No attempt has as yet been made to work out the graptolite zones in these rocks, but it seems probable, considering the enormous thickness of the rocks, that such zones will be found. The most plentiful graptolite of the central area is *Tetragraptus fruticosus*. Besides this form there are two other species of *Dedymograptus*, *Tetragraptus quadribrachiatus*, *T. bryonoides*, *Dichograptus octobrachiatus*, *Loganograptus Logani*, *Goniograptus Thureaui*, *Phyllograptus typus*, *Thamnograptus typus*, and some forms apparently referable to *Dendrograptus*. All these species, it will be remembered, occur in the Quebec group of rocks. A crustacean of common occurrence is *Lingulocaris M'Coyi* (R. Etheridge jun.). This is the same as the oft-quoted *Hymenocaris Salteri*, a manuscript name of Professor M'Coy's. Two species of *Protospongia* occur, but are rare.

The extension of the Bendigo rocks to the southward along the line of strike is cut off by a newer granite, which is about ten miles across. To the south of this again comes the Castlemaine goldfield. The river gravels of this area, both recent and tertiary, were very rich in gold, but although a few rich "reefs" were found they did not prove of a permanent character, and mining is now at a very low ebb in the district. The structure of the country is similar to that of Bendigo. The anticlines succeed one another very rapidly, being only about three hundred yards apart, as a rule, and the strike is very constant. The main axis of elevation passes through the township of Chewton, about two miles east of Castlemaine, and the lowest beds contain a graptolitic fauna, apparently identical with that of Bendigo. Two or three other zones may be recognized overlying this one. *Tetragraptus fruticosus* does not range above the lowest zone. *Didymograptus bifidus* is the commonest fossil in the next zone, and the problematical *Didymograptus caduceus* of Salter marks the next. The other recognized species agree very closely with those of the Quebec group, species of *Tetragraptus*, *Dubograptus*, *Logarograptus*, *Goneograptus*, *Temnograptus*, *Thyllograptus*, *Dendrograptus* and *Thamnograptus* occur.

THE MARINE TERTIARIES OF AUSTRALIA.

BY T. S. HALL, MA., CASTLEMAINE, AUSTRALIA.

TERTIARY beds of marine origin are extensively developed in the southern portion of Australia, forming a more or less broken fringe along the coastline from the head of the Great Australian Bight to the Snowy River in the east of Victoria. With the exception of a prolongation up the basin of the Murray River they do not extend far from the coastline and attain no great height above the sea. They are absent from the eastern coast of Australia, being apparently faulted below sea-level. Till of late years very little has been done towards the elucidation of the fauna, only a few species having been described. Recently, however, Professor Ralph Tate, of Adelaide, has done a great amount of work among the Mollusca and Echinoderms of the series and has enabled several workers to enter the field. The fauna is remarkably rich, especially in the older rocks, and not far short of 2,000 species have been recorded. The limit is far from reached, as fresh forms are coming to light at every new locality visited. Several papers descriptive of the beds as seen in different localites, with more or less imperfect lists of fossils, have appeared in the publications of the Royal Societies of South Australia and of Victoria. The most exhaustive one is by Mr. J. Dennant, on the beds of Muddy Creek, Victoria.*

More recently Professor Tate and Mr. Dennant have, in the same publication, begun the work of correlating the whole series of beds as shown in the two colonies.

By Professor Sir F. M'Coy the lowest and most widely occurring beds are referred to Oligocene age, and he refers others, which differ lithologically, to the Miocene. Messrs. Tate and Dennant class both as Eocene, and it has been shown that in one locality at any rate the so-called Miocene really underlies the so-called Oligocene. The lists from Muddy Creek, above alluded to, show 511 recorded species, of which only one and a half per cent are living at the present day.

The fauna of the older tertiaries presents a more tropical aspect than that found on our coasts at the present day. Murex, Vobeta and Cypræa are extensively developed and often of gigantic size; the *Cypræa gigas* of M'Coy, for instance, is a very globose form and reaches the length of eight inches.

The strata consist of sands, clays and limestones, the latter being usually composed in the main of polyzoal remains. In some places an Orbitoides limestone occurs, the chief species being *O. Mantelli*. The clays yield the greatest numbers of forms, which in some places are beautifully preserved in a stiff blue clay that cuts like new cheese.

The Miocene beds of Tate and Dennant are not so extensively developed as the Eocene, while Pliocene beds with marine fossils are still rarer. In many places marine gravels occur, which have been ascribed to this age, but apparently on very slight grounds. Where they will be placed now is quite uncertain.

Below the lowest marine beds, and frequently separated from them by a denuded basalt-flow, is, in some places, a series of terrestrial and fresh-water deposits with plant remains with beds of lignite. These have, for many years past, been spoken of as Miocene. It is now proposed to remove them to the Cretaceous. It will be a strange thing if we have to wage war in a case so closely comparable with the Laramie one.

*Trans. Roy. Soc. S. Australia.

THE SCIENTIFIC MAN ON THE FARM.

BY CHARLES B. COOK, OWASSO, MICH.

For many years the average farmer has been a man of few resources. His city brother has outwitted him in every department of his business. He has availed himself of no opportunity to secure a scientific education, and still worse, his county paper is the only periodical that ever enters his dwelling. As a result he is ignorant of the most vital laws that underlie farm husbandry in all of its branches and "farms it" in a general "go-as-you-please" style. These facts alone are sufficient to account for the farmer's general reputation as a man totally unfit for any other business. To make a bad matter worse, the illiterate farmer is continually belittling his profession to an extent that is limited only by his vocabulary.

In direct contrast to the above style of farmer the scientific agriculturalist is growing more and more to take hold of the farm, not only as a field for experiment and study, but as a vocation that will generously respond, financially, in direct proportion to the amount of mental force applied; for it is a fact just beginning to dawn on the minds of the public that the farmer's bank account compares most favorably with that of his professional brother, and where genuine ability prevails, coupled with a love for the vocation wherein one is called, the farmer's account is likely to run ahead.

The educated farmer of to-day is placed almost beyond competition, while the lawyer, the mechanic and the doctor find talented competition on every corner. The scientific man's education enables him to make the most

of the occult laws of nature governing farm life. By a knowledge of economic botany he is able to make the most of his soil and crops by a judicious selection of plants best adapted to his farm, both as regards soil and climate.

Insect enemies are becoming more numerous as the country grows older. New insect pests are continually arising, and those that for long years have been branded as *"thieves and robbers"* in the Old World are being continually introduced. While these insect pests are a constant thorn in the flesh to the illiterate farmer, the scientist is able to ward off their attack, and thus be greatly benefited, personally, by their general depredations. The same is also true of germ diseases, such as pear blight, peach yellows and the like, as such diseases make large crops and correspondingly large prices possible only in the hands of the skilled horticulturalist.

A knowledge of physiology is also of great use to the man who would make the most of the farm. Plant physiology and veterinary science are branches of farm economy the importance of which is just beginning to be realized.

And last but not least the educated farmer is a man able to devote much time to the literature of the day. In the farm journals he finds the latest and best ideas of the most progressive men which aid him in thinking and planning for himself, and in turn contributing his mite to the agricultural press.

There is an old saying that education drives men from the farm, but we are just coming to recognize the fact that the average college graduate with a scientific education, finds on the farm an opportunity for original investigation and financial success fully equal or exceeding that in any other vocation. This assertion finds abundant proof in the lives of many practically scientific farmers, and also in the fact that numerous college men are going onto farms every year, who become enthusiastic and devoted agriculturalists that hold their farms in the highest esteem.

We are rapidly approaching the time when a "survival of the fittest" basis must characterize the life of the American farmer. In times past our vast areas of tillable land have formed a basis for almost exhaustless agricultural operations. This state of affairs, coupled with the fact that a man failing in all other vocations can make a living on a farm—provided he possesses only the power of mimicry born of ignorance—is sufficient to explain the low intellectual standard on the farm, and also accounts for the manner in which the cheap farmer is universally held in derision.

Severe competition on the farm is already being felt and the poorest managers are continually going to the wall. We forget that it is the man that hampers the agricultural profession and not the farm that grinds its occupant.

The educated agriculturalist is slowly but surely driving the uneducated and unthinking man from the field. With the retirement of every quack and the corresponding advent of the thinking man on the farm arena, is elevated the whole agricultural profession, which is thus brought one step nearer its true position that it justly held in Roman times—the foremost rank of all the world.

The uneducated man goes onto the farm as a last resort. His other resources have either failed or never materialized, and he is compelled to eke out an existence in what he considers a belittling business. On the contrary, the educated man goes onto his farm out of love for his chosen vocation, respect for his farm and faith in his ability to make the farm an unqualified success. He makes his home a model of comfort and convenience that may well excite the envy and admiration of his most well-to-do city brother. For besides the comforts and luxuries within his reach he enjoys absolute peace and seclusion unknown to city life.

Let us have more men with active brains and more culture and refinement in rural life, and we will hear less of unproductive and abandomed farms and less of farmers' boys going to the city for a more congenial business.

THE ECCENTRICITIES OF A PAIR OF ROBINS.

BY OLIVE THORNE MILLER, BROOKLYN, N. Y.

ONE never looks for eccentricities in the robin family, and great was my surprise at the curious conduct of a pair who came under my observation last Summer. I fear their heads were turned by a disappointment to begin with, for they successfully raised a brood of three in a nest under the edge of the veranda roof, and never displayed any vagaries. When the young birds had flown, the deserted nest was removed, because the veranda was to be painted.

On beginning to think of a second brood, they seemed greatly disturbed at the loss of their nest. They had fixed their hearts on that veranda, and for days they could not give it up, and judging from subsequent events I am inclined to think it seriously unsettled them. They inspected every corner, the top of the columns where the nest had been, the support that held a string of corn for the squirrels, a peg driven in under the roof, the niche over the door, the chinks in the lattice,—none of them were satisfactory, and at last they turned their attention elsewhere.

They did not seem to please themselves, although several times we thought they were settled, and one day it became plain that trouble was brewing between them. Like some bigger folk, they had let their mutual calamity sour them toward each other.

Madam had plainly selected for the new homestead a delicate crotch on a frail branch, close beside the veranda where her heart was. This was the first sign of aberration of mind, for it was an absurd choice, ludicrously inadequate to the demands of a robin's nest, and her sensible little spouse refused to consent, but kept himself out of sight and hearing of such folly.

But she had made her decision; she began to build. The first I saw of her, she came with a beakful of dried grass from the lawn, flew up to the selected branch near the tree, and then ran out on it as on a path, till she reached the crotch. I was delighted. I had long wished to watch the whole process of building a nest, and here I saw my chance. It was in plain sight, and the robins had learned not to fear us. I placed myself, and the show began.

The bird came with her mouthful of grass, as I said, and when she arrived at the spot, she simply opened her beak and let her load fall. Some of it lodged in the crotch, but most of it fell to the ground. Down she went at once and gathered it up, returned by her pretty path,—and repeated the performance!

Then a kind bird-lover from the house scattered some short pieces of string on the walk for her use. She saw them at once, came down, gathered up an enormous beakful, returned to her branch, and dropped them as she had the grass. Hardly a particle lodged, and she went down and brought it up again; even a third time she repeated the operation.

By this time it was plain to lookers-on that her heart was not in her work, that she was merely "pretending" to build, that, in fact, she was in a "tiff," undoubtedly with her mate. But she went through all the motions so charming to see when done in earnest. She settled herself in the crotch as though it were a nest. She tried it this side and that, and she made great pretence of having