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The Chinese calendar, like most ancient calendars, was a luni-solar one: the beginnings of the months were determined in a more or less accurate way by the times of new moons, and the beginning of the year by a certain point on the annual solar path along the ecliptic (depending on the historical period this could be the winter solstice, the middle of the zodiacal sign Aquarius, or some other point). Starting with the Quarter Remainder system 四分曆 of the Han 漢 dynasty, the details of a large number of mathematically defined calendars following the above general characteristics are known. These have been studied, for example, by Yabuuti Kiyoshi 篠内清 (中國の天文曆法, Tokyo 1969, second ed. 1990) and by Chen Meidong 陳美東 (古曆新探, Chenyang 1995), while their mathematical characteristics have been analysed and summarized by Jean-Claude Martzloff (Le calendrier chinois: structure et calculs [104 av. J.-C.-1644], Paris 2009). The earliest systems were based on average lengths for the lunar month and the solar year, ignoring the irregularities in the solar and lunar motions. By the end of the seventh century, however, satisfactory solutions for calculating the irregularities on the basis of interpolation methods had been devised. These efforts culminated in the Season-Granting system 授時曆, compiled in the 1270s by Wang Xun 王恂, Guo Shoujing 郭守敬 and others for the Yuan emperor (see Nathan Sivin, Granting the Seasons: The Chinese Astronomical Reform of 1280, With a study of its many dimensions and a translation of its records, New York 2009).

Robert Gassmann’s book deals with the calendar of the state Lu 魯, a vassal state of the Zhou 周 dynasty (first millenium BC). In this period no fixed calendar rules existed and no systematic corrections for the irregularity of the solar and lunar mean motions were carried out yet. The author,
retired professor of the University of Zurich (Switzerland), carries out a meticulous inspection of all available dated records in the *Spring and Autumn Annals* (the chronicle of Lu), the associated *Commentary of Zuo* (左傳), and the contemporaneous *Discourse of the States* (國語) in order to provide a carefully and systematically reconstructed calendar for the period from 722 to 468 BC (Chapter 4). He shows that at many places his reconstruction improves on the commonly used chronological tables by Zhang Peiyu 張培瑜 (中國先秦史歷表, Jinan 1987) and Xu Tangqi 徐鐍祺 (西周至西漢歷譜, Beijing 1997), and that various of the general calendar principles assumed by these authors are invalid for the period concerned. Thus this new reconstruction may be of great utility in further historical studies of the Spring and Autumn period, in particular when it comes to the problematic dating of bronzes and the reconstruction of the chronology of the Zhou dynasty.

A full justification of his reconstruction is given by Gassmann in three accompanying chapters, of which the one on the structural principles of the Lu calendar is translated into English in Chapter 6. The specifics of the Lu calendar need to be determined from dated records of various types of phenomena, for example eclipses. For some years multiple dated records are included, but for others no records may be available at all. Gassmann is nevertheless able to reliably determine the numbers of the months, the locations of intercalary months and those of intercalary days (see below) by carefully studying each record, comparing the dates of consecutive phenomena, and determining the exact meaning of the given elements for each date. Besides the reign year, the lunar month, and the day expressed in the sexagenary cycle (*ganzhi* 干支), the records in the *Spring and Autumn Annals* include some further elements that may be helpful in finding month beginnings, in particular the indications *shuo* 朔 for the first day of a month, *hui* 晦 for the last day of a month, and some other, rarer expressions for other days.

Gassmann’s careful analysis shows that, different from later times, in the Spring and Autumn Period no fixed calendar rules appear to have been in use that could exactly produce calendar dates over many years. However, a number of precedents existed for various aspects of the calendar which were applied with only relatively few exceptions. The first month of the year was clearly not yet tied to the winter solstice (or another significant point within the solar year) as tightly as in later periods, but varied within time spans of around two months. The intercalary month, which was inserted seven times within each 19 years in order to keep the beginning of the year roughly in the neighbourhood of the winter solstice, was located mostly at the end of the year (as a second twelfth month), but occasionally also at other places within the year. Since the intercalary years
play such a central role in the reconstruction of the calendar, details of the analysis of every single record involving an intercalary year are provided in Section 2, whereas all other notes on the reconstruction are collected in Section 3.

Gassmann finds that the Spring and Autumn calendar used the regular alternation of long months of 30 days and short ones of 29 days, which is already known from the Shang 商 dynasty. This requires the insertion of what he calls “an intercalary day” approximately once every 33 months in order to keep the beginning of each month close to the actual time of a new moon. He investigates the possibility that the intercalary days were inserted precisely in the intercalary months, which is made plausible by the fact that only slightly more of the former are needed than of the latter. Although this insertion is possible in around half of the total of 90 intercalary months in the reconstructed part of the Lu calendar, there are again exceptions that make clear that here also no strict rule was applied. The numerous records of solar eclipses in the three primary sources could also be important for synchronisation with western dates, but it turns out that these do not always coincide with the first day of a month, so that one must conclude that they were not directly used for establishing the calendar.

Two of five fictitious solar eclipses in the Spring and Autumn Annals are shown to indicate “calendar reforms” that took place by inserting an intercalary day. Although the other three fictitious eclipses cannot be directly connected to characteristics of the calendar, Gassmann suggests that also these may have had an ominous meaning of some kind.

Gassmann finds various other interesting results in relation to the Spring and Autumn calendar. He furnishes evidence that the inclusion of the character wang 王 in the dates indicates that the month as used in the Lu state ran parallel to that of the kings of the Zhou dynasty. In this way he is able to reconstruct not only the Lu calendar but also large parts of that of the Zhou. As he makes clear by several examples in remark 3 on p. 25 (English on p. 448), traces of other early Chinese calendars can be recognized in the available records. He furthermore comes to the conclusion that the accuracy of the Lu calendar and some of its underlying rules (especially that for the beginning of the year) appear to have varied under different political circumstances.

A table of the elements of the sexagenary cycle in Section 1.9 and concordance between sexagenary days and Julian dates in Section 5 round off this very useful work, which stands out thanks to its thorough analysis of the available calendar data and the presentation of a full justification for its calendar reconstruction.