except when we were in it so the specimens would never be disturbed.

While we were hard at work there one weekend we had a phone call from California. Our daughter told us her husband had accepted an offer from a Detroit firm and that they were moving back very soon. Our excitement is understandable. To have both girls

living near after having had neither was almost too good to be true.

They arrived, that tired young couple, late one Friday evening in November. Their car was loaded to capacity. Sharing the back seat with piles of clothes and bedding, two lamps, skis, and a carton of dishes were a tabby cat, a dog, and a eucalyptus tree in a wooden tub. We turned over the guest room to the young people; the cat and dog took possession of the house. Once again it was full of life and activity.

They were eager, of course, to have a home of their own and we did exhaustive house hunting. Eventually they found one that was large enough but not too large which they slowly furnished, starting almost from scratch; the house they had rented in California had been equipped even with animals. They moved into their new home the next March (1953) with the cat, the dog, and the eucalyptus tree and, most important of all, with newborn twin sons. Our house seemed very empty and quiet.

But not for long. A month later our younger girl's son was born and from then on we often had one, two, and sometimes three babies parked there. Put and I found that being grandparents of three little boys almost simultaneously gave us plenty to talk about -- and we tried not to.

I had had such difficulty keeping my mind on my studies all semester that in June I decided once more to end my college career. The courses though interesting were not related to our fossils, and there seemed to be many other uses for my time and energy.

Both Put and I were ready for a vacation when July rolled around. We stopped at the Southworths on our way to the cottage and learned about an exposure of the Ipperwash we had never seen. A date was made to go there soon.

Calling for Charlie and Annie one morning, we drove to Ravenswood and left the car beside the road. Then, climbing the fence, we walked through a pasture to a patch of woods where Charlie pointed out two thick limestone ledges.

"The fossils are in that brownish shale in-between," he said. "You have to dig 'em out carefully for they're crumbly till they get a chance to harden. See -- like this," and he demonstrated by pulling out a lump from which he extricated a large brachiopod. "Lay 'em to one side for a while and they'll be safe to handle."

Annie watched for a few minutes but it was not her idea of collecting. She found a fallen log in the shade and sat down, apparently quite happy. The three of us grew so interested in getting out the fossils that we forgot about her until she said mournfully: "Not much to do around here."

Nobody answered.

"Oo -- I can't get up, Charlie!" Her voice was anguished; Charlie went on digging.

"Oh, dear! I can't get up!" she said more loudly.

"Well, you'll look mighty funny sitting there next winter," replied Charlie and he kept on digging.

Put and I grinned at each other as Annie, furious, stood up easily and walked over to another log.

We had done a lot of collecting by the middle of the month when the Ehlers came for a visit. Jim examined our fossils with interest and asked a lot about the beds from which they had come; some of his questions we could not answer because we never noticed such things. The time had come, Jim decided, for us to do so.

The next morning we all drove over to Hungry Hollow and Jim showed us how to measure a section, digging a small trench with his hammer, measuring each rock unit, and noting its characteristic fossils. Though I had learned about this in a Wayne class, I had never put it to practice.

He told us these Thedford-Arkona beds could be correlated with some in the Alpena area of northern Michigan. "For example, the Hungry Hollow Formation is considered the equivalent of the Four-Mile-Dam Limestone -- on the basis of fossils, of course."

He drew diagrams, he explained the presence of strata in Michigan that were lacking in Ontario and that must be accounted for by an unconformity, and he held Put and me spellbound. We had never realized how much more there was to fossil collecting than gathering specimens.

Another day we took the Ehlers to two outcrops about four miles apart where we had found similar fossils. After looking them over, Jim thought the fossil assemblages the same, too. That afternoon, back at the cottage, he had a lot to say about those two exposures of the Widder Shale. Mabel buried herself in a book while we listened.

From a topographic map Jim figured the approximate elevations of those two outcrops and told us how to figure the approximate dip of the beds. He suggested that we get ourselves a hand level and showed us how to use it. With one, we could find out more about the various outcrops and begin to get an idea of the

structure of the whole area. Sometime, he said, we might write a little paper about the geology of southwestern Ontario.

Put looked at Jim. "We'd need a lot of help," he said slowly, "and I know how we could get it best. Shorty, why don't you go to Ann Arbor and get that master's degree?"

"Yes, why don't you, Jean?" asked Jim.

"I don't see how I could. It's too far to drive often. Besides"

Put interrupted me. "You're thinking about those little babies but their mothers can manage very nicely without you. We'll look up trains when we get back to town," and he beamed as he said it.

We talked occasionally about this revolutionary scheme after the Ehlers left; I could not see how it would work. Then suddenly in August the matter seemed to be taken out of my hands.

First, talking to John Sanford, we learned that he approved highly of the plan. "You two are most interested in fossils," he said, "and those men at the Museum are the people best qualified to help you. If you can arrange to do it I think you should."

Then we found that the Michigan Central Railroad had a convenient schedule to and from Ann Arbor, and that I could transfer easily from the Wayne Graduate School to that at The University of Michigan. The matter was settled.

We prepared, then, to go to Nova Scotia in early September. Shortly before we were to leave Put brought home a long letter from Jim Ehlers he had received at the office. It contained detailed suggestions for our field work and it concluded as follows:

Obviously there is need for tying in all the sections and publishing a revision of the Devonian succession. You and Jean go to it; I shall be glad to help you. . . . Best wishes for an enjoyable trip to Nova Scotia.

Put was looking at me as I finished reading. "That's a big assignment he's given us, isn't it?" he said.

"I should say so! I wonder if we can handle it."

"Sure we can together -- and what fun it's going to be!"

XVII

We had been trying to get down to Nova Scotia for seven years, ever since Dr. Cox had told me

about its rock formations. The letters he had written had been tempting.

"I didn't do much fossil-hunting this summer," he once wrote. ". . . But I took two parties of enthusiasts down to Arisaig and gave them a day's coaching on the lay of the land there.

"I look forward to doing the same for you some day. It is the most wonderful place to see the Silurian -- miles of cliffs lining the shore and packed with fossils. (Doesn't that make your collector's mouth water?)"

It did, and Put and I decided we must get there soon. We read on as Dr. Cox described the collection of mollusks he had recently made for the Nova Scotia Provincial Museum, and another he hoped to make for it someday, adding: "But 'Ars' is so long, and 'vita' so short! The older you get (and I am so awfully old) the more things you see that you want to do and the less time to do them in."

Put smiled. "He must be a great guy. I'm even more anxious to see him than those cliffs. When shall we go?"

Many things delayed us, however, and when we finally went in 1953 we were too late to see Dr. Cox who had died the previous January, and too late to see my aunt and uncle.

Our trip was planned around some business appointments Put had in the East. At their conclusion we sailed from Boston on a Furness Lines' ship bound for Liverpool via Halifax. Two days later we steamed slowly into Halifax Harbor in a dense fog. It had lifted by the time we docked; the sun was shining and the church bells ringing.

Getting the car we had rented, we drove out of the city, around Bedford Basin, and north the hundred miles to New Glasgow to visit our old and elderly friend Rachel. It was past noon when we drew up before her house; she was rocking on the porch and watching for us. After a warm greeting, she announced that dinner was waiting and the housekeeper anxious to get off for the afternoon. Yes, she'd like Put's arm to help her into the dining room.

We sat down to an old-fashioned "Sunday dinner," the kind that leaves one feeling stuffed and stupid. While she carved the roast chicken, Rachel brought us up-to-date on the local news. The town had changed a lot, she said; not as much going on as there used to be, new people in some of the old houses -- she hadn't called on them. "And now tell me just what it is you're going to do. I don't seem to remember."

I explained that we wanted to see some interesting rocks Dr. Cox had told me about; we hoped she would drive there with us.

She shook her head. "No, thanks just the same but I don't go out much nowadays."

It was plain that Rachel had changed a lot, too. She had always been ready to go anywhere at any

time. It had never been too stormy to step out to a party or too late for one more rubber of bridge.

On Tuesday after lunch Put and I set off on our first expedition -- a short one to French River. Armed with directions Dr. Cox's daughter had given us, we drove out the Sydney highway for about fifteen miles until we found the small road leading down to the small bridge she had mentioned. Unfortunately we did not find the large trilobite she had promised us. In fact, we brought back little except the pleasure of being in a pretty place on a nice afternoon.

The next day we left Rachel's soon after breakfast to see those Silurian cliffs. Again we had explicit directions. We were to follow the shore road through Merigomish and Lower Barney's River until we got to Stonehouse Brook.

This brook proved to be what our notes said -- "just a trickle." We parked the car in the farmer's yard as directed, followed the trickle down to the shore, and there on our right were those magnificent cliffs -- as wonderful as Dr. Cox had led us to believe. Looking to the northeast towards Arisaig Point we could see them stretched out for miles. According to the geology book we had consulted, the formations grew progressively older in that direction.

The cliffs were made up of rock layers -- red and green, gray-green, and blue-gray shales and sandstones. They dipped at such an angle that it was a trick to stand on one layer and chip fossils out of one above. I was content to leave that to Put and look for loose fossils on the shore. We were in a small cove separated by rock barriers from those on each side of it; the waves splashed against the foot of the cliffs. Prince Edward Island lay in the distance to the left, and straight ahead there was just the sea.

As the morning wore on we investigated the cliffs in several coves. Each time we had to climb up to the car, drive on to another gorge, and walk down to the shore. Each time the rocks were different in color and age.

"I wish we could have come here with Dr. Cox," I said. "He could have shown us which layers have the best fossils."

"That's true, and named all the fossils we found. Well, Jim Ehlers will be able to identify them when we get back. I'm glad you're going to work at the Museum this winter."

I was too, I thought, and still more glad I had a husband who enjoyed a day like this.

The salt air made us ravenous. About noon we found a clearing not far from Doctor's Brook for our picnic lunch. Rachel's housekeeper had made us a much more elaborate one than we ever fixed for ourselves and we ate every morsel of the cold chicken, tomato wedges, buttered biscuits, and date-filled cookies. Afterwards we discovered that our ambition

to see rocks and fossils had vanished. We were content to sit for a while, reveling in the view and the smell of the deep woods just across the road.

Then we turned about and went back to New Glasgow along the shore road.

We found it hard to say good-bye to Rachel when our time was up; she was again rocking on the porch in the afternoon sunshine. It was hard also to drive away from New Glasgow; there seemed to be something final about this trip.

The road took us through Lyon's Brook to the lovely old town of Pictou perched on the side of a hill. We paused there a moment to admire my great-grandfather's house overlooking the harbor and to look across the water at the wooded point where we had had a cottage one summer when our children were very small. Then we drove on. Joggins lay ahead and geology was a good antidote for nostalgia.

From the north shore road we could see Prince Edward Island clearly -- only fourteen miles away. We passed through River John, Tatamagouche, and Pugwash before turning inland; a short drive took us to Amherst near the New Brunswick border where we spent the night.

"Another perfect day," Put remarked the next morning as we started for Joggins. "We've been lucky in the weather. The tide seems to be going out, doesn't it?"

"Yes -- smell it!" I took a long deep breath.

Put laughed. "You and your low tide smell! I can take it or leave it. Still, it always reminds me of clam chowder; I must have some tonight."

The little town of Joggins sits on the top of the famous rocky cliff and overlooks the Cumberland Basin, an arm of the Bay of Fundy. The coal mine which lies beneath the town reaches out under the Basin; coal from Joggins was sold in Boston as early as 1720. The mine was not working in 1953, however, and not even a speck of coal dust smudged the neat houses.

We went down the hill to the shore.

"You keep your minds on that tide, won't you?" a man we passed warned us. "It comes in fast."

He told us that not long ago some people forgot about it -- got too interested in the stones. Suddenly they found themselves cut off by water under that cliff.

"What happened?" we asked.

"A chap happened to see 'em and went for 'em in his boat. Scared stiff, I can tell you."

"I'll bet they were!" Put said. "Well, don't worry about us. We've seen the Bore come in."

We had watched that forty-foot tide rushing up a riverbed between red mud banks, creating reversed

rapids as it pushed against the current, and we would take no chances. Later we thought of those stranded people as we stood beneath that overhanging cliff, so deeply undercut that no one could climb it. High above us in the rocks were the great fossil tree trunks we had read about.

"Well, it's all they say and more," Put remarked as he gazed up at them. "How far do these cliffs extend?"

I looked at our notes. "About ten miles, and they dip at an angle of 19 degrees. It's been estimated that the total thickness of the rocks is over 14,000 feet. Why, that's more than two miles thick."

"Nearer three miles, I'd say."

"You're right. And some geologist counted 76 distinct coal seams," I read. "Think how long it took to form 76 swamps, forests, and then shallow seas -- over and over again."

I put the notes away and we wandered along the shore, finding an occasional fossilized twig or root. A small boy with keener eyes than ours picked up a piece of shale showing a fossil fern which we were pleased to accept. Then, realizing that the shore was getting narrow, we grabbed our knapsacks and hurried up the road.

The next two days we spent driving in a leisurely fashion around the Basin of Minas and down the Annapolis Valley, not as geologists but as sightseers. We reached Yarmouth late Sunday afternoon, turning in our car in ample time to get to the dock.

The ship on which we were sailing to Boston was full of hilarious tuna fishermen, returning to the States at the end of the annual International Tuna Cup Match. They were celebrating in both English and Spanish -- and they were very happy.

Put and I stood at the rail in the stern as we sailed out of Yarmouth Harbor in the early evening. The sky was ominous, the sea leaden. We watched Nova Scotia grow smaller and smaller -- a string of lights, a lighthouse, then nothing. The Province had a new dimension for us both.

The weather which had been ideal all week broke that night and, according to Put, the storm was a wild one. I slept soundly through it and the celebrating.

We flew home from Boston and life at once became normal again. Yes, I said over the phone, I'll be glad to look after the twins Thursday morning; I've put it on my calendar. Yes, indeed, I told my other daughter, I can take care of Michael Friday afternoon; I'll be there at two.

"Perhaps I shouldn't go out to the University and register after all, Put," I said that evening. "There's so much for me to do around here."

"Now, look, Shorty," he said sternly. "The

girls did very well without you while we were in Nova Scotia and they can while you're in Ann Arbor. You're

taking that early train Wednesday -- and I'm taking you to that train!"

XVIII

Things worked out much better in Ann Arbor than I had dared hope. By going one morning on the early train and spending the night there, I could get in the lectures, labs, and library assignments in time to take the afternoon train back the next day. With such a program I could get my master's in two years' time. The goal was in sight.

When I told this to Put at dinner he thought the arrangements ideal. "And we'll still have most of the week free. I envy you taking Jim's course on the index fossils."

"Yes, it'll be a good one and so will Bob Kesling's micropaleontology. The main problem is going to be my homework. I must always get it done during the daytime."

For several weeks everything ran smoothly. Then came a series of emergencies and catastrophes that made studying out of the question. One evening before I was due to go to Ann Arbor I sat in our workroom with my books open, much too tired to concentrate. And how silly to try, I thought suddenly. What other grandmother could I name who was doing a crazy stunt like this?

"What's wrong?" Put asked from the doorway. He came in and sat down across the table from me.

"Well, I've just decided I've made an awful mistake. Graduate work would be okay if it didn't interfere with my being a wife, mother, and grandmother but it does. I'm going to sign off tomorrow. Don't you think that's wise?"

"No, I do not!" he said emphatically. "This week's been an unusual one; there may never be another like it. Besides, I figure you're getting the best possible insurance -- better than all the money in the world. If anything should happen to me first . . ."

"Oh, Put!"

"I know you don't like to think about such things but lawyers have to. Let's be realistic, dear. If that should happen, you'd have something absorbing to do which would be very important. I've known too many widows who were left with big insurance policies but no real interests. They are pathetic. No -- please don't give up. Remember the courses you are taking are helping me too."

That settled the matter once and for all. As the weeks went by I learned to manage better and so did

the young mothers. Somehow the homework always got finished without neglecting anybody.

We escaped to the cottage for the weekend whenever we could, taking advantage of good weather to do more collecting before winter set in. One Saturday afternoon in October we joined the Southworths, Dr. and Mrs. Cooper from Washington, and Dr. Helen Muir-Wood (of the British Museum) at Hungry Hollow. We soon learned that Dr. Muir-Wood was anxious to get as many specimens as possible of the little spiny brachiopod we called Strophalosia for her work on the book she and Dr. Cooper were writing together.

"Then we'd better get right over to Frasers'," said Charlie. "We always find more there than anywhere else."

We left the cars behind the Frasers' hen house and walking down towards the river, Charlie began to chuckle. "Remember the time, Put, when you drove down this hill and the car broke while we were driving back up it?"

"I'll say I do!" Put turned to Dr. Cooper. "Something snapped under the hood -- something even Charlie couldn't fix. It was a very hot Sunday afternoon. The Frasers weren't home and neither was anybody who had a telephone from here to Arkona. I had to keep going."

"You mean you walked in to Arkona? Why, that must be about five miles."

"It seemed more like fifty. By the greatest luck Mr. Paisley was at his gas station there and thought he knew what the car needed. He drove it and me back in his truck and by Jinks! he was right."

We had reached the woods and hurried down through them to the riverbank. The hardwood trees on both sides of the narrow river were ablaze with color. Luck was with us; the brachiopods we wanted were unusually plentiful and by the end of the afternoon each of us had put a handful of them into Dr. Muir-Wood's bag.

"You say these aren't really Strophalosia." Put said to her as we walked back to the car. "Are they Leptalosia? I've heard them called that, too."

"No, not Leptalosia either. I can't tell yet what they are."

When that book was published some years later we learned their name -- Devonalosia wrightorum

Muir-Wood and Cooper, a new genus and new species; we felt highly honored. We were reminded of the lovely fall afternoon beside the river and of the evening that followed when we had all visited together before a fire in our cottage.

The second semester at the University was easier than the first in spite of the fact that I was carrying three courses instead of two. One of these was Win Stumm's stratigraphic paleontology, which covered the typical rock formations and fossils of each geologic period.

The lab at the Museum contained drawers of these fossils -- 278 of them, to be exact. It was necessary to become so familiar with these specimens that one could recognize them quickly in the monthly tests, giving their names, formations, and age. Again my art training helped. By drawing each fossil on a three-by-five card and writing its data on the other side, I had a pocket-size collection I could study any time, any place.

Put often drilled me on these flash cards. Some of their fossils like our Devonian ones he too knew well. Some, like the huge Cambrian trilobite with the musical name Paradoxides he had heard about before. All this inspired his valentine to me:

To show my deep devotion
 O many years ago
 I'd practice holding Jeanie's hand
 While at a show.
 Now with no less emotion
 Today I hold a card.
 "Is't Paradoxides?" I say;
 "Come, dear, try hard."
 The tricks the years play on us
 Are hard to analyze;
 I only know each year with you
 I prize and prize and prize.

In mid-June we went to Manitoulin Island with the Ehlers on the Michigan Geological Society's annual field trip and toured the island for two days, examining Ordovician and Silurian outcrops. John Sanford, in charge of the trip, had everything under control except the black flies, which were there in abundance. I discovered I was allergic to their bites; in spite of all precautions, I grew hourly more swollen and itchy.

Driving back, we made a detour to have a look at the Devonian reef at Formosa. A road had been cut through it since we were last there which made collecting easier if less picturesque. Then we drove on to the cottage for a night before heading back to Michigan.

As soon as our vacation began in July Put and I began the project Jim had suggested the previous summer -- work on the stratigraphy of the Thedford-Arkona region.

Of the three formations in that region -- four, if one includes the Ipperwash which occurs near Lake Huron -- the Widder interested us most. At both Rock Glen and No. 4 Hill this formation is over forty feet thick and is exposed by tributary creeks of the Ausable River; in each case the creek plunges over a hard limestone into a rocky glen. Charlie had taken us to these places and to many small outcrops in the area where, although the rocks and fossils were not always the same, they were recognizably "Widder." We had tried to figure out the relationship of these scattered outcrops, without success.

When the Ehlers arrived for a visit we discussed this problem with Jim. He knew the way to solve it. He said if we were to make a detailed section of the Widder at its thickest exposure -- No. 4 Hill -- we could then match up the rocks and fossils of all the Widder outcrops with the units of that section. This would help us work out the structure of the whole region.

Accordingly the four of us drove to No. 4 Hill the next morning, left the car, and walked in to the top of the falls, perhaps a quarter of a mile away. We spent some time examining and measuring the beds above the waterfalls, then slid down the path into the wooded glen. Here we located the base of the Widder on top of the Hungry Hollow Formation and, farther to the right, found a vertical shale wall where we could see all the rock between the base of the Widder and the waterfall above.

Jim set to work to make a detailed description of that section. Beginning at the bottom and working upward, he dug a narrow trench with his hammer, measuring each rock unit with his metal rule, and getting a sample of its fossils for Put to pack in labeled paper bags. I recorded the data in our notebook as Jim called out the number and description of each unit and its fossils.

Tabulating the results later, we found there were 23 distinct units in that 45-foot section. Most of these were shales, some of them thick limestones. One of the latter, Unit 17, was a hard, massive, finely crystalline limestone about 18 inches thick; it contained a unique fossil assemblage -- two large brachiopods and a long straight cephalopod. This unit was of great importance to us for in the months and years ahead we were able to trace it across the country from Rock Glen to a rocky reef on the shore of Lake Huron, approximately eleven miles to the northwest.

Although a metal rule is used to measure the height of an individual bed, a hand level is needed to measure the height of a number of beds or the vertical distance between two that are some distance apart. For example, we had located Unit 17 on a slope beside the highway east of Thedford; we wanted to know how much lower was the outcrop of Widder Shale lying near that highway and about a tenth of a

mile nearer town.

We got the answer in this way. Put stood on the bed of shale and sighted through the hand level while I walked slowly up the road; when he could see my bright red sneakers through its glass he stopped me. Then he took my place and I walked on until he stopped me again -- and so on and on. We knew that his eye-level was exactly five feet three inches from the ground. It was easy, therefore, to measure the vertical distance from one location to another by multiplying the number of intervals by five feet three. Our notebook contains such entries as "5 (EPW) + 45 in." and "2 (EPW) - 8 in."

This field work on the Widder Formation was slow and fascinating, and it took us years.

During the next two semesters at the University I finished taking the prescribed courses and worked on my thesis. I had chosen as its subject the most spectacular genus of brachiopods occurring in the Thedford-Arkona region -- the *Spinocyrtia*. Annie Southworth had once picked up a fine specimen of it in the Arkona Shale, Put and I had found some even larger ones in the Widder, and we had all found three that appeared to be quite different in the Ipperwash Formation.

Charlie called them all *Spinocyrtia granulosa* regardless of horizon, because that species from the New York rocks is well known. However, there was a good chance that the Ontario specimens were all new. Under Jim Ehlers' direction I set out to find the answer.

The first things to do, he said, were to compare our specimens with the original descriptions of the genus and species, and with the type specimen. This was easier said than done. The original description of the genus was in Russian, the original description of the species was brief and not illustrated, and the type specimen had disappeared in the interval since 1837 when it was described.

Then, Jim said, before we could work on my specimens we must choose a "neotype" to take the place of the lost type; this was necessary not only for my work but for all research on that genus in the future. It must be a specimen that agreed closely with the original description and if possible, it should

come from the same bed.

We examined all the specimens of *Spinocyrtia granulosa* in the collections of three museums of New York State. Jim chose as the neotype one that had come from a locality in New York where Conrad might have found his type specimen -- Eighteen Mile Creek, that favorite collecting-place of the early geologists. Comparing our Ontario fossils with it, we saw that they were indeed all new species.

Two of these, Jim said, would be sufficient material for my thesis. I chose Annie's fossil from the Arkona Shale and the large specimens we had found in the Widder. My paper contained an account of our investigations, a description of the neotype, and descriptions of these two new *Spinocyrtias*. I had learned a lot from this research, the most important thing being the way to work. Jim's thorough, cautious method was an example Put and I both tried to follow in our later projects.

As soon as my thesis was accepted, Jim decided we should add descriptions of the three new *Spinocyrtias* from the Ipperwash Formation and publish the enlarged paper jointly. I was, of course, tremendously pleased.

In early May Put and I drove to Colgate University with the Ehlers to attend the New York Geological Association's field trip led by Dr. Cooper. His wife, Jo, rode with the four of us to the various outcrops of Silurian and Devonian formations, which added to our pleasure. One afternoon Put and I left the group and collected fossils at several small exposures of the Hamilton rocks in which Dr. Cooper knew we would be particularly interested.

Spring was at its best; the hilly country was beautiful with fruit trees in bloom and the grass a fresh new green. We lunched one day beside a little brook, visiting with another friend, Dr. Winifred Goldring.

June eleventh was Commencement Day at The University of Michigan in 1955. It was not until I read my diploma that I could believe I had really acquired that M. S. in geology. Put read it with as much satisfaction, then we put it carefully away and went up to the cottage to start the season's field work.

XIX

Our two girls and their families occupied the cottage in succession that June and although we joined them there some weekends, it was in the capacity of grandparents, not geologists. We had fun helping with Michael and his baby brother and later with the

twins but we had no time to think of rocks and fossils. The two-year-olds were fearless and like quicksilver; as they tried out everything within reach, we kept our hammers and other equipment on a high shelf. It was not until we had the cottage to ourselves in July that

we dared get down our new toy -- an altimeter.

We had ordered it months before on Jim Ehlers' recommendation. While discussing the Widder Formation with him one evening, Put mentioned the difficulties we had had trying to get the elevation of certain outcrops with our hand level. Jim said an altimeter was what we needed and described its use. It arrived from California months later in a strong carton labeled in bold letters "DO NOT DROP" and packed too tightly to budge. Inside we found a heavy object about the size and shape of a child's toy drum; it was encased in leather, with a hinged leather lid and a carrying strap. We could hardly wait to put it to work.

It is understandable, therefore, that Put lifted this beautiful instrument from the closet shelf as soon as the last grandson had been whisked away from the cottage. We reread the directions and decided he was the person to handle it; I would drive it and him from place to place.

We knew it was used in conjunction with a topographic map so we studied ours, locating convenient "bench marks" which showed the elevation above sea level of certain locations. At the beginning of a day's work Put would set our altimeter at one of those bench marks, then go to nearby outcrops to determine their altitudes. It seemed very simple.

The bench mark Put chose that first morning was in the middle of Highway 82 at its intersection with a much-used crossroad. Very gently he laid the open altimeter on the pavement and laid himself, in clean khaki field clothes, gently beside it. Then, oblivious to approaching cars, tractors, or trucks, he proceeded to set our instrument at the proper number -- 638. Terrified, I watched all four directions, prepared to stop traffic until he and the altimeter were safely off the road; fortunately, it was a quiet interval and he worked fast.

We went from there to several outcrops where Put got the elevation, each time flat on the ground beside the delicate instrument. It was not long before we discovered that as the heat and humidity increased the altimeter became unreliable. This meant that we had to drive back to the same bench mark or another that was equally hazardous to reset it. By the end of the long hot day Put was quite lame and I decidedly edgy.

Nevertheless, on almost all fair days that summer and the succeeding ones, the altimeter went wherever we did, whether we were alone or with guests. The Ehlers and later the Keslings -- Mimi, Bob, and their two boys -- all took part in this project; Put handed the altimeter over to the professors with relief.

Eventually we obtained the elevation of thirty outcrops in that area, roughly ten by eleven miles in size. Most of these were exposures of the Widder Formation but some were outcrops of the Hungry Hollow Formation, the Arkona Shale, and the Ipperwash

Formation -- readings we took for future reference.

Sometimes, of course, we left the altimeter at the cottage and just had fun hunting fossils. Then we walked the banks of the Ausable in search of more specimens of the pelecypod Leiopteria which occurred low in the Arkona Shale.

We had to go fossiling without the Southworths that summer, because in February Charlie had had a bad heart attack which prevented his getting much exercise. One day as Put and I were driving back from Hungry Hollow we talked about the possibility of there being other exposures of the Arkona Shale where we might look for Leiopteria; we stopped at Charlie's to ask if he knew of any we had never seen.

He shook his head. "No, I've taken you to all I've been to and I've tramped over every inch of this country since I was a boy."

"But couldn't there be some out-of-the-way place along the riverbank?"

"I don't think so. No, you've seen 'em all."

Still we wanted to be sure. One weekend when a daughter and her husband were with us we borrowed a canoe. With it on top of the car, we all drove to Rock Glen where we eased it down the steep hill and put it in the river just below the old dam.

The young people were enthusiastic about their exploring and hopeful they would discover other shale outcrops besides those we had marked on their map. They paddled gaily out of sight.

Hours later Put and I waited on the high bridge near Sylvan, wondering what had happened to our children. To be sure the Ausable had a snakelike course but they were long overdue. When at last the canoe came in sight we breathed more easily and rushed down to the river to hear what they had to tell us. It was a lot.

They said they had seen no Arkona Shale not marked on their map. In fact, the shale ended before they had gone far, then there was only brown mud. They had done very little paddling because of large boulders in the bed of the river and fallen trees across it. Their last portages had been made by wading in murky water at the foot of smelly farms, and they'd like to get back to the cottage quickly for a swim -- with soap.

Charlie had been right.

At the end of August Put and I drove up to Alpena for a few days' collecting with the Ehlers -- our first opportunity to see those formations of northern Michigan with which the beds around Thedford and Arkona are correlated. We found a lot of familiar fossils and we had a lot of fun.

The months that followed were busy ones and we made frequent trips to Ann Arbor. As Put was on the Development Council of the University, he often combined its meetings with a session at the Museum. We

spent a number of weekends at the Ehlers; fossils seemed to creep into the conversation frequently but never to spoil the fun.

Put now had nearly 200 specimens of his Leiopteria, most of which required slow painstaking cleaning under the microscope. Once, while removing excess matrix, he was pleased to discover he had a fine specimen with both valves, not often found. Since two early collectors, the Reverend Hector Currie of Thedford and Professor Charles Schuchert of Yale, had reported finding at Hungry Hollow pelecypods they identified as Leiopteria rafinesquii Hall, it seemed advisable to see Hall's types of this fossil as soon as possible. Jim wrote to the Museum at Albany to borrow them.

At about this time the Spinocyrtia paper Jim and I had written was published in the Contributions from the Museum of Paleontology. Put received a few copies hot off the press with a note from Jim; he brought them home, claiming he had been carrying one of them around in his hip pocket all day.

The research for that Spinocyrtia paper had several interesting and rather surprising developments. Jim and I had wondered if a large brachiopod mentioned by an early French geologist as having come from the "bords de lac Huron" might be the same as that we were describing from the shore of Lake Huron at Stony Point -- our new species Spinocyrtia carinata. Francis de Laporte, Comte de Castelnau, had inserted rather poor sketches of his Spirifer huroniensis in his Essai sur le système silurien de l'Amérique septentrionale published in 1843. These sketches and the description of this brachiopod made us wish we could see it. The Essai stated that his specimens had been deposited in the Paris Museum of Natural History; however, upon making inquiries, we learned from various sources that his fossils were no longer there. According to one story, the Germans had destroyed them during the war.

The Museum of Paleontology had a copy of this Essai, a slim volume of 57 pages with plates, and it was good reading. It contained an account of de Castelnau's journey from the Atlantic coast to the Middle West, and from Quebec to Florida, a journey that had taken him nearly five years. He had collected fossils in many places and had been given others; he admitted that he was quite confused about some of them. One specimen, he said, might be Silurian from New York or perhaps Tertiary from the Potomac; he really did not know.

Jim thought an English translation of this little book would be helpful to paleontologists and I went to work on it, later going over my translation with a French scholar to check its accuracy.

Then we had a great piece of luck. In a back number of the Journal of Paleontology I happened to see a notice describing the services of "The Center of Paleontological Studies and Documentation of the

Paris Museum (C. E. P. D.)." I wrote at once, inquiring about the old de Castelnau collection and explaining our interest. We had a prompt reply. To our surprise we learned that some of that collection was still intact; Dr. Furon enclosed a list of surviving specimens and it included Spirifer huroniensis! More than that, he wrote that he would be glad to loan us any fossils we needed for our study. We asked for the two specimens of huroniensis.

Progress was continuing, meanwhile, on Put's pelecypods. The type specimens of Leiopteria rafinesquii had arrived from Albany. They were considerably larger than all the Ontario specimens and they had an ornamented shell instead of being smooth. The Ontario Leiopteria was very definitely another species.

Put thought it would be wise also to check the specimens from Hungry Hollow reported as L. rafinesquii. In January (1956) we went to the Royal Ontario Museum of Zoology and Palaeontology in Toronto to see the pelecypod the Reverend Hector Currie had found; it was small and smooth like those Put and Jim were studying, unlike the types of rafinesquii. Then in February Put went to Washington and saw Schuchert's specimens; they, too, were small and smooth. There was no further doubt. No one had found rafinesquii in Ontario; the Leiopteria from the Arkona Shale was indeed a new species.

Put began writing it up; it was to be called Leiopteria ausablensis, from the name of the river.

About this time the two specimens of de Castelnau's Spirifer huroniensis came from Paris; they were quite different from our Spinocyrtia carinata from Stony Point. Jim recognized them as poorly preserved specimens of Spinocyrtia granulosa from western New York, and the dark gray rock adhering to the shells as Wanakah Shale. They had probably come from the shore of Lake Erie where de Castelnau had found other fossils, rather than from Lake Huron. We wrote a short paper telling of the existence of these fossils in the Paris Museum, and giving our conclusions.

Then we decided to borrow the rest of de Castelnau's fossils so we could include photographs and revised descriptions of them in our translation of his Essai. Dr. Furon was most cooperative and for many months small batches of these old and precious fossils traveled across the Atlantic from one museum to another, to the consternation of two Customs Departments.

The foregoing might lead one to think that Put had given up his law practice and that I was neglecting our children and grandchildren. The notations in our 1956 engagement calendar show this was not the case.

In March our fifth grandchild, a little girl, was born. In mid-June Put and I assisted with the Michigan Geological Society's field trip in southwestern Ontario; it included stops at two of our favorite out-

crops, Rock Glen and Hungry Hollow, and at two on the lake shore -- Stony Point and Kettle Point.

One Saturday soon after this Put played his

annual game of golf. His place in his old foursome had been filled long ago by a friend who cared nothing for fossil hunting.

XX

Not long after Jim Ehlers and I began borrowing the de Castelnau fossils we received a letter from Dr. Jean Roger, Director of the Center of Paleontological Studies of the Paris Museum. He had learned from Dr. Furon what we were doing with them and he asked if we would furnish brief descriptions and photographs of the same specimens to be published as "fiches" in the *Palaeontologia Universalis*. We were pleased to do so and continued this twofold project until 1960. The translation of de Castelnau's *Essai* was never published, incidentally, for a number of reasons.

Put knew French too, but neither of us could read German. "It would be a help if we could," he said one day. "Then I could find out what Goldfuss wrote about pelecypods without bothering the people in Ann Arbor."

We were considering taking a course in German when somebody suggested that I work for a Ph.D. The idea startled us but the Geology Department took it calmly. The first step, it said, was to pass the language requirements. There was a "Special Reading Course" in German designed particularly for doctoral candidates and starting soon in Detroit. Why not take it?

We did, Put and I, in the fall of 1956, with others who knew no more than we did. As the weeks and months passed, we were gratified to find that German grammar became easier as it became more advanced. And, thanks to de Castelnau, I passed the French requirement by examination.

Meanwhile we were both busy with fossils. Put and Jim were deeply involved in finishing their paper on the new species of *Leiopteria*, and I had several irons in the fire. One was the work I was doing with Jim, describing the French fossils; another was the "check list" of Thedford-Arkona fossils which Win Stumm and I were compiling together. The two dove-tailed nicely.

A check list summarizes all the references in geological literature to the fossils occurring in certain beds. It is compiled by running down the publications listed in the bibliographies of all the books and papers which mention such fossils. We found that 171 publications had described, listed, or referred to fossils from the Thedford-Arkona region. These publications we arranged alphabetically and numbered in sequence.

As an introduction to our check list we wrote a

summary of the stratigraphy of that region, giving a chart to show the changes in stratigraphic nomenclature. With Charlie Southworth's help, we wrote a "Geographic Glossary"; it explained such obsolete place names as Widder, Canada West, and the early names of Hungry Hollow -- Bartlett's Mills, Marsh's Mill, and Marshall's Mills.

Under the heading of each of the four formations was a classified list of all the fossils reported from that formation, arranged alphabetically. Each name was followed by the numbers of all the publications in which it was mentioned. Thus a paleontologist could see at a glance what books and papers would help him; it helped nobody more than it did Put and me.

Win and I finished it before Christmas, 1956, and submitted it to the editor of the *Contributions from the Museum of Paleontology* in which all the papers Put and I wrote were published.

The program for the annual meeting of the Michigan Academy of Science is made up right after the first of the year. Jim urged me then to give a talk on de Castelnau's *Essai* and the status of his *Spirifer huroniensis*. I worried about it for months, needlessly, for the audience was sympathetic and the talk quickly over.

The following June we began to count the days until we could start our field work and a letter from Charlie made it seem urgent. He wrote that the Indians at the Kettle Point Reservation had deepened their boat wells by dynamiting and dredging; the shale they had brought up was heaped on either side of the channels and full of beautiful fossils. We had better come soon before they were picked over.

We got up there as fast as we could. One afternoon early in July we stopped for the Southworths and drove on to the Reservation. Annie came for the ride, being unable to see to collect, and Charlie came with excitement, the piles of shale being near enough so he could walk to them from the car. The beautiful fossils were still there; we found specimens of our *Spinocyrtia* from the upper Ipperwash, delicate *Mucrospirifers*, and unfamiliar *Cyrtinas*.

Even more important than the fossils, however, was a chunk of rock over two feet high that had been brought up by the dredge. Most of it was massive gray limestone capped with a thick band of chert on which were small patches of black shale. We realized

that we were looking at the contact between the Middle Devonian Ipperwash Formation and the Upper Devonian Kettle Point Shale -- a contact we had never seen before. By this time we had attracted so many Indian children that we feared the rock might not remain very long in prime condition.

We were so anxious to have Jim see it that we drove him and Mabel to the Reservation soon after they arrived from Ann Arbor. Jim was as interested in it as we had expected. He photographed it, then we took measurements and made careful notes about its lithology and fossils. It was well that we did, for the block did not last out the summer.

When fall came Put and I enrolled again in our Special Reading Course. Everyone was now translating a technical book in his own field; we had a "Lehrbuch" with compound geological terms of unwieldy length. I had given up all thoughts of a Ph. D.; it was not necessary for our research.

The de Castelnau paper was published, the check list in the hands of the printers, and I was home so much of the time that in November Put and I decided we really did not need Mrs. Reed's help any more. Regretfully, we let her go back to her daughter though she will always seem part of our family.

The *Leiopteria* paper was nearing completion and Put presented it at the Michigan Academy meeting in March of 1958. We opened up the cottage some weeks later to be ready for our field work.

However, early in May Put had some tests which led to major surgery and a long stay in the hospital. It was weeks later when we moved up to the cottage, not for that field work but for his recuperation. Put found it boring. He was tired of sitting around, tired of reading. We tried a little fossil hunting but his strength was so limited he despaired of ever being any good again.

On one of the blackest days we received a wonderful letter from Lew Kellum, Director of the Museum of Paleontology in Ann Arbor, informing us that we had both been appointed Research Collaborators in the Museum!

"Well," said Put briskly, a smile on his face, "we can't let those people down. They're counting on us! We'd better get busy on the Widder Formation again. How about going into No. 4 Hill tomorrow?"

"Why -- that's quite a walk."

"Not too much, though. We'll take it easy."

That was the turning point. We spent the next morning making further notes on the rocks above the waterfalls, we picnicked in the shade near the woods, and we drove back to the cottage soon afterwards to rest up for what Put had already planned to do on the morrow.

When we returned to Detroit the first of August

he was ruddy-cheeked again, with the old glint in his eye. The doctors wondered at the great change but we knew it was geology that had done the trick.

The next weekend we went back to the cottage, now occupied by a daughter and her family. Almost immediately we discovered that the big rambling cottage in which we had been rattling around was not large enough for three generations. The walls seemed to have grown thinner and the floors creaked loudly. We disturbed the grandchildren and they disturbed us.

Driving home Monday morning we hit on a solution. We would turn that cottage over to our girls and build ourselves a smaller one -- a cottage with sound-deadening, insulation, and a good furnace.

Put started drawing plans at once. The cottage developed rapidly from his plans to an architect's blueprints to stakes in the ground; when the local builder said he could have it finished by next summer it became an excavation. Before the first snow fell there was a shell with a roof on it and we could see that it was going to be just what we wanted. I started making yards of material into curtains.

On June fifth, 1959, we moved into that new cottage not even dreamed of a year ago. We loved every inch of it. From some windows we looked out at Lake Huron, from others we looked into the woods. The children and their children were in the big cottage -- near but not too near.

It was a summer to remember. Put was well, we did a lot of constructive field work, and we filled the cottage with friends. Mabel and Jim Ehlers and Jo and Arthur Cooper came together to try out our two guest rooms, and the season ended on a gay note.

When Christmas, our wedding anniversary, and the New Year had been properly celebrated we turned our attention again to geological matters, chief of which was our work on the Widder Formation.

Our task was to go over the notes made at all the Widder outcrops to decide what conclusions could be drawn. We had a sample of the fossils and rock from each outcrop in its own cigar box. By looking in those cigar boxes lined up in our workroom, we could see how those outcrops compared with each other and with the numbered units of our lectotype section at No. 4 Hill. We found this so fascinating that we spent hours at it.

Put managed to sandwich in work on his pelecypods, too. He had 94 specimens of a second species which he thought might be a new one. The first step in determining this was to see the type specimens of some similar New York State pelecypods at the American Museum of Natural History. When he found he had to be in New York on business in February, he made an appointment for the two of us on a Thursday morning.

We were taken up into the collection rooms

where several trays containing Hall's type specimens were set on a convenient table. Put bent over them with reverence.

"Why, if here isn't Hall's 'Peterina flea-belly!'" he exclaimed, pointing to a fossil.

The young curator with us looked at Put in such horror that I laughed, hastening to explain that we loved Charlie Southworth's pronunciation of Pterinea flabella. We assured him that Charlie's knowledge of

fossils was orthodox even if some of his pronunciations were not.

When Put finished with the pelecypods we asked to see their specimens of Middle Devonian starfish and brittle-stars. They had no starfish like that occurring in the Arkona Shale nor any brittle-stars like the tiny one Put had once found at Hungry Hollow. We left the Museum realizing that our fossils could keep us busy indefinitely. All we needed was enough time.

XXI

Put and I made great strides in our work on the Widder Formation during the winter and spring of 1959-60. Comparison of the rock samples and fossils from the various outcrops stored in our phalanx of cigar boxes had permitted us to make a chart showing the relationship of most of those outcrops. There still remained a few questions which could be answered only in the field.

Anxious to get at them, we opened the cottage early in May. From then on we spent every possible weekend and all the month of July trying to find those answers.

Two problems were particularly intriguing. For instance, we had never been able to find one of the three characteristic fossils of our key bed, Unit 17, at No. 4 Hill; this was the large brachiopod Megastrophia concava. As we had seen it at all the other exposures of that limestone, we felt it essential that we find it at the place where we had made our lectotype section.

We drove back to No. 4 Hill one morning in July, determined to track it down. As the creek was almost dry, we were able to examine that hard limestone inch by inch in the three-foot wall beneath the upper waterfall -- in vain. Just north of the waterfall we located a continuation of that limestone in the field, but we saw no sign of the brachiopod there either. Still farther, we found Unit 17 jutting out of the hillside high above the glen. It was difficult to get at but at length we saw what we had been hoping for -- a fragment of the elusive Megastrophia -- and we were greatly relieved.

Another problem that had bothered us for years was the relationship of the rocks in a certain creek bed to those of other Widder outcrops. Although the shale and some of its fossils were typical of the formation, other fossils were unique. One Saturday in August on our way to Thedford we saw a man drilling a well about a quarter of a mile from the bed of that creek. We went over to talk to him, learned what he was finding, and explained our interest. He was very helpful and when he finished drilling, sent us a copy of his log. This enabled us to place the rocks in the bed of that creek about ten feet above the highest units of the

Widder found elsewhere. For years we had searched for other exposures of those topmost beds. We finally came to the conclusion that they must have been scraped from the land by the glacier; this was substantiated by our finding deep glacial striae on the limestone in that same creek bed less than a quarter of a mile from the place we had collected those distinctive fossils.

The Ehlers and the Coopers came to the cottage for the Labor Day weekend and while they were with us, Put and I discussed our Widder project with Jim. He said we were ready to determine the strike and dip of the beds.

According to Webster's dictionary, the strike is "the direction of a horizontal line supposed to be drawn on the upper edge of a tilted stratum"; the dip, always at right angles to the strike, is defined as "the angle of steepest inclination of a stratum to the horizontal."

Our altimeter had given us accurate elevations of seven exposures of Unit 17. The lowest of these was the rocky reef on the shore of Lake Huron -- 581 feet above sea level; the highest was an abandoned quarry more than seven miles to the southeast -- 719 feet above sea level. The other five exposures were in-between, both as to altitude and location. These elevations made on the surface showed that the Widder Formation sloped in the same general direction as the land. We wanted to know how and how much; in other words, we wanted to know the strike and the dip.

As soon as time permitted that fall we set to work, using a method of determining the strike when three points not in a straight line are known. It involved the use of a topographic map, an accurate ruler, a triangle and T-square, and some simple arithmetic. Trying this method with our elevations and our map, we were excited to find that each computation produced a line parallel to the others; this was the strike. Further figuring showed that it was approximately north 14° west and that the average dip was about 32 feet to the mile in a southwesterly direction.

The preliminary work we had begun in 1953 was over and we were ready to start the paper. As it was

the first one we were writing by ourselves, we were doubly anxious that it be good. Once it was organized the pieces fell into place; it was practically complete by January, 1961.

Jim asked us to give it at the annual meeting of the Michigan Academy of Science the following March and Put prepared the outline. He had intended to present it but at the last minute found it impossible, so I did. This was not hard as we had gone over the outline together often; the slides Jim made for us carried the talk along.

In-between times that spring Put continued work on his pelecypods. He finished cleaning and measuring all the specimens he thought might be a new species, and checked all the literature on the subject, translating pages of Goldfuss' *Petrefacta Germaniae* for himself. The first draft of his paper on this pelecypod was written by the time we went up to the cottage the following July.

We decided to concentrate that summer on the Ipperwash Formation, on which we had done considerable field work in past years.

Dr. Clinton R. Stauffer, in his book *The Devonian of Southwestern Ontario*, had described this formation as consisting of two limestones separated by a covered interval of indefinite extent. These limestones, we had found, contained quite different fossil assemblages. Put and I had measured the upper Ipperwash in the field near Ravenswood, and had examined it on the shore both east and west of Kettle Point. We had measured the lower Ipperwash at Stony Point -- about two and a half miles to the east of Kettle Point -- and knew that Stauffer's covered interval was represented by Ipperwash Beach lying between these two points, the beach sand probably covering shale.

Once, in 1958, we had seen the lower Ipperwash briefly in a second locality. While that excursion was not scientifically important, it was unforgettable.

Charlie Southworth had told us about the place reluctantly. When we had begged him to think of some outcrop where we had not been, he recalled rocks that might be Ipperwash in the beaver meadow.

"What's a beaver meadow?" we had asked.

"Oh, you know -- a meadow where beavers live!"

"Where is it?"

Charlie had hesitated before replying. "Down behind the Military Camp, not far from Stony Point -- but you'd better not go there. Trespassers are forbidden and besides, there are still some unexploded land mines from the war lying around."

"Yes, it's not safe," Annie had added. "Time past, some boys sneaked in and one of 'em lost an arm."

Nevertheless, late that fall we decided the place

should be investigated. We had gone first to call on the Commandant of the Camp; he had seemed surprised that we wanted to go to that swampy wooded spot but could see no harm either to government property or to ourselves. We thanked him and departed.

The day was bitterly cold, with a piercing wind blowing off the lake. We were bundled up in extra clothes, wearing plenty of red so as not to be mistaken for beavers or anything shootable, but we shivered anyway. Following a trail, we stepped gingerly on the black oozy mud, our eyes peeled for mines and beavers. We saw neither and we gathered up all the chunks of rock we could carry to examine later in the warm cottage.

Put filled two pages of our field notebook with an account of our venture. Dated November 1, 1958, under the heading "Beaver Meadow in Ipperwash Military Camp," he drew a diagram showing the Guard House near the highway and the "winding wood trail" we had followed for " $\frac{1}{4}$ - $\frac{1}{2}$ mile" to the spot marked X.

His description is terse: "exposure consists of loose rock -- no section possible -- much weathered -- lying about in clearing in woods -- 'Clearing' is only relative -- a spot less wooded than that surrounding it."

The faunal list below shows that several of the rocks we had carried away were found to contain specimens of the lower Ipperwash Formation. That was all we wanted to know about the outcrop.

Remembering how helpful Charlie had been then, we went to Thedford at the start of our 1961 vacation to tell him about our plans and ask if he could suggest any other place where we might see the Ipperwash.

"Yes," he said. "They've recently dredged the boat wells over at Shepherd's near Cedar Point, bringing up rocks and fossils much like those in the Indian Reservation. You might go over and have a look."

We did so at once. We found great heaps of blue clay, chert, and limestone beside the newly dredged channel and, climbing around on those heaps, collected fossils similar to those from the Reservation. There was no question about this being the upper Ipperwash Formation; we had specimens to prove it.

While there, we learned that we could go by boat to Blue Point, about five miles away, something we had wanted to do for years. Stauffer had reported great masses of Ipperwash Limestone there close to the edge of the lake; we felt it should be inspected.

One day towards the end of July we went back to Shepherd's with one of our sons-in-law and rented an outboard. The Indian guide who ran it was skillful in avoiding the huge glacial boulders which cover much of the lake bottom between the two places, rising almost to the surface.

With binoculars we could see no rocks on the shore until we reached Blue Point where we landed. Then, walking along the beach, we examined the huge

blocks of limestone lying on the sand; some of them were six feet long and about two feet thick. Among the fossils on the surface was the lower Ipperwash *Spinocyrtia*. The blocks of limestone appeared to have been brought in the ice with the glacial boulders. As at Beaver Meadow we had learned nothing of importance but at least we had not overlooked anything.

By the end of the summer we had checked all the places where the Ipperwash Formation had been reported or even suspected. Our notebook was full of data and our workroom full of Ipperwash fossils. We were ready to assemble the information preparatory to writing it up.

As if to encourage us, the paper we had written

on the Widder Formation appeared in print about the middle of September. We mailed one at once to Charlie and received a letter that was typically exuberant:

I have read with great interest your paper on the Widder beds. I am delighted and pleased with you both. I am proud of you. It is a splendid piece of work. I am impressed with the tremendous amount of detailed work and study you must have put into it. . . .

He was right again -- but it had given us a tremendous amount of pleasure for more than seven years.

XXII

We went back to Shepherd's one Saturday morning in late September to check some point, collected a few fossils and had lunch before going on to the cottage for the weekend. That was the end of our field work.

Put awoke Monday morning early in such pain that I drove him at once to Detroit, to our doctor, and the hospital. About a month later, without warning, he became partially paralyzed -- a blessing as well as a tragedy for it took away much of the suffering. It also took all uncertainty from the future.

His mind remained as clear as ever. We outlined our paper on the Ipperwash, he worked a bit on his pelecypods, and he dictated a book to me -- recollections of his childhood in a more leisurely Detroit, of school and college days, and of his life as a Naval Aviator, No. 954, in World War I. Typed, they made a hundred and fifty pages of delightful reading.

On April seventh, 1962, he slipped away in a deep sleep.

Weeks later in a state of bewilderment, I remembered what Put had once told me -- that if I were ever left alone, I must have "something absorbing to do." I got out our notes on the Ipperwash Formation and tried to finish up the paper we had started; it was slow work. In January Jim Ehlers went over the first draft with me and helped me put it in acceptable form.

The paper was an interesting one. It summarized our field work and discussed the two limestones of the formation and their fossils. We had found two brachiopods at the Indian Reservation which were new species; these were described and named *Mucrospirifer cooperi* and *Cyrtina staufferi* to honor two men who had contributed greatly to the knowledge of the region's geology. Photographs of these fossils and of that important block of limestone were used in the plates.

When the paper was turned in I felt my days as a paleontologist were over. I knew too little about pelecypods to complete the work Put had underway and I had no incentive to begin anything else. First, however, I must give our workroom a thorough cleaning. There were dusty bags of fossils on the table that should have been attended to long ago; I would sort the specimens and put them away properly, then lock the door firmly.

In very low spirits one May morning I set to work. The first paper bag I picked up was labeled in Put's handwriting "Ipperwash - Shepherd's - Sept. 16, 1961." That was the last time we had collected. I remembered the day vividly. We had hunted fossils on the piles of shale, then picnicked sitting on the bluff overlooking the lake.

Reaching into the bag I pulled out something hard wrapped in a paper napkin. It turned out to be a thin slab of Ipperwash Limestone about three inches long with a few fossils on the top. My hand lens showed a pair of tiny, beautifully preserved pelecypods each about three-eighths of an inch long. I had no idea what they were; I had never tried to learn the names of the Devonian pelecypods which Put knew so well.

The quickest way to identify them was to consult our *Index Fossils of North America*, a large book containing 837 pages and 303 plates. By looking at the pictures in the pelecypod section I might see one like them.

I laid the book on the table and it fell open. Imagine my surprise when I saw before me a photograph of that very fossil. I checked the description of Figure 10 on the opposite page; the species illustrated was *Cypricardinia indenta* from the "Devonian . . . Hamilton . . . Ontario." There was no question about its being the same pelecypod; the beds of the Thedford-Arkona region are part of the Hamilton Group.

My hands were shaking. It was almost as though Put had told me its name. What had happened, I reasoned, was that he must have studied that page so often the book naturally opened there and, to prove this, I laid the book on the table as I had before, letting it open where it would. It opened somewhere else. I tried it again and it opened at still another page. I could not make it open at Plate 166 and, though I have tried occasionally since then, it has never again opened at that place.

For a little while I sat there dazed. Then I felt as if I had been given directions. I had a double job to do now -- for Put, too. I must continue working on our collection and I must continue the field work. I had no time to waste, certainly none for self-pity. I replaced the Index Fossils in the bookcase, put the Cypricardinia with a label in the pelecypod cabinet, and finished straightening the room.

Our Ipperwash paper was published that fall in the "Edward Pulteney Wright Memorial Volume" of the Contributions from the Museum of Paleontology. It contained papers by many of our friends on the Museum staff and was prefaced by Put's photograph and a fine tribute to him written by Lew Kellum, the Museum's Director.

Each summer our collection continued to grow. Charlie and Annie Southworth went fossiling with me as long as they were able to get about, and our good friends the Ehlers, the Keslings and the Stumms, the Coopers and the Sanfords continued to come up to the cottage when they could to do some collecting. At times some of the nine grandchildren joined me on a "fossil hunt" and found exciting things.

When the cottage was closed for the winter there was always lots of work to be done on the fossils at home.

Put and I had been concerned about the ultimate disposition of our collection from the time it became well organized, as we wanted it to be available for research. Our wills provided that eventually it should be given either to the Museum of Paleontology at The University of Michigan, or to the United States National Museum, part of the Smithsonian Institution, whichever had the best facilities for its care when we were ready to dispose of it.

After Put's death my responsibility in this connection seemed great and I wondered if I was right in keeping the collection in our house; if not, where should it go? The Museum in Ann Arbor, so dear to both of us, was even more cramped than it had been when we knew it first, and the hoped-for addition was not in sight.

When the Keslings spent a few days with me at the cottage in the fall of 1968 I talked this matter over with Bob, the Director of the Museum since Lew Kellum had retired. Bob thought a few minutes before answering.

"Hang onto your collection as long as you enjoy having it at home," he said at last. "Then, if you find it a burden, give it to the National Museum. They are much better equipped to look after it in Washington than we are, and it certainly ought not to be stored away some place in boxes."

This was the wise decision of a wise man, and a hard one to make.

Early in September, 1969, I flew over to Chicago to be with the Ehlers, Keslings, and Coopers and to hear some of the papers given at the North American Paleontological Convention. Walking over to the Field Museum before one of the sessions with Dr. Cooper, now Senior Paleobiologist of the Department of Paleobiology at the United States National Museum, I asked him to tell me frankly if he would like to have our fossil collection when I was through with it.

"Yes, indeed -- very much," he said, and the question was settled.

He wrote soon to confirm this, saying he had had a conference with Dr. Porter Kier, Chairman of that Department, who was "as keen to have it here as I am." He concluded: "I hope that we will be able to welcome you here during the fall or winter. Perhaps you would like to come to see our facilities and how we will care for your collection in its final resting place."

I had known Porter when he was a student in Ann Arbor and learning that he was to deliver the Ermine Cowles Case lecture there in October, I went out to hear him. Again he told me how pleased they were at the National Museum about getting our fossils sometime.

My plans to keep them indefinitely suddenly changed. One night the next February a gas explosion blew up a large house not far from ours, reducing it in a fraction of a minute to a heap of rubble and a chimney. Horrified, I decided to give our collection away as fast as I could.

When in March I went to Washington to visit the Coopers I took along data about its size and contents. During the next few days I saw much of the magnificent Natural History Building, in the East Wing of which the invertebrate fossils are kept. Dr. Cooper showed me what seemed acres of cabinets devoted to the study collections, he introduced me to many of the paleontologists and to Dr. Cowan, the Director of that Museum, and I came home tremendously pleased that our collection was going there in June.

During the next two months I got it in good shape to hand over, cleaning some of the prize fossils, listing and counting all of them. I was surprised to find that we had collected 10,242 specimens in the Thedford-Arkona region of Ontario -- 271 different species.

On Tuesday morning, June 16th, the Coopers

arrived at the house soon after nine, followed shortly by two young paleontologists in a red Smithsonian truck; it was laden with Museum drawers and packing materials. The three men worked hard that hot day, transferring the trays of fossils from our shallow drawers to theirs, packing them with cotton batting and crushed newspapers, and taping the drawers together in tiers so securely that nothing could budge them. Later I watched the truck drive away with both pride and relief; a long chapter in our lives had ended in the best possible way.

The next morning the Coopers and I went up to the cottage to relax and do some collecting; the Ehlers had planned to join us later but were unable to come. Jo, Arthur, and I had four days of field work in four kinds of weather -- everything from heat to bitter cold, from bright sunshine to showers.

We were all disturbed by the condition of the outcrops. They had obviously been looked over by a great many people for there were surprisingly few whole fossils and innumerable cigarette butts. As Charlie Southworth was apt to say when his luck was poor, "This place ain't what it used to be!"

"Do you think collecting will ever be good around here again?" I asked Dr. Cooper one afternoon.

"No, not unless the number of collectors is controlled as it is, for instance, at a place in Virginia.

But this is the story in many parts of the United States where visitors by the hundreds are transporting our fossils away. I doubt if the collection you and Put made could ever be duplicated. Even the more common species seem to have disappeared."

However, between the three of us we found some good specimens of trilobites, blastoids, and crinoids that had been overlooked; these the Coopers took to Washington when our holiday was over.

One might think I would be sad with our workroom now empty of fossils but that is not the case. I feel as though a much-loved daughter had married a wonderful man and had gone away to a beautiful new home.

"The collection arrived safely," Arthur wrote after their return to Washington, "and now occupies 2 storage cupboards at the end of the Devonian collection. Fred rearranged it to put all of the different kinds of critters together as you had it. . . . let me again say thank you for giving us the collection you and Put worked so hard to accumulate. It is in good hands and will be studied by many students. Many thanks again for a most enjoyable week."

Yes, Put and I did work hard to accumulate those fossils but how much fun we had doing it! And how very much our lives were enriched by finding years ago that queer pebble in the lake!

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