

## Every Slide Rule Tells a Story - Establishing an early A.W. Faber-Castell Chronology

Colin Tombeur

### Introduction

Slide rules, in common with many of today's collectables, are not always dated or serial numbered. This can be particularly true of early examples from a manufacturer, where there is also little reliable information in the public domain. It creates an interesting challenge when trying to establish a date of manufacture for individual specimens, or an evolution of features and models.

The solution is to catalogue as much information as possible from as many examples as possible and establish a realistic sequence of changes in the slide rules. This sequence can then be referenced against any available hard dating evidence to create an approximate timeline of changes in features. Individual specimens can then be compared against the chronology and ascribed an approximate date of manufacture.

I have a particular interest in the mass produced slide rules of A.W. Faber and A.W. Faber-Castell (hereafter referred to simply as 'Faber'; the company changed its name in 1905 [1]) from their inception up to around the First World War, a period that provides collectors with very little direct dating evidence. With collaborator Trevor Catlow, a fellow early Faber slide rule enthusiast, I set about compiling a spreadsheet database of slide rules and their features that I could then analyse.

This article gives an overview of the database and the underlying method of analysis I adopted in order to establish a chronological sequence of the features of the slide rules, which can then be used to date individual specimens. Hopefully it will give useful direction to similar endeavours, but it also provides the basis of a series of further articles by Trevor and myself describing in detail the early Faber slide rule chronology and specific focus areas.

### Background

Faber, the well-known and highly regarded German manufacturer, was among the first mass-producers of slide rules, starting production in 1892 [1]. Their initial 300 series of wooden models developed and grew until 1935, when the numbering system changed [2]. Subsequently, new materials, production methods and models came and went until production eventually ceased in 1977 [2].

My particular interest in Faber's early rules developed from a more general interest in their 300 series rules as I began to realise that the relatively few actual designated models of the first 20 years or so, up to about the start of the First World War, showed many subtle differences. In fact it was not always obvious what defined one model as being different from another, even after model numbers began to appear on the slide rules themselves (at first they did not). Clearly there was a complex underlying evolution of design and production in these formative years. I resolved to understand something of this evolution and Faber's model definition from this period. After this time Faber did continue to make changes, but the models and general design and construction appear to be more stable - Faber had apparently found their 'winning formula'.

I quickly became frustrated in my endeavours as it became apparent that the information available on the subject was both scarce and sketchy at that time. Also, Faber did not serial number its slide rules and only began dating them when blind stamps were introduced in 1920 [2]. It was clear that the only way forward was to compile and study as much information as possible, and crucially, to catalogue and analyse as many slide rules as possible beginning with my own.

Trevor Catlow's ground-breaking 2009 JOS article [3] was a constant, robust reference for me during my early investigations, and it was clear that Trevor and I had similar interests. Eventually our paths crossed and, after several years swapping ideas and discoveries, and realising that it was an opportunity too good to miss, our collaboration to improve and expand Trevor's work began.

### **Development of the Slide Rule Features Database**

Our methodology had strong similarities with that explained in an article by Rodger Shepherd [4]. Rodger had examined the series of editions of Pickworth's manuals covering early Faber slide rules, and I can do no better now than restate the methodology he used.

"As I acquired specimens and photocopies, I examined them for similarities and differences. I used spreadsheet software (Excel) to construct a flexible matrix of specimens vs characteristics. Gradually I discerned a logical sequence of my specimens, and I imposed a hierarchy of "Editions" and "Versions" on the matrix." [4]

Slide rules raise problems different from those of manuals, but the guiding principles are the same. We needed to gather as much information as possible from as many examples of Faber slide rules from before date stamping was introduced. Key starting points were our own collections, but in addition we can now access the slide rules of others around the world who have made their collections available by posting detailed images on the internet. This was a significant development that we were keen to exploit.

It stands to reason that the more examples one has of anything, the better one's understanding will be of the bigger picture. Apparent anomalies in slide rule features become mainstream and part of an overall evolution as more examples are discovered and patterns established. This, however, can be a double edged sword. The more specimens one studies, the more differences or changes one is likely to uncover and need to make sense of. In attempting to find new answers one may stumble across new information that requires a reassessment of the specimens, including analysing features that previously appeared to have no significance. Even the moments of inspiration that come may threaten to open a whole new can of worms.

The process can seem to become quite daunting and infuriating at times, with the scope of the project appearing to escalate out of all proportion. Sometimes I have felt that at best I have been taking two steps forward and one back, or else just going round in circles. However with perseverance and a logical approach, things gradually fall into place. New information and insight will come, along with, hopefully, a few 'eureka' moments. Ultimately I have found it very absorbing, enlightening and rewarding.

Trevor and I had been sharing information and ideas for about three years before we began compiling our database in earnest in late 2015. The general aim was to use it as the basis of one or more detailed articles on the development of early Faber slide rules. We appreciate that any such analysis will never be complete, and at several points we felt that we had reached a stable position where we should offer our insight to a wider audience only to be thwarted by new insight. Discoveries do not stop just because you are ready to move on [5], and until recently we kept finding Faber slide rules that extended our knowledge. However, we have now reached a point where analysing new specimens only seems to support our sequencing of the slide rules, and our dating of the feature changes. Consequently we have decided that now is a good time to begin to spread the word of our findings.

Trevor's original article was based on the 20 or so Faber slide rules in his collection at the time that covered the period from the start of manufacture in 1892 up to the introduction of date stamping in 1920. He developed his knowledge by shifting the rules around on his table until the chronological sequence started to make sense, struggling for a while with the published information which contained errors and inconsistencies at that time [6]. At the time of writing, our database has reached 188 slide rules covering the entire 28 year span. 166 are from our particular 22 year focus period up to the beginning of the First World War (1914), after which, although there are obvious changes in the rules themselves which can be sequenced, it is proving difficult to find corroborative evidence to date these changes. We have catalogued specimens of 20 different

models including some rare 12.5cm and 50cm scale models, and a few specimens of specialised models such as the non-logarithmic 366. However the vast majority, 176 specimens, are from the 15 standard 25cm scale Mannheim based models of the time, including log-log and a few other variants.

We have identified and are recording changes to 46 separate slide rule features, plus a further 9 relating to the slide rules' boxes. The features catalogued cover all aspects of the slide rules from their physical appearance and construction, to scale design and marking, and adorning text and labels. Some examples are: stock length, presence of wooden fixing pins for the celluloid facings, presence and type of lateral scale lines, presence and style of gauge marks, scale numbers typeface, presence of individual registered design or patent numbers, cursor material, cursor window shape, box shape, and brand text style on both the slide rule and the box. We have deliberately excluded some features because they are either unchanging or not relevant, and others we may simply have not noticed (yes, it does happen!).

The slide rules have been separated into 35 distinct groups with comparable features, and for each group we have either identified or speculated date points where features changed. Not including the 1914-20 group, the number of specimens in a group ranges from 1 up to as many as 17, with the longest date range being 6 years, and the shortest probably less than a year. Our evidence shows that not all models or market variants evolved at the same rate, so some of the date ranges overlap and this is discussed later.

Without the facilities provided by a computer spreadsheet program the task of analysing all of the data and determining a chronological sequence would be extremely difficult. Even with this technology the task was substantial. To facilitate the process and make it more efficient, with a greater likelihood of establishing a realistic evolution without going round in circles or hitting brick walls, a defined approach, or rationale, was essential. Even then some slide rules refused to fit into a logical sequence and possible explanations for this must be considered. These specimens, or to be more precise some of their features, are considered as "anomalies" in the sequence, although as new evidence appears or dating adjustments are made these anomalies usually resolve themselves and disappear.

### **Supporting Information for Corroboration and Dating**

Since the slide rules themselves are not dated or serial numbered, it is necessary to look to other sources, direct or indirect, in order to attribute approximate dates to changes in slide rule features.

Unfortunately, there is almost no information available from Faber themselves relating to slide rule production during our period of interest, but there is other information to be found 'out there'. The main sources I have found useful, to a greater or lesser degree, are:

- Patents, registered designs and awards
- Faber catalogues and instruction leaflets
- Books and manuals of the time
- Later published books, articles and comment
- Annotations and additions to specimens

These sources each have their own worth and potential problems which I will discuss briefly in turn, but in all cases they should be used with caution. Much of the information is undated, either the publication itself, the information it contains, or both. Work is often subject to the author's interest and interpretation, may be based on limited or incorrect source material, and never revised or updated. Some sources are obviously reliable and rigorous, while others appear little more than conjecture or uninformed guesswork! Common examples of this problem include cases where the start date of Faber slide rule production is wrong, or where patent or design numbers are treated as model identification numbers or serial numbers. In each case careful consideration should be given to the quality, source and purpose of the evidence before suitably guarded conclusions are drawn.

I would like to offer another word of warning here. It is very easy to fall into a trap of cyclic confirmation where evidence is not explicit or compelling. Documents may suggest a pattern in slide rules, which in turn confirms the documents, or vice-versa. This is not necessarily a problem, but should be recognised.

Despite these warnings, as much relevant material as possible should be gathered and reviewed in context. It may be discounted, it may corroborate other information, or it may open new avenues of investigation or pose new questions. Even undated material may provide a 'missing link' in a previously problematic sequence, or suggest a new sequence where none was obvious before.

#### Patents, Registered Designs and Awards

These are extremely useful for providing solid date points. Faber printed most of their early German patent and registered design numbers on the slide rules. This potentially gives two date points. It is fairly safe to assume that Faber would have begun printing the numbers on the slide rules fairly quickly after the number was issued or the application granted. Clearly a slide rule cannot have been made, or at least completed, until after a patent or design number that appears on it has been issued. Secondly the patent or design lasted a finite time, so while the feature may have persisted beyond this time, the number was removed from the slide rules once the patent or design lapsed.

During our period of interest, German patents ("Deutsches Reichspatent" or DRP) lasted for 15 years [7]. Faber did not apply for many German patents during this time, but detailed information and dates survive for some of those that were registered. German registered designs ("Deutsches Reichsgebrauchsmuster" or DRGM) lasted for three years but could be extended for a further three, up to a maximum of six years [7]. Several DRGM numbers appear on, and subsequently disappear from, Faber slide rules during our timescale. Rough titles and initial dates of the designs are known and provide valuable date-points, but sadly it appears that most of the original DRGM records up to 1934 were lost or destroyed [8], and there is no official information on their detail or whether Faber extended them. Nevertheless, by combining the DRGM information with other pointers it is possible in many cases to determine the probable dates that the DRGM numbers were removed from the slide rules.

It is important to remember however, that an actual design feature may have appeared on a slide rule prior to the submission of the design application, or after it had lapsed. While the latter may be expected, the former does not seem logical or desirable, but there is evidence that Faber did do this. Consequently dates for design applications must be considered within the context of whether the design is present on an example and if the design number is also present or not.

Design awards were often given at trade or cultural exhibitions. Details of these awards are scarce and they are not featured on Faber slide rules. However they do appear on some company literature and on the labels on the back of some slide rule boxes. Some of the awards are dated (for example "Paris 1901", "St.Louis 1904") and can be used as collaborative dating evidence. It is reasonable to assume that Faber would have added these details as soon as practically possible to enhance the company profile.

#### Faber Catalogues and Instruction Leaflets

Product catalogues and pricelists show which models were available at particular times. They are potentially gold-mines of information as they would have been produced, or at least sanctioned, by the company themselves. They usually contain detailed drawings of the products and describe distinct features and innovations.

Unfortunately there are only a few examples of early Faber catalogues around. Those that survive are usually undated, but even when they are dated, this only indicates that a feature or model was present at this time, not when it was introduced. Further, it is evident that pictures and text are not updated consistently or even at all. For example, innovations are described as 'new' across several catalogues that clearly cover a span of

several years. Similarly, drawings of slide rules, which were obviously very accurate when first made, persist unchanged in later versions when some displayed features are clearly obsolete or have been superseded.

Another point worth noting is that it is possible that not all models produced at a given time were listed in all the catalogues of that time. Some models may have been omitted, possibly dependant on the target country or market for the catalogue.

Experience has so far shown that the instruction leaflets included with early Faber Slide rules are of limited value. None are dated, and any text other than the operating instructions is limited and general. They are also quite rare, but as they were produced by or for the manufacturer they are worth seeking out just in case there are any worthwhile clues.

### Books and Manuals of the Time

Third party manuals and books published in the target timeframe can be a useful source of indirect information, but they are not often dated. Their third-party nature means the information contained relating to models and features may be limited, and less reliable than Faber catalogues because of the author's own focus and interpretation. However, anything relevant can be integrated into the overall evidence pool and reviewed, especially if the publication is dated.

For my investigations Charles N Pickworth's Faber instruction manuals and his "The Slide Rule - A Practical Manual" books have proved very useful. Pickworth wrote and updated his in-depth instruction manuals for Faber over a 25 year period starting in about 1896 [4]. As well as instructions they contain detailed drawings and some descriptions of various Faber slide rules and their features. They are not dated, but approximate dates can be ascribed to them by careful study and analysis, as has been done by Rodger Shepherd in his aforementioned article. Pickworth's 'Slide Rule' series of books, published in 24 editions from 1894 to 1955 [9], are general manuals but do contain Faber references and, importantly, all have a dated preface by the author.

### Later Books, Articles and Comment on Slide Rules

It is well worth while collating as much information as possible that is either directly or indirectly related to the slide rules from later published books, articles and comment, including those on the internet.

Due to the scant supply of 'official' information and lack of authority on early Faber slide rules, these sources should initially be reviewed with the utmost caution with nothing taken for granted. This warning applies even, as is not unusual, to material written by company family member or ex-employees since memories can be flawed. No dates or information should be taken at face value, but carefully scrutinised against all other available data to confirm, or otherwise, their validity and relevance.

The material is not deliberately misleading, but often based upon the very limited information available at the time, and not updated. The most helpful sources are often those that confirm or contradict dates or sequences based on research into areas around the slide rules themselves, such as registered company names and addresses or other supporting information. It is prudent to be cautious, but there are some well researched and extremely useful sources available for reference.

### Annotations and Additions to Specimens

Here I am referring to anything that has been included with, or added to, the pristine item since its manufacture, rather than the actual features of the slide rule or box. For example, occasionally a previous owner may have inscribed, somewhere on the rule or box, their name or address, and very rarely an ownership date. It is even possible that a dated purchase receipt is included.

Addresses can provide additional location information. Dates indicate date of ownership rather than manufacture, but can be useful collaborative evidence. Anything handwritten on both the rule and box can tie the two together. Usually there is nothing of note, but potentially anything could turn out to be useful and justify the time and effort of the extra scrutiny.

As an aside, I find the annotations by previous owners found on slide rules or their boxes valuable in their own right. They add a personal dimension to what is otherwise just an ingenious device [9].

### **Sequencing Rationale**

What follows is a discussion of the approach used in analysing the slide rules and features catalogued in the spreadsheet database. I do not describe the content of the database in detail, the specific detail of any analysis, such as how a specific ordering was determined, or the way the features changed and how this was established in each case. This information will be provided in later articles in this series.

The primary function of the database is to sequence and date changes in features of slide rules so that unidentified specimens can be compared against it in order to date them. The sequence of the changes is actually constructed by examining the specimens and grouping them where they have the same features. These groups are then ordered into a logical sequence by studying them in relation to each other and referring to any relevant supporting information. Where possible, dates can then be attributed to the change points, or they can be approximated, thereby producing a chronological evolution with a reasonable degree of usefulness and confidence of accuracy.

This approach is all very well in theory, where the slide rules are made one at a time with progressive changes, but unfortunately that is not how it works in practice. The slide rules were mass produced, probably with the parts being made separately in quantity and then assembled in some sort of production line. This means stockpiles of parts could contain parts with subtle differences as changes were introduced and 'old' stock was used up. The parts would then be combined with other parts from their own stockpiles, with their own differences, to create the finished product. Consequently it becomes very difficult, if not impossible, to resolve the specimens into a perfect chronological series of groups. It may be possible to group most specimens and logically order those groups, but a few specimens are left with combinations of features that do not fit no matter how the slide rules are grouped or the groups ordered.

The solution is to accept that a few slide rules will show unexpected combinations of features due to the changing designs and latency in the manufacturing process, for example an 'old style' stock found with newer scale markings or a newer stock with older scales. However, the apparently anomalous features on individual specimens should be dated within a relatively short time of where the rule otherwise fits in the sequence based on the majority of its features. Given that dating is approximate this should be a year or so at most, with the anomalous features most likely appearing in the adjacent group. I call this the 'box of bits' theory which explains the errant features on a small number of specimens and enables a realistic sequence to be established.

Accepting then that a few slide rules may have the odd anomalous feature from a slightly earlier or later group, the specimens are grouped and the groups ordered into the most logical solution based on their features and the other evidence, and approximate dates determined for the change points. A later feature or feature change cannot appear on an earlier specimen, but an earlier feature or feature change can, until discontinued, appear on a later specimen. Specimens with apparently anomalous features are grouped where most of their features belong, or where they belong most sensibly taking into account the features that match and those that do not, but keeping in mind that they should be close to the group where the errant features logically fit.

There are further considerations which complicate the sequencing process. Different models were introduced over time sporting different features. Existing features evolved as designs were improved, new features were introduced and obsolete or redundant features phased out. Specific features were not necessarily changed on

all relevant models at the same time, and it is also evident that models and features were not necessarily consistent across all markets at any given time.

Once sold, cursors and boxes can be lost, replaced or swapped. Replacement items may be non-Faber, or Faber parts from a different model or time-frame to the original. Such changes are not always easy to spot. In rare cases, which are usually obvious, a previous owner may have modified the slide rule itself in some way, or even produced their own replacement cursor or box.

All of this must be considered when attempting to establish a sequence from the slide rules specimens available for study, so grouping the slide rules by their features can appear quite daunting and difficult at first. The key is to start simply, considering just a few features so as not to be overwhelmed by the task, but still including as many specimens as possible.

A simple yet powerful example of grouping, sequencing and dating Faber slide rules comes from a period where two significant feature evolutions overlapped, one of which has hard dating evidence. The first Faber slide rules had a completely flat back, a feature we call Flat Backs. Only a few known examples exist of this type before Faber changed the back to a rebate with stuck on paper information tables. However, some specimens with much later features also have flat backs. One of these later features is the appearance of celluloid facings to the wooden body of the slide rule onto which the scales were marked, whereas the first slide rules had the scales marked directly on the wooden stock. Sometime after the facings were introduced wooden fixing pins were added to better secure the celluloid [1]. A registered design exists for this technical improvement, DRGM 371190 [2], and this identifier is printed on some specimens with the pins but not others. In fact, we found examples with many different combinations of these features. By grouping the specimens with the same combination of these features, and the knowledge of the date of the DRGM and its probable expiry (in this case after 6 years, determined by other subsequent feature changes), it is possible to work out the progression of the changes as can be seen in Table 1. It became clear that the flat back was re-introduced for a time spanning when fixing pins were introduced, but before the design for fixing pins was registered. From other evidence we could determine when the flat back was first phased out, between approximately 1893 and 1896 depending on market, and that its re-introduction was short lived, lasting only a year or so. It is likely that Faber registered its fixing pin design shortly after its introduction so the flat backs probably were present again from only about 1906 to 1908.

Back of Rule	Celluloid Facing	Fixing Pins	Pins DRGM (1908)	Notes
Flat	No	-	-	Flat back, no facings
Rebate	No	-	-	Flat back changed to rebate
Rebate	Yes*	No	-	Facing introduced
Flat	Yes	No	-	Back reverted to flat
Flat	Yes	Yes	No	Pins introduced before design registered
Rebate	Yes	Yes	No	Back becomes rebated again
Rebate	Yes	Yes	Yes	Pins DRGM registered and stated (c1908)
Rebate	Yes	Yes	No	Pins DRGM expired and removed (c1914)

\* Note some models continued without facings.

Table 1: Progression of slide rule back and celluloid facing features.

Gradually more features and changes can be considered in the analysis, which will break the specimens into smaller groups, thus defining the chronology more and more accurately and with greater scope. Grouping specimens by their construction and scale features will almost always take precedence over features on a box or cursor since these may have been replaced. Box and cursor features are therefore generally confirming rather than defining, unless a definite connection between the rule and the box or cursor can be established, for example by the presence of writing on them by a previous owner. If a connection can be established, then some features can provide valuable dating evidence, such as the exhibition awards and prizes printed on the box labels as mentioned earlier.

As well as referring to the supporting documentary evidence and constantly re-assessing the slide rules, it is useful to consider why the changes may have been made and the possible processes involved in

manufacturing. Unfortunately, knowledge of Faber's production process is largely guesswork and probably had its own equally unknown evolution. However, at a simple level the following seems a reasonable starting point:

- Stocks and slides made.
- Cursors made.
- Boxes made.
- Scale lines and tick marks printed/incised.
- Scale text added.
- Other text added.
- Slide rules assembled
- Slide rules boxed with instruction leaflets.

When considering manufacturing it is realistic to assume that since Faber was a large and respected mass-producer of slide rules it would have had robust, though changing, manufacturing processes and procedures. Consequently, there should be relatively few anomalous features, and probably no prototypes in the general marketplace. Also, the developments would have been made for solid design reasons, good or bad, but it is not always obvious what these may be. It may take some time to uncover a sequence as it may be hidden behind an unknown specification, or combination of other features. However, there should be a sequence to find, albeit with some explainable anomalies, but the sequence may be complicated and involve model and language specific evolutions and so difficult to unravel.

It is not unrealistic or surprising that some features exhibit different changes, or the timing of the changes differs, from one model to another or by intended market. Faber were producing new models and evolving the existing ones at the same time as increasing their production and changing their production practices to be more efficient. Roll out of feature changes may have been dependent on the slightly different production processes for each model, the demand and, where language is a factor for different markets, considerations of culture and aesthetics. Unfortunately without greater knowledge of Faber's design and production methods it is impossible to verify these assumptions, but it seems reasonable and appears to fit the observations. For example, Faber maintained a set of all-wood models for some years after the introduction of the more popular celluloid faced models, but it is evident that these two sets followed a different evolution for some of their features. Some feature changes that occurred on the celluloid faced models did not always appear on the all-wood models, or if they did, usually sometime after. Similarly, German language model versions show distinct evolutionary differences to their English language counterparts.

The chronology should be as simple as possible while making sense of all the data. When it appears impossible to resolve certain feature changes into logical groups, it often helps to broaden the approach and consider seemingly unrelated features or possible manufacturing motives, such as those already mentioned, in order to find patterns and a sequence that makes the most sense. This was the case in the example above concerning all-wood models and their features. Because some feature changes have different timelines for certain sets of slide rules, these distinct changes will have more than one change point in the chronology, based on the set, and sets of slide rules may overlap in terms of the features they do or don't have. As a result chronology will, necessarily, become complicated and there is a danger that it will become difficult to follow. A consistent approach to defining and describing the groups, features and change points is therefore essential to keep the sequence as clear and understandable as possible.

It is important to scrutinise as many slide rules and gather as much supporting evidence as possible. With more data features that previously appeared to be anomalous or 'one off', and so unable to be rationalised, may form new dating groups, particularly if the changes are model or market specific. A good example of this is the flat backs feature described above. A specimen appeared that was clearly from the period when slide rules were made with rebated backs with printed labels, but this one had a flat back. Initially this was dismissed as an oddity, but as the size of our database grew more and more examples of this flat back feature appeared. We could see that these slide rules could be grouped along with a series of other feature changes. Interestingly, some of the boxes of these specimens contained cardboard strips printed with the same

information that is normally found on the printed labels on the backs of the slide rules themselves. We had identified a previously unrecorded feature, and were able to date it accurately to a period lasting just a couple of years. Obviously someone's great idea had come to nothing.

When analysing any new evidence, be it documentary, new specimens or considering additional or newly spotted changes in features, it is important to reappraise the current sequence, specimens and documentary evidence. Clues may be spotted that were previously missed, patterns may emerge where none were evident before, or additional areas of investigation may suggest themselves that may not have been noticed or considered before. Experience has shown it is very easy to overlook changes or patterns, some of which turn out to be 'missing links', or to be blinkered by what has already been achieved. Always assume the current chronology is just the current 'best-guess', and that it may be necessary to adjust the groups and reorder the sequence in order to make sense of new data. Eureka moments, when everything falls into place, will occur and these are very satisfying, but often when definite knowledge is lacking, similar insight may be found using common sense reasoning based on realistic assumptions, educated guesswork and a little imagination.

Thus the process of grouping the slide rules and sequencing them is speculative and iterative as well as determinative. Ultimately, the methodology produces a sequence of groups of slide rules with the same features, although some specimens may have the odd anomalous feature that can be explained by the 'box of bits' theory, or are replacement items. Groups may be generic, model specific, or language specific for different markets. In the case of model or language specific groups, these may overlap other groups and have a different timeline for similar features or changes in features.

Dating can be applied to these groups by looking at the succession of changes in relation to known date points from the supporting information gathered. It will not be possible to date all change points from this information, but it should be possible to set approximate dates based on the number of observations and the flow of changes in relation to the known date points. The approximate dates can then be refined as more information and specimens come to light and the sequence is updated. The more supporting evidence that can be found, the more specimens studied and changes catalogued, the more defined the evolutionary timeline will be. I have found that as the sequencing has included more and more rules with more and more features, it has become more robust with fewer anomalies. Most of the small number of anomalous features that remain seem to be within about year or so of the group the slide rule belongs to, and so, given that the dating is approximate, can be explained by mass-production considerations and are of no great concern. The remaining few anomalies will hopefully be explained in the future when more specimens come to light to establish a pattern, or other further insight is available.

From the chronological sequence it is then possible to identify the broader evolution of features or models, and to date individual slide rule specimens.

#### **Dating Slide Rules Using the Database Chronology**

Having established the chronology of changes in slide rule features, the features of individual specimens can be compared against it to roughly determine probable dates of manufacture based on available evidence. An overview of our chronology is published in the UKSRC Slide Rule Gazette [11] and may also be found on the UKSRC website Gaz Plus page in larger printer friendly formats [12].

In the chronology, groups of slide rules with similar features will have approximate dates when the features were introduced and phased out. A slide rule can only be as old as the introduction of its most recent feature, and as young as the earliest time a feature present on it was phased out. If the specimen to be dated has features that sit entirely within a single group, then its date range of manufacture is that of this group. Alternatively, the specimen may have the majority of its features aligning with a particular group, but the odd anomalous feature from an earlier or later group. If all the anomalous features are associated with groups before the main group, then the manufacture period is that of the main group. If any anomalous feature is from a later group, then it must be dated to a time at least when this feature appeared, but not long after since it will have more features consistent with an earlier group.

Following this method means the manufacturing period arrived at is more likely the 'final assembly', or finishing for sale, of the slide rule rather than the total time span of manufacture for all of its parts. This dating is, in my opinion, the more succinct and useful. When Faber later introduced their blind date stamps, it is not known at which point in the manufacturing process they were applied, but there is some evidence to suggest that this was also done towards the end of the construction of each slide rule.

## Conclusion

Filling in the gaps in a history is a time consuming process, unlikely to ever be perfectly accurate or complete. There will always be more to discover and explain.

Like the problem I am trying to solve, my method has grown and become more complex, but neither are exceptional. My approach is certainly not completely original, and while it feels right for the problem, it is certainly open to question and suggestion. However, by analysing as many undated slide rules as possible and applying a logical rationale, Trevor and I have created a robust, though by no means definitive, evolution of the earliest Faber slide rules and their features. To this we have been able to apply best-guess date points to create a chronology with, we believe, a useful degree of accuracy to within a year or so.

## Acknowledgements

I am indebted to the many collectors who made their slide rule collections available for scrutiny by posting detailed images of them on the internet. There is no doubt that the boost in accessible data has significantly increased the breath, depth and quality of our analysis. Similarly, the contribution provided privately by individuals answering questions and pleas for information cannot be overstated. All internet sources and private contributors are listed in the bibliography.

## References

- [1] *Slide Rules: a Journey through Three Centuries* (Dieter von Jezierski), Astragal Press, 2000
- [2] *Rechenschieber Slide Rules A.W. Faber A.W. Faber-Castell* (Peter Holland), self-publication, seventh revised edition, 2014
- [3] *Suggestions for Dating pre-1920 Faber-Castell Slide Rules* (Trevor Catlow), Journal of the Oughtred Society, Vol. 18, No. 2, Fall 2009, page 46
- [4] *The Faber Slide Rule Manuals by Pickworth* (Rodger Shepherd), Journal of the Oughtred Society, Vol. 10, No. 1, Spring 2001, page 2
- [5] "Any [attempt] to provide comprehensive information on the slide rule ... is inevitably going to be an iterative process, and never complete! Each new source provides additional information and the temptation is to continue adding information and never establishing a baseline", *Slide Rules, their History, Models and Makers* (Peter M. Hopp), Astragal Press, 1999, page i
- [6] "No good model ever accounted for all the facts, since some data was bound to be misleading if not plain wrong.", James Watson (joint discoverer of the structure of DNA with Francis Crick) from: *What Mad Pursuit: A Personal View of Scientific Discovery* (Francis Crick), Basic Books, 1988
- [7] *D.R.P. and D.R.G.M.* (Roadsideimports LLC), [www.switchbladekits.com/index.php?l=product\\_list&c=182](http://www.switchbladekits.com/index.php?l=product_list&c=182)
- [8] *D.R.G.M Numbers & D.R.P Numbers* (National Association of Watch & Clock Collectors), [mb.nawcc.org/showthread.php?50529-D-R-G-M-Numbers-D-R-P-Numbers](http://mb.nawcc.org/showthread.php?50529-D-R-G-M-Numbers-D-R-P-Numbers)
- [9] *Pickworth* (Peter M. Hopp), United Kingdom Slide Rule Circle (UKSRC), Slide Rule Gazette, Issue 6, Autumn 2005, Page 57
- [10] *What's in a Box?* (Colin Tombeur), United Kingdom Slide Rule Circle (UKSRC), Skid Stick, Issue 50, June 2015, Page 12
- [11] *Overview of A.W. Faber-Castell Slide Rule Dating Chronology 1892-1920* (Colin Tombeur), United Kingdom Slide Rule Circle (UKSRC), Slide Rule Gazette, Issue 17, Autumn 2017, Page 49
- [12] *A.W. FABER-CASTELL SLIDE RULE FEATURES 1892-1920* (Colin Tombeur), United Kingdom Slide Rule Circle (UKSRC), Gaz Plus, Gazette 2017 Vol 17, Supplemental Material, [uksrc.org.uk/gazplus.html](http://uksrc.org.uk/gazplus.html)

## Bibliography

- Adams, Robert: *Elektro Slide Rules: Their Use and Scales*: Proceedings of the 13th International Meeting of Slide Rule Collectors, September 2007, Page 154
- Adams, Robert: private correspondence
- Barnes, Colin: private correspondence
- Brentini, Fabrizio: private correspondence
- Brentini, Fabrizio: *Rechenschiebersammlung*: [www.rechenschiebersammlung.ch](http://www.rechenschiebersammlung.ch)
- Castleberry, Clay: *Those Decimal-Keeping Cursors?*: Journal of the Oughtred Society, Vol. 18, No. 1, 2009, Page 46
- Catlow, Trevor: *How did A.W. Faber-Castell Mark their Scales?*: United Kingdom Slide Rule Circle (UKSRC), Slide Rule Gazette, Issue 17, Autumn 2017, Page 70
- Catlow, Trevor: private correspondence
- Catlow, Trevor: *Suggestions for Dating pre-1920 Faber-Castell Slide Rules*: Journal of the Oughtred Society Vol. 18, No. 2 2009, Page 46
- Catlow, Trevor: *Suggestions for Dating pre-1920 Faber-Castell Slide Rules: an Update*: Journal of the Oughtred Society Vol. 22, No. 1 2013, Page 45
- Catlow, Trevor: *The Earliest Faber Slide Rules*: United Kingdom Slide Rule Circle (UKSRC), Slide Rule Gazette, Issue 17, Autumn 2017, Page 100
- Chamberlain, Edwin: *Slide Rule Decimal Point Location Methods*: Journal of the Oughtred Society, Vol. 7, No. 1, Spring 1998, Page 38
- Deutsches Patent- und Markenamt: [www.dpma.de](http://www.dpma.de)
- Dongen, Hubert van: *My Faber-Castell slide rule collection*: [sliderulemuseum.com/isrm/hmd](http://sliderulemuseum.com/isrm/hmd)
- ebay: sale items, [www.ebay.com](http://www.ebay.com)
- Espacenet: *Patent Search*: [worldwide.espacenet.com](http://worldwide.espacenet.com)
- Faber, A.W.: *A.W. Faber "Castell" Regla de cálculo de la más alta precisión*: A.W. Faber, year unknown (c1920)
- Faber, A.W.: *A.W. Faber Improved Calculating Rules*: A.W. Faber, year unknown (c1907)
- Faber, A.W.: *Half-Yearly Report*: A.W. Faber, July 1903
- Faber, A.W.: *Instructions for the use of A.W. Faber's Calculating Rule for Electrical and Mechanical Engineers*: A.W. Faber, year unknown (c1910)
- Faber, A.W.: *Instructions for the use of A.W. Faber's Improved Calculating Rule*: A.W. Faber, 2 versions, years unknown (c1911)
- Faber, A.W.: *Pries-Liste über A.W. Faber "Castell" Präzisions-Rechenstäbe*: A.W. Faber, year unknown (c1915)
- Faber, A.W.: *Pries-Liste von A.W. Faber*: A.W. Faber, 1913
- Faber, A.W.: *Priesliste über A.W. Faber Rechenstäbe*: A.W. Faber, year unknown (c1910)
- Faber, A.W.: *Rechenstab*: Kaiserliches Patentamt, Patentschrift Nr 206428, 1908
- Faber, A.W.: *Instructions for the use of A.W. Faber's Calculating Rule No. 378 for Electrical and Mechanical Engineers*: A.W. Faber, year unknown (c1910)
- Faber-Castell, Alexander von: *Improvements in Slide Rules*: UK Patent No. 10280, 1903
- Fabregas Zazza, George: *Jfzazza Reglas de Calculo*: [www.reglasdecalculo.com](http://www.reglasdecalculo.com)
- Fernández, Jose G.: private correspondence
- GSA: *Nickel Silver: Characteristics, Uses and Problems*: [www.gsa.gov/portal/content/113754](http://www.gsa.gov/portal/content/113754)
- Hems, Ray: private correspondence
- Herwijnen, Herman van: *Herman's Archive*: [sliderules.lovett.com/herman/begin.html](http://sliderules.lovett.com/herman/begin.html)
- Holland, Peter: *A. W. Faber Model 343 - System Baur. Another Unusual Slide Rule*: Journal of the Oughtred Society, Vol. 20, No. 1, 2011, Page 9
- Holland, Peter: *Early Cooperation between A.W. Faber and Dietzgen*: Journal of the Oughtred Society, Vol. 19, No. 1, 2010, Page 29
- Holland, Peter: private correspondence
- Holland, Peter: *Rechenschreiber, Slide Rules A.W. Faber, A.W. Faber-Castell (Seventh revised edition)*: self-publication, 2014
- Hopp, Peter M.: *Pickworth*: United Kingdom Slide Rule Circle (UKSRC), Slide Rule Gazette, Issue 6, Autumn 2005, Page 57

- Hopp, Peter M.: *More Unusual Faber-Castell slide rules*: United Kingdom Slide Rule Circle (UKSRC), Skid Stick, No. 50, June 2015, Page 9
- Hopp, Peter M.: private correspondence
- Hopp, Peter M.: *Slide Rules - Their History, Models and Makers*: Astragal Press, 1999
- Hoyer, Dave: *Dave's Slide Rules*: [www.encoreconsulting.com.au/sr/index.html](http://www.encoreconsulting.com.au/sr/index.html)
- Jeziarski, Dieter von: *Slide Rules - A Journey Through Three Centuries*: Astragal Press, 2000
- Jeziarski, Dieter von: *Lang's Grain Density Caliper-Slide Rule Combination*: Journal of the Oughtred Society, Vol. 12, No. 2, Fall 2003, Page 17
- Jeziarski, Dieter von: private correspondence
- Jeziarski, Dieter von: *Transition from boxwood to celluloid on boxwood within A.W. Faber*: United Kingdom Slide Rule Circle (UKSRC), Skid Stick, No. 11, June 2002, Page 7
- Jeziarski, Dieter von: *The Duplex Slide Rules of Faber-Castell*: Journal of the Oughtred Society, Vol. 17, No. 2, 2008, Page 17
- Jeziarski, Dieter von; Shepherd, Rodger: *Faber-Castell Model Numbers*: Journal of the Oughtred Society, Vol. 8, No 1, Spring 1999, Page 35
- Jeziarski, Dieter von; Schiller, Hans: *Werk Geroldgrün und der Rechenstab*: Faber-Castell, Hauszeitung 'aktuell' 2/2008, supplement
- Jeziarski, Dieter von; Shepherd, Rodger; Weinmann, Paul: *A.W. Faber Model 366 - System Schumacher A Very Unusual Slide Rule*: Journal of the Oughtred Society, Vol. 13, No. 2, Fall 2004, Page 10
- Knott, John V.: *British Thornton - A Slide Rule Manufacturer of Manchester England*: Journal of the Oughtred Society, Vol. 6, No 1, March 1997, Page 29
- Knott, John V.: *Faber-Castell's first UK Patent No. 10230 - 1903*: United Kingdom Slide Rule Circle (UKSRC), Skid Stick, No. 6, October 2000, Page 12
- Konshak, Mike: *International Slide Rule Museum*: [www.sliderulemuseum.com](http://www.sliderulemuseum.com)
- Kugel, Günter: *On Faber Log-Log Scales*: Journal of the Oughtred Society, Vol. 10, No. 1, Spring 2001, Page 42
- Lawrence, Richard: Printing Historical Society, private correspondence
- Lovett, Rod: *Rod Lovett's Slide Rules*: [sliderules.lovett.com](http://sliderules.lovett.com)
- Manley, Ron: *Ron Manley's Slide Rules site*: [www.sliderules.info](http://www.sliderules.info)
- Marcotte, Eric: *Eric's Slide Rule Site*: [www.sliderule.ca](http://www.sliderule.ca)
- Martin, Gonzalo: *Reglas*: [photocalcul.com/reglas.html](http://photocalcul.com/reglas.html)
- Martin, Tom: private correspondence
- MIT Museum: *MIT Museum*: [webmuseum.mit.edu](http://webmuseum.mit.edu)
- National Association of Watch & Clock Collectors: *D.R.G.M Numbers & D.R.P Numbers*: [mb.nawcc.org/showthread.php?50529-D-R-G-M-Numbers-D-R-P-Numbers](http://mb.nawcc.org/showthread.php?50529-D-R-G-M-Numbers-D-R-P-Numbers)
- Nichols, David: private correspondence
- Oughtred Society: *The Oughtred Society Reference Manual (Second Edition)*: Oughtred Society, 2010
- Pickworth, Charles N.: *Instructions for the use of A.W. Faber "Castell" Precision Calculating Rules*: A.W. Faber, year unknown (c1913)
- Pickworth, Charles N.: *Instructions for the use of A.W. Faber's Calculating Rule*: A.W. Faber, year unknown (c1896)
- Pickworth, Charles N.: *Instructions for the use of A.W. Faber's Improved Calculating Rule*: A.W. Faber, 7 versions, years unknown (c1901, c1902, c1902, c1903, c1907, c1909, c1911)
- Pickworth, Charles N.: *Instructions for the use of A.W. Faber's Improved Calculating Rules*: A.W. Faber, year unknown (c1912)
- Pickworth, Charles N.: *Revised Instructions for the use of A.W. Faber's Calculating Rule*: A.W. Faber, year unknown (c1897)
- Pickworth, Charles N.: *The Slide Rule - A Practical Manual*: UKSRC collection, 23 editions, 1894-1955
- Rance, David G.: *David's calculating sticks*: [www.sliderules.nl](http://www.sliderules.nl)
- Rance, David G.: private correspondence
- Riches, David M.: *Mathematical Instruments - A Private Collection*: [www.mathsinstruments.me.uk](http://www.mathsinstruments.me.uk)
- Riches, David M.: private correspondence
- RoadsideImports LLC: *D.R.P. and D.R.G.M.*: [www.switchbladekits.com/index.php?l=product\\_list&c=182](http://www.switchbladekits.com/index.php?l=product_list&c=182)
- Shepherd, Rodger: *Faber Slide Rule Manuals by Pickworth - A Postscript*: Journal of the Oughtred Society Vol. 20, No. 1 2011, Page 4

- Shepherd, Rodger: private correspondence
- Shepherd, Rodger: *The Faber Manuals by Pickworth - Revised Chronology*: Journal of the Oughtred Society Vol. 21, No. 2 2012, Page 6
- Shepherd, Rodger: *The Faber Slide Rule Manuals by Pickworth*: Journal of the Oughtred Society Vol. 10, No. 1, Spring 2001, Page 2
- Smithsonian: *The National Museum of American History*: americanhistory.si.edu
- Thornton, A.G.: *Calculating Slide Rules*: pricelist, year unknown (c1895)
- Tombeur, Colin: *Count Belmiro's Curios*: www.countbelmiro.com
- Tombeur, Colin: *Overview of A.W. Faber-Castell Slide Rule Dating Chronology 1892-1920* (Colin Tombeur), United Kingdom Slide Rule Circle (UKSRC), Slide Rule Gazette, Issue 17, Autumn 2017, Page 49
- Tombeur, Colin: *Thornton Ads on a Faber Box!*:  
www.countbelmiro.com/slides/srman/ThorntonOnFaber\_w.pdf, February 2015
- Tombeur, Colin: *What's in a Box?*: [http://www.countbelmiro.com/slides/srman/WhatsInABox\\_w.pdf](http://www.countbelmiro.com/slides/srman/WhatsInABox_w.pdf), February 2015
- Tomozawa, Atsushi: *Atom's Page*: www5b.biglobe.ne.jp/~tomozawa/en/index.htm
- Venetsianos, Panagiotis: *A.W. Faber Castell Slide Rules - The Relationship Between Date of Manufacture and Indication of Brand Name, Model Number, and Model Name*: Journal of the Oughtred Society, Vol. 9, No 1, Spring 2000, Page 3
- Venetsianos, Panagiotis: *Pocketbook of Gauge Marks (Second and revised edition)*: Oughtred Society, 2011
- Wetton, Jenny: *Slide Rule Making in Manchester - A G Thornton and the Local Industry*: Proceedings of the 5th International Meeting of Slide Rule Collectors, August 1999, Page 45
- Zerfowski, Detlef: *Our Worldwide Knowledge on Calculating Machines, Slide Rules and Calculating Tools*: self-publication, 2012