

The life and times of E. M. Antoniadi, 1870–1944

Part 2: The Meudon years

Richard McKim

Introduction

In Part 1¹ we saw something of Antoniadi's early years. In 1902 he had left Flammarion's employ. 'Both men had large egos, and could not be expected to work in harmony forever', writes William Sheehan, who comments on the parallel between Antoniadi's break with Flammarion and Douglass' with Lowell; 'in both cases the junior astronomers went from being prodigious canal-mappers to their severest critics'.² Antoniadi and Flammarion had not been in touch for some years, but in 1909 they resumed a correspondence: 'My dear Master', began Antoniadi in reply, 'I was very touched to receive your nice letter and to become aware that you have it in mind to forgive my past ingratitude . . .'³ He rejoined the SAF in the same year, and was invited to use Flammarion's telescope again.

Meudon, 1909–1911

By 1909, Antoniadi imagined Mars to be a planet with only natural features, devoid of geometrical canals. The forthcoming apparition was an unusually favourable one, with Mars near perihelion at opposition. It seemed to be a good time to seek irrefutable observational evidence. Henri Deslandres, Director of the Meudon Observatory placed the 'Grande Lunette' at Antoniadi's disposal (Figure 1). He was to make good use of this privilege. For several months before opposition he had followed Mars from Juvisy and with his own 8½-inch (216-mm) Calver reflector; now he was to use the great lens of the Henry Brothers, 32¼-inches (830-mm) aperture. Percival Lowell, with whom Antoniadi now resumed a correspondence warned him, rather characteristically: ' . . . remember that you will have to diaphragmed [*sic*] it down to get the finest possible details. Even here we find 12 or 18 inches the best sizes.'⁴ Fortunately, Antoniadi did not follow Lowell's advice.

It is supremely ironic that his first view with the great telescope on 1909 September 20 proved to be the best of his career, and he was to wait a lifetime in vain in the hope of experiencing again such long spells of perfect seeing as he had met with on that night. Antoniadi's artistic skills, already formidable, had been further sharpened by his preparation of the St Sophia book⁵ (see Part 1), and his drawings of the 1909 apparition were unsurpassed both artistically and areographically. Figure 2 shows Mars on that memorable night. As he placed his eye to the eyepiece, Antoniadi thought he must be dreaming and scanning Mars from its outer

satellite:⁶ 'The planet appeared covered with a vast and incredible amount of detail held steadily, all natural and logical, irregular and chequered, from which geometry was conspicuous by its complete absence.'⁷ He described the land between *Syrtis Major* and *Hellas* as being 'like a green meadow, sprinkled with tiny white spots of various sizes, and diversified with darker or lighter shades of green.'⁸

Antoniadi wrote excitedly to Barnard, Hale, Lowell, Schiaparelli, Stanley Williams and others. Five days after this revelation he wrote to Wesley: 'I have seen Mars more detailed than ever, and I pronounce the general configuration of the planet to be very irregular, and shaded with markings of every degree of darkness. Mars appeared in the giant telescope very much like the Moon, or even like the aspect of the Earth's surface such as I saw it in 1900 from a balloon at a great height (12,000 feet).'⁹ A later letter concludes: ' . . . the spider's webs of Mars are doomed to become a myth of the past.'¹⁰ Barnard, Hale, and many other correspondents were quick to praise Antoniadi's work. Lowell thanked him politely for his drawings, but did not think the



Figure 1. The dome of the Meudon Observatory's 'Grande Lunette', from a drawing by Antoniadi in *Bull. Soc. Astron. France*, 41, 145 (1927).

September 20 view the best: ‘... the one you marked tremulous definition strikes me as the best. It is capital.’¹² Antoniadi’s October 19 drawing, made in average seeing and reproduced in the *BAA Journal*¹³ shows several canals, with one (*Phison* and *Euphrates*) geminated. The ‘canal illusion’, he said, was a product of poor seeing. Antoniadi’s letters to Lowell were as polite as the American’s,¹⁴ and his comment that any differences between his and the Flagstaff astronomer’s drawings ‘must be due to clouds on Mars’ (1909 October 9)¹⁵ was generous indeed! Antoniadi had described the fine detail in *Mare Tyrrhenum* as being like the skin of a leopard.^{7,16} Lowell would have none of it: ‘This is the great danger with a large aperture – a seeming superabundance of image when in fact there is a fine imperceptible blurring which transforms the detail really continuous into apparent patches’.¹² Antoniadi pointed out that he was holding all this detail steadily.¹⁷ Lowell described his curious ideas about images and seeing in person at a BAA meeting in 1910; it makes interesting reading today.¹⁸ Privately, he complained that: ‘The chief trouble with Antoniadi is that he is a man without knowledge of how to observe’.¹⁹ He seems to have given the Meudon work little consideration.

Twice Antoniadi had occasion to contemplate what he considered to be the true structure of the Martian deserts, as he wrote to Lowell: ‘This I saw for 10 or 12 consecutive seconds in *Amazonis*. The soil appeared covered with a maze of knotted, irregular, chequered streaks and spots, which no one could ever think of drawing. I subjoin a diagram of my impressions, no marking of which corresponds to anything real on the planet. But I think it will give an idea of what I saw so definitely ...’²⁴⁷ This remarkable little sketch is reproduced here in Figure 3. Dr William Sheehan has drawn attention to the similarity between this impressionistic view and *Mariner 9* and *Viking* imagery.^{20,21} The resemblance of the pattern of windblown streaks around the cratered terrain to Antoniadi’s sketch is very striking and suggestive (Figure 3).²²

In *La Planète Mars* (1930) Antoniadi was to give the following summary: ‘Personne n’a jamais vu un véritable canal sur Mars, et ainsi les “canaux” plus ou moins rectilignes, simples ou doubles, de Schiaparelli n’existent ni comme canaux, ni comme tracés géométriques; mais ils ont une base de réalité, puisqu’à l’emplacement de chacun d’eux, la surface de la planète présente soit une traînée irrégulière plus ou moins continue et tachetée, soit un bord déchiqueté de grisaille, soit encore un lac isolé, complexe.’²³ Privately, he went a little further, as in this letter to Barnard (1910 June 21): ‘... I came to the conclusion that the so-called “canals” are irregular, complex streaks, furrowing the surface in a way comparable with our valleys. They are no more regular than our synclinal folds. Thus considered, those “mysterious” streaks tighten the analogy between Mars and the Earth, instead of making an artificial world of Mars’.²⁴

Antoniadi’s past mentor, Flammarion, was a champion of the Flagstaff work. ‘M. Flammarion wishes to

remain the great Martian authority, defending straight lines and kindred delusions. Your negative evidence and mine must appear in his eyes as a dangerous invasion of his prerogative’, wrote Antoniadi to Barnard in 1911.²⁵ To the same authority he admitted: ‘Although I am in correspondence with Dr Lowell, yet I am, and always have been, the scientific foe of his occasionally curious views’.²⁶ Although genuinely impressed by the excellent Flagstaff planetary photographs, Antoniadi was quick to point out how these photographs confirmed his own drawings rather than Lowell’s! Antoniadi was, in fact, more than a match for Lowell in literary terms, and enjoyed a good argument in print.²⁷ Though Lowell could never be made to change his mind, Antoniadi later described him as a sincere man in *La Planète Mars*. Schiaparelli, who also never changed his mind about the *canali* told him privately: ‘The polygonal arrangement and the geminations of which you have such a horror (and which horror is shared by many others!) have in fact been confirmed so decisively that it is useless to protest.’²⁸ Several Interim Reports of the Mars Section for 1909 appeared promptly in the *Journal*, but the *Memoir* did not appear till 1915.⁶

The work with the great telescope continued in 1911. Both the 1909 and 1911 apparitions were marked by the incidence of yellow cloud (dust storms), and Antoniadi was thus able to relate the incidence of these obscuring clouds to the Martian seasons and to measure their speeds.²⁹ He proposed, correctly, that such clouds were due to windblown sand or dust, and from the deformities they produced when crossing the terminator was able to give good estimates for their heights.³⁰

The Grande Lunette also enabled him to make detailed colour notes. The colour variations he observed with the changing seasons led him to support



Figure 2. Mars by Antoniadi, 1909 September 20. A drawing with the Grande Lunette in perfect conditions, from *J. Brit. Astron. Assoc.*, 20, 80f (1909). In the version in *La Planète Mars* (1930) the features have somewhat softer outlines.

Antoniadi, Part 2

the vegetation hypothesis. We now know that the colours of the Martian maria are partly real and partly due to subjective contrast.³¹ The presence or absence of dust over the desert areas must play a big part in determining the apparent colour of the dark markings. De Vaucouleurs has written: 'Only in his elaborate descriptions of colours can one wonder whether he was not misled by the effects of the strong secondary spectrum of the great refractor.'³² Whether Antoniadi actually tried colour filters we don't know, but he did approve of them, as we see in this letter to Lowell: 'Do you think that your telescope, stopped to 12 or 15 inches, can really be considered to have a separating power comparable to an aperture of 33 inches, where focusing is accurate to within 1/25 inch? I would never stop down a *perfect* object glass; should the image be too bright, then I would use coloured screens before the eye-piece.'¹⁷ Some of Antoniadi's Meudon views were published in colour.³³ The 1911 *Memoir*³⁰ included a very important Appendix, 'The Phenomena of the Martian Year', a seasonal calendar of martian phenomena. Antoniadi was still using terms such as 'excellent, poor, tremulous' for definition in his English publications, but his numerical scale of 'seeing' appears in the *SAF Bulletin* in 1909. The 'Antoniadi Scale' is still widely used in Europe today.

Other writings and letters, 1909–1913

Antoniadi followed Halley's Comet in 1910. He looked at it on May 24 with the Grande Lunette, power 320, but no nucleus was revealed, 'merely a nebulous mass'.³⁴ He subscribed to the view that the Earth had actually passed through the tail of the comet, which is the accepted opinion today. The central line of the 'beaded' eclipse of 1912 passed close to Paris, and Antoniadi went to observe it from the forest of St Germain, with his wife and a party of other astronomers, including the Crommelins from England.³⁵

As we saw earlier, Antoniadi's health seems to have been a source of concern to him. For, as he confided to Barnard, on 1913 May 28, 'My health too is always delicate . . .'³⁶ He also offered some advice to Barnard, who had been unwell: 'A few weeks of radical change, during which you ought to avoid even *thinking* of astronomy, would restore your health to its usual, robust, standard'. Antoniadi seems to have withdrawn himself from the astronomical community, for he continues: 'I have practically retired from the astronomical circle of friends, and never see anybody, save for my work at Meudon.'³⁶ Antoniadi continued to show signs of isolationism in later life.³⁷

The First World War – Interregnum

Antoniadi observed Mars with his 8½-inch in 1914 and 1916 but made few drawings. The Grande Lunette was closed owing to extensive repairs in the dome.

Throughout WWI he continued to work on his backlog of Mars reports, and his best *Memoirs* were published during it. German artillery pounded the city, and there were some Zeppelin raids, but the victory on the Marne had saved Paris from serious damage.³⁸

In 1917 September, during the depths of War, Antoniadi resigned his BAA membership, and his Mars Section Directorship.³⁹ He had directed the Section through more than a complete 15-year cycle of oppositions, issuing ten *Memoirs* in all. Personally, I feel that the work of compilation and analysis coupled with his other activities had been too great a strain on his uncertain health. 'These reports entail a tremendous amount of work', he once confided to Wesley.⁴⁰ Antoniadi offered to hand over the observations and drawings he had received during his Directorship;⁴¹ regrettably for us, the then Secretary of the Association declined. For his successor, Council turned to Harold Thomson.⁴²

Antoniadi did no other astronomical writing again until 1924. What else was he doing during this second interregnum in his life? In 1927 he received the Cross of the Chevalier of the Legion of Honour, for his astronomical work and for his services to France during WWI.^{43,48,90} One is tempted to suggest that Antoniadi may have assisted his adopted country by putting his

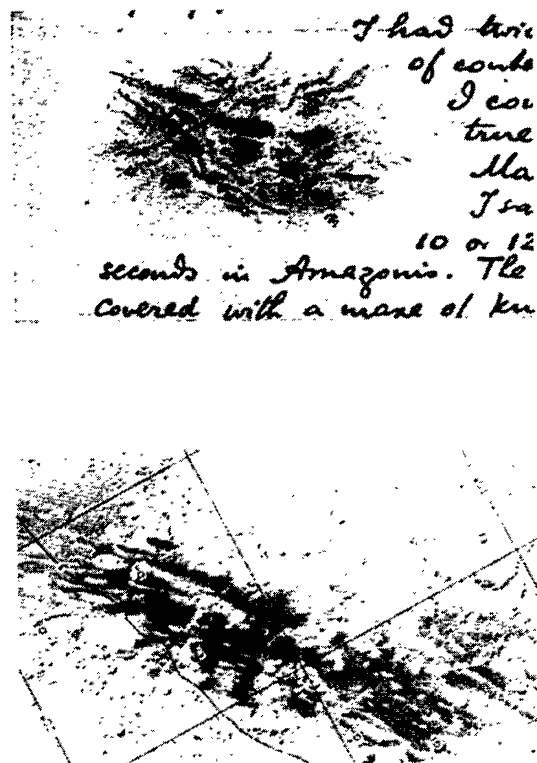
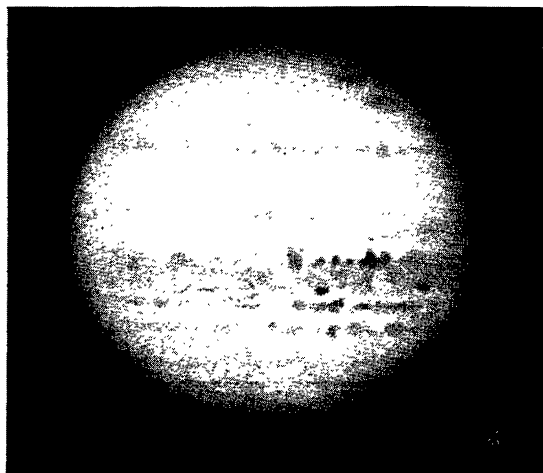


Figure 3. (a) (top) Impressionistic 1909 Mars sketch by Antoniadi showing the structure of small markings in the *Amazonis* desert, from a letter to Percival Lowell (see text).

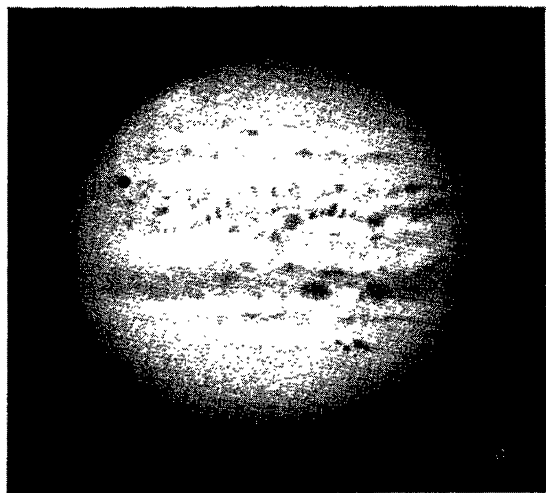
(b) (bottom) Part of a modern airbrush map of Mars after *Viking* imagery, longitudes 185–190°, latitudes +10–20°, orientated so as to make a suggestive comparison with (a).

knowledge of languages to use in the translation of foreign wartime intelligence. This is, of course, unwarranted speculation.

In 1923 November he resigned his Fellowship of the RAS; unfortunately, the actual letter of resignation is not in the RAS correspondence.⁴⁴ One wonders if it was precipitated by a note by the Secretaries⁴⁵ claiming priority for the discovery by the Russian astronomer Tikhov of a relationship between the shrinkage of the Martian polar caps and solar activity, a subject upon which Antoniadi had once written in the *Monthly Notices*.⁴⁶ In his reply, Antoniadi seems to have mistaken the editorial note for a personal attack: he said that he had not seen, and could not have seen the Russian astronomer's paper, as it had been published in a Russian journal.⁴⁷ We may never know his real reasons for progressively cutting his astronomical ties in 1917–1923.



Jupiter. 1928. August 11^d 04^h 05^m Antoniadi



Jupiter 1928. December 8^d 18^h 00^m Antoniadi

Figure 4. Two drawings of Jupiter by Antoniadi at Meudon in 1928, BAA Jupiter Section Archives, showing the planet before and during the great SEB revival of that year. (a) (top) August 11d 04h 05m (b) (bottom) December 8d 18h 00m. Previously published in *Mem. Brit. Astron. Assoc.*, **34** (2), Plate XIII (1939).

Astronomical studies in the 1920s

The year 1924 again finds Antoniadi at Meudon, observing Mars during its closest opposition of the twentieth century, and embarking upon a series of daylight observations of Mercury. Although he frequently now had the use of the Grande Lunette up to the time of his death, he was never a paid member of the observatory staff, rather an 'astronome volontaire'.⁴⁸ He was to observe most oppositions of the Red Planet up until 1941, either at Meudon or at the Paris Observatory. Each Mars opposition saw a paper or a series of papers in the *SAF Bulletin*;⁴⁹ there was one letter in the *BAA Journal*, too.⁵⁰

The BAA was no longer the only place where amateurs sent their Mars drawings for analysis. Since 1914, W. H. Pickering of Mandeville, Jamaica had published regular contributions to the American magazine *Popular Astronomy*.⁵¹ Pickering's speculative and incomplete analyses of these and his own observations ran through 44 reports up to 1930.⁵² In his 1926 report he reproduced several of Antoniadi's fine Meudon drawings, copied from *l'Astronomie*. Antoniadi must have cringed to read Pickering's comments: 'They [the drawings] would be very important indeed, if his seeing were good enough to take advantage of the large size of his aperture. Such, however, is not the case, but his skill as an artist and observer is such that the drawings give an excellent idea of how the planet looks when the seeing is fair, but not really first class.'⁵³ Understandably, Antoniadi had no time for Pickering. 'W. H. Pickering's northward rush of the martian clouds in 1935 is base speculation, like everything he writes',⁷⁸ he once noted. Unfortunately Pickering reached a mass audience and the canal question continued to surface.

Antoniadi was also writing about Venus and Saturn. His conclusions on Venus were summarised in two papers in the *Journal* in the late 1920s and early 1930s.^{54,55} He favoured the long rotation period, with the Venusian axis perpendicular to the orbital plane, but could give no estimate for the length of its day. In the *SAF Bulletin* there was a fine series of papers on Saturn,⁵⁶ summarising all that was then known about the planet. Other papers and reviews dealt with Jupiter⁵⁷ (Figure 4), the Moon and Uranus. He also wrote about cosmological topics, describing the work of Ritchey in a letter to the *BAA Journal*: 'I enclose a drawing made by me from one of the American astronomer's photographs, in which some of the many thousands of remote spirals discovered by him form a chain, as if sown by the hand of the Creator in the depths of space.'⁵⁸ He had the highest regard for Hale and Ritchey, probably because, like himself, they were pioneers in astronomical observation.

Honours – Naturalisation – Paris residences

For his astronomical work the SAF awarded him the prestigious Prix Janssen in 1925, a unique achievement

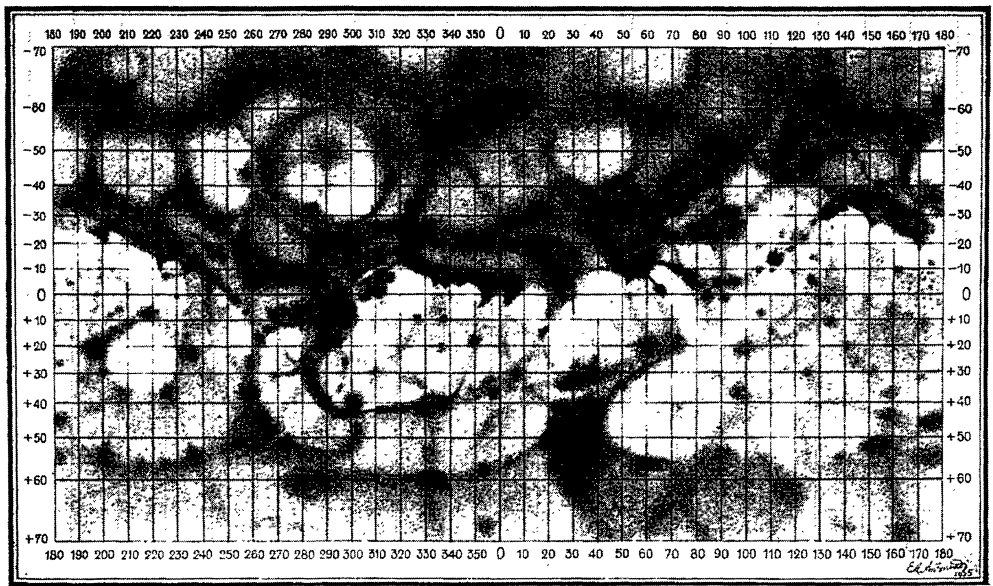


Figure 5. Antoniadi's general map of Mars, from *La Planète Mars* (1930).

for an amateur, while in 1927 (as already noted) he was awarded the Croix de Chevalier de la Légion d'Honneur.⁴³ Two major prizes came from the French Academy of Sciences: the Prix Guzman in 1926 (worth 2500FF) and the Prix Lacaille in 1932, high commendation indeed.

We mentioned in Part 1 that the Antoniadis became naturalised French citizens in 1928.⁵⁹ By that time, Eugène and Catherine had lived in France for more than a quarter of a century, Eugène having been there longer than he had lived in Turkey in his youth. Since Abdul Hamid Khan's deposal, Turkey had fought in the Balkan Wars, sided with Germany in WWI, and surrendered to the Allies in 1918, when Istanbul had been occupied by an Anglo-French army.

It is interesting to follow Antoniadi's changes of residence; I know of seven different addresses. Most of these were in quite expensive regions in the western part of the city. In 1920, the Antoniadis moved from Rue Jouffroy to 15 Rue Arsène-Houssaye. A brief period in 1930 at 21 Avenue de la Grande Armée was followed by a final move to 16 Rue Saussier Leroy.

La Planète Mars

Antoniadi's best-remembered book was published by the Librairie Hermann et Cie in 1930, price 80 francs.⁸⁰ Its detailed map in three sections contained some 560 named features, and there was a smaller unlettered map of the whole planet (see Figure 5). Antoniadi systematised the pre-IAU martian nomenclature. He revised some of Lowell's names (correcting those that were grammatically incorrect) and added many of his own. Antoniadi's classical background made him the ideal person to extend Schiaparelli's nomenclature. The book was an immediate success, despite some criticism of the author's tendency to play down the work of those

who held different opinions to his.⁶¹ (In this respect some of the footnotes are almost as interesting as the text!) A very large coloured original Mars map by Antoniadi can be seen today in the Palais de la Découverte in Paris.⁶²

Even in the finest Meudon seeing, as I have pointed out elsewhere, Antoniadi never saw any direct evidence for martian surface relief. Indeed, he realised that mountains would not show up on the terminator as viewed from Earth. What he wrote about possible martian topography was inferred from other results. He did not think the martian mountains would be as high as those on the Moon. At the same time, he considered that volcanic phenomena might occur on the planet: 'Mais nous n'en avons aucune preuve visible, a moins que l'aspect cendré fréquent de la terre rouge de *Deucalionis Regio* ou bien les voiles atmosphériques jaunes n'en soient des manifestations, ce qui en tous cas est bien énigmatique.'⁶³ It is interesting that his drawing of 1924 December 24, made during a global dust storm, shows *Nodus Gordii*, later to be recognised as one of the *Tharsis* volcanoes, as virtually the only visible feature on the disk, reminiscent of the *Mariner 9* encounter in 1971. Antoniadi considered that orogenic processes should be feeble, but that the irregular north-south streaks which ran into the equatorial maria seemed to indicate differences in altitude and the basins of ancient rivers.⁶⁴ Antoniadi never wrote anything about the question of craters on the surface, so a speculative drawing of Mars seen from one of its moons⁶⁵ is therefore of particular interest. The drawing shows what seem to be large craters in the vicinity of the terminator of the gibbous martian disk (Figure 6). Clearly he believed the surface *could* be cratered.

Antoniadi's views on martian life can also be given. In this, he subscribed to Flammarion's belief in 'la pluralité des mondes habités'. 'We have seen that the great extended dark areas of Mars behave as though

covered with vegetation, which makes it very probable that *one* form of life exists there . . . Also, the melting of the polar snows and the absence of ice in the temperate and equatorial regions proves that the temperature is not too low to support living things . . . If, then, we consider life's marvellous power of adaptation, one of the aims of the Creator of the Universe, we can see that the presence of animals or even human beings on Mars is far from improbable . . . However, it seems that advanced life must have been confined to the past, when there was more water on Mars than there is now; today we can expect nothing more than vegetation around the vast red wildernesses of the planet.⁶⁶

L'Astronomie Egyptienne

The book 'Egyptian Astronomy' appeared in 1934,⁶⁷ filling a gap in the literature. Antoniadi made extensive use of Greek sources: 'Distrusting the shifting accuracy of Egyptian texts, as deciphered, I have preferred erudition in carefully translating the solid writings of the Greek philosophers.'⁶⁸ As Deslandres explained in the Preface, Antoniadi could read the ancient texts directly.

As mentioned already, it was very important to Antoniadi that he should define priority in the discovery of knowledge. There is a long list of 'What the Greeks Owe to the Egyptians'. In addition, much space was given to demolishing the originality of Copernicus' heliocentric theory, by meticulously comparing the statements in Copernicus' text with those by Aristotle, Plato, Diogenes, Ptolemy and others. Later chapters deal with the Denderah planisphere and 'The Astron-



Figure 6. Antoniadi's impressionistic sketch of Mars as viewed from Phobos (see text).

omy of the Great Pyramids'. Antoniadi had personally visited the pyramids; at the pyramid of Kheops (Cheops), he says: 'When coming out of the King's Chamber and above the upper staircase, visitors amuse themselves by shouting and hearing the echoes . . . I have never heard anything so majestic . . .'

La Planète Mercure et la Rotation des Satellites

In 1934 Gauthier-Villars brought out Antoniadi's second planetary work.⁶⁹ This slim booklet supported Schiaparelli's 'captured' rotation period for the planet of 88 days, justifying the situation in terms of tidal forces. It was not until radar work in the 1960s that we learnt that the true period was 58.6 days, two-thirds of the sidereal period. Mercury is best seen from any particular location on Earth every third synodic period (one synodic period = 116 days). By an accident of nature, after this interval has elapsed the planet presents the same face to the observer. In the absence of observations of the unfavourable elongations the observer would find the daily displacement of the vague Mercurian markings too small to distinguish between the true and the captured period. Antoniadi also used the tidal theory to explain the captured rotations of the Galilean and other satellites.

It was with Mercury that Antoniadi made a notable error, namely by his contention that the dark markings were frequently obliterated by clouds, even more frequent than the Martian clouds. Naturally he was criticised for holding these opinions; the kinetic theory of gases tells us that the low gravity and high temperature of the planet could not let it retain much of an atmosphere. Although Antoniadi continued to uphold the accuracy of his Mercurian observations, he later wrote: 'The domain of theory is too often a deceitful one. I myself regret to have indulged in explaining by dust the clouds of the planet Mercury, although they may be due to dust. I take care to adopt no view, in the interpretation of facts, liable to be subsequently overturned.'⁷⁰ Did he make too little allowance for the variable transparency of the *Earth's* atmosphere?

Antoniadi was able to make use of the reports of the Association's Mercury and Venus Section in his researches.⁷¹ Combined with later Pic du Midi work (adding observations of the other 180° of longitude) his drawings were used to map the whole surface.⁷² Antoniadi thought that Mercury would be a world of the same nature as Mars and the Moon, a widely-held view, based on photometric evidence. Whatever its theoretical drawbacks may have been, *La Planète Mercure* was to remain the standard text for many years.

Observing technique – the later 1930s

Proposed (and persuaded?) by Phillips, Antoniadi rejoined the BAA on 1935 March 27. He now took an

active part in the work of the Sections again. In a photograph of him from around this period we see his long-time colleague F. Baldet at the eyepiece of the Grande Lunette, while Antoniadi is making notes nearby (see front cover). Maggini⁷³ reproduces a similar view, and a little-known portrait.

Due to the absence of his observational notebooks (see later), we don't know for certain Antoniadi's observing technique, but Professors Dragesco⁷⁴ and de Vaucouleurs have both told me they had heard Antoniadi always made sketches of *parts* of the disk of Mars (with written notes) at the eyepiece and worked them up into finished, full-disk (or other) drawings later. 'He used brushes and Indian ink with consummate skill',⁷⁵ wrote de Vaucouleurs. The notebooks were probably meticulously neat, just as his letters, always handwritten, were.

In the 1930s, global interest in planetary work had declined generally, and this makes Antoniadi's papers all the more valuable.⁷⁶ Lowell had died in 1916, but the canal question had not died with him. Most European observers accepted Antoniadi's hypotheses, but American observers did not. Antoniadi once wrote to Gabrielle Flammarion to tell her that Lowell had left a personal fortune of some 50 million dollars: 'We can therefore talk for a long time about canals on Mars', he added.³⁷ Thus E. C. Slipher continued to keep the question alive by his observations and photographs at Flagstaff.⁷⁷ Antoniadi's 1935 correspondence with R. L. Waterfield (then BAA Mars Section Director), shows that he was still attacking the 'canalists'. The English amateur Robert Barker is mentioned: 'I saw Barker's drawings of Mars some years ago in the *English Mechanics*. The planet was utterly different from what he represented. He admires Lowell blindly.'⁷⁸ We can certainly agree, but the following is perhaps unduly severe (though doubtless his true opinion): 'To my mind, Lowell was an honest Don Quixote, who never made himself a single discovery. I have a post-card of Cerulli's to me, showing two donkeys: under the one, Cerulli wrote "Lowell"; under the other "Brenner". Good!'⁷⁸ Sheehan suggests that Antoniadi's particular antipathy toward Lowell was due to the similarity between the two men: 'They were both brilliant, dogmatic, arrogant'.² Furthermore, Prof. Audouin Dollfus tells me that Antoniadi had a reputation at Meudon for being 'difficult'.⁸⁰ Dr Patrick Moore has kindly given me his impressions of Antoniadi as he met him in the later 1930s: 'I met Antoniadi a couple of times, once in Paris and once in London, when I was a teenager . . . He had a naturally rather curt manner, but he was very friendly, and we had animated discussions about Mars in particular. Certainly he was out to help a boy such as myself who was really enthusiastic – I am glad to have met him'.⁷⁹ Antoniadi passed on his observing skills to young French astronomers such as Henri Camichel, who later worked at Pic du Midi.

Important papers by Antoniadi in the later 'thirties include his observations of the edgewise rings of Saturn

in 1936–37,⁸¹ and studies of the markings of Ganymede⁸² and the other Jovian satellites.⁸³ There are some 59 BAA *Journal* references against Antoniadi's name in the cumulative index.⁸⁴ Even more contributions were made to the SAF *Bulletin*. The advent of War in 1939 and the occupation of his country the following year did not stem the flow of papers. He also compiled a bibliographical card index of astronomers and the astrophysics of the solar system.⁸⁵ This is now kept at Meudon.⁸⁶

The Second World War

Eugène Antoniadi was still corresponding with his English friends in 1940. The occupation of Paris on June 14 severed his overseas contacts forever. The last letters the writer has seen, written to B. M. Peek, are perhaps the most interesting of all, as they reveal many of Antoniadi's philosophical ideas more clearly than any others. Living since the early 'thirties in Rue Saussier Leroy, some 1000 metres from the Arc de Triomphe, he may well have witnessed the German victory parade through the city. But in 1940 February he thought the Nazis could still be beaten: 'By destroying the Roumanian petroleum wells, and by sending 1000 incendiary air-planes to the Caucasus, we would secure a rapid victory over the monstrous enemy.'⁷⁰ Antoniadi further comments on speculation in science: 'My aversion to XXth century speculation, and its infectious breath, is founded on the impossible 4th-dimensional spacial theories of Einstein; on his accurate enumeration, by Eddington, of the particles composing the universe, the number of whose suns and worlds will eternally remain an insoluble mystery; . . . Perhaps the most important discovery of Jeans is that St Paul's cathedral contains as many flies as the universe stars and nebulae.'⁷⁰

Conditions for the Parisians during the War were not good. During the occupation ' . . . they lived by expediency, their meagre rations eked out by food parcels from the country, their apartments heated by stoves filled with sawdust.'³⁸ However, intellectual life in the capital still flourished. Although a night-time curfew was imposed, Antoniadi could still observe from Meudon. His last observations of Mars, made during the favourable approach of 1941 show that his observing eye was still as keen as ever.⁸⁷ Gerard de Vaucouleurs invited Antoniadi to take part in some laboratory experiments he had arranged at the Sorbonne in 1943 (G. Fournier, A. Dollfus, J. Dragesco, and others took part), but he declined, probably on account of failing visual acuity and health.⁷⁵ A photograph of Antoniadi in his last year appears on the front cover.⁸⁸

Antoniadi did not live to see the German surrender on 1944 August 25, for he became ill with an incurable complaint.⁸⁹ In his last months, however, he made weekly astronomical broadcasts on Radio Paris.⁹⁰ He died in hospital on 1944 February 10, leaving a widow but no family. Four days later, a memorial service was

held at the Greek Orthodox Church in Rue Georges Bizet, which was attended by many leading French astronomers, and at which the President of the SAF (Antoniadi's old friend, Ferdinand Baldet) read a memorial address.⁹⁰

After Antoniadi's death, SAF representatives visited his home to recover any astronomical documents, but could find none. It may be recalled that in 1901 he had indicated to the RAS that he wished to leave his notebooks in English hands. Prof. Dollfus told me that it would appear that Antoniadi himself had destroyed his records during the War. We must remember that Antoniadi was then an old man living in an occupied country.

Conclusion

I hope that in this paper I have thrown a little more light on Antoniadi's personality. He excelled in many fields: he was a writer, artist, historian, archaeologist, architect and astronomer. Friendly to some but aloof to others, Antoniadi emerges from the analysis as a perfectionist in an imperfect world; a man who was meticulously careful to write nothing which might be proven wrong later, who preferred solid observational work to theoretical speculation; a man whose health was not good, and one who increasingly preferred to work in solitude. Whatever new astronomical discoveries there have been since 1944, nothing can take away from him his unique achievements of a lifetime devoted to the pursuit of knowledge. 'Antoniadi was by far the best planetary observer ever; he had an unsurpassed skill in transferring to paper the fleeting telescopic views',⁷⁵ writes de Vaucouleurs. Eugène Antoniadi was the greatest-ever authority on the planet Mars, and one of the most remarkable amateur astronomers of the twentieth century. But let the last words be Antoniadi's own, written to Barnard in 1913: '... my only ambition is to defend the truth and write nothing susceptible of being overthrown. When we feel sure that our work will remain, that our representations of the heavenly bodies are accurate, and that we have honestly given to Caesar what belongs to Caesar, then we may quit this world with the satisfaction of accomplished duty'.³⁶

Acknowledgements

Mr Peter Hingley, RAS Librarian, allowed me to raid the RAS Archives on many occasions over several years: his kindness was much appreciated. The RAS Council kindly allowed me to reproduce material from the archives. Prof. Audouin Dollfus provided Figures 7 and 8. M. Jacques Pernet, curator of the Juvisy Observatory, provided copies of Antoniadi's correspondence with Flammarion and much additional information. I am extremely grateful to messrs. Dollfus and Pernet for so kindly arranging for me to visit Juvisy for myself in 1992, and I thank them both for stimulating discus-

sions. Dr William Sheehan was especially helpful in getting copies of the letters Antoniadi wrote to Barnard and to Lowell, and I thank him for his inspirational correspondence and help. I am grateful to the authorities of the Vanderbilt University for permission to quote from Barnard's correspondence (Special Collections, University Archives, Jean and Alexander Heard Library). Mr Haldun Menali, a BAA member resident in Istanbul made searches of the local records for me. Mr John Brown gave prompt and much appreciated help with a great deal of translation from the French language. Dr Patrick Moore lent me his MS English translation of Antoniadi's *L'Astronomie Egyptienne*. Both he and Dr Henri Camichel gave me the benefit of their reminiscences, while Mr Richard Baum and Mr Thomas Back made many helpful suggestions. Mr Brian Peek let me have copies of letters from Antoniadi to his late father and Dr John Rogers copied some documents from the Jupiter Section records. To all these I extend my sincere thanks and appreciation.

Address: 5 Ashton Road, Oundle, Peterborough PE8 4BY

Notes and references

- 1 McKim, R., *J. Brit. Astron. Assoc.*, **103**, 164 (1993).
- 2 W. Sheehan to R. J. McKim, 1991 September 14.
- 3 E. M. Antoniadi to C. Flammarion, 1909 July 2. (Fonds Camille Flammarion de l'observatoire de Juvisy-sur-Orge (France).)
- 4 P. Lowell to E. M. Antoniadi, 1909 September 26; Lowell Observatory Archives. Antoniadi and Baldet experimented with stopping down in 1924 (*Bull. Soc. Astron. France*, **38**, 457 (1924)). As expected, the seeing improved, but the colours, dark markings and fine detail all faded considerably. (The RAS Library has a microfilm copy of the early Lowell Observatory correspondence.)
- 5 This work included some 750 drawings by its author.
- 6 Antoniadi, E. M., *Mem. Brit. Astron. Assoc.*, **20**(2) (1915). The Meudon 1909 observations were also published in *Bull. Soc. Astron. France*.
- 7 Antoniadi, E. M., *J. Brit. Astron. Assoc.*, **20**, 79 (1909).
- 8 Antoniadi, E. M., *J. Brit. Astron. Assoc.*, **21**, 104 (1910).
- 9 E. M. Antoniadi to W. H. Wesley, 1909 September 25; RAS Letters, 1909.
- 10 E. M. Antoniadi to W. H. Wesley, 1909 October 30; RAS Letters, 1909.
- 11 For a broader view of the 1909 observations the reader is referred to: Hoyt, W. G., *Lowell and Mars*, Arizona University Press, 1976; Sheehan, W., *Planets and Perception*, Arizona University Press, 1988; Crowe, M. J., *The Extraterrestrial Life Debate, 1750-1900*, Cambridge University Press, 1986.
- 12 P. Lowell to E. M. Antoniadi, 1909 November 2; Lowell Observatory Archives.
- 13 Antoniadi, E. M. *J. Brit. Astron. Assoc.*, **20**, 80f (1909).
- 14 The letters Antoniadi and Lowell wrote to other correspondents are much less polite when one refers to the other!
- 15 E. M. Antoniadi to P. Lowell, 1909 October 9; Lowell Observatory Archives.
- 16 Antoniadi, E. M., *Bull. Soc. Astron. France*, **24**, 489 (1909).
- 17 E. M. Antoniadi to P. Lowell, 1909 November 15; Lowell Observatory Archives.
- 18 *J. Brit. Astron. Assoc.*, **20**, 285 (1910); *Observatory*, **33**, 201 (1910).
- 19 P. Lowell to W. Kaempffert of *Scientific American*, 1916 January 31, quoted by Hoyt, *op. cit.*
- 20 Sheehan, W., *op. cit.* (note 11).
- 21 W. Sheehan to R. J. McKim, 1992 January 22.
- 22 T. Back to R. J. McKim, 1992 February 26. I am grateful to Mr Back for suggesting and contributing a suitable section of a modern albedo-topographic map for comparison (Figure 3b).
- 23 Antoniadi, E. M., *La Planète Mars*, Hermann et Cie, Paris, 1930, p. 28. For an English translation of this book by Patrick Moore, see: Antoniadi, E. M., *The Planet Mars*, Keith Reid Ltd., 1975.

Antoniadi, Part 2

- 24 E. M. Antoniadi to E. E. Barnard, 1910 June 21; Vanderbilt University Archives.
- 25 E. M. Antoniadi to E. E. Barnard, 1911 May 11; Vanderbilt University Archives.
- 26 E. M. Antoniadi to E. E. Barnard, 1910 February 6; Vanderbilt University Archives.
- 27 Witness the lively exchange of views between: Brydon, H. Boyd, *J. Roy. Astron. Soc. Canada*, **27**, 66–74 (1933), and Antoniadi, E. M., *ibid.*, **27**, 285–292 (1933).
- 28 Antoniadi, E. M., *La Planète Mars*, p. 31; English edition, p. 42. More Antoniadi–Schiaparelli letters appear in: *Corrispondenza Su Marte Di Giovanni Virginio Schiaparelli*, volume 2 (1890–1900), 1976.
- 29 The early history of the BAA Mars Section is relevant here; see: Ryves, P. M., *Mem. Brit. Astron. Assoc.*, **36**(2), 86 (1948).
- 30 Antoniadi, E. M., *Mem. Brit. Astron. Assoc.*, **20**(4) (1916).
- 31 Hartmann, W. K., *Sky & Telesc.*, **77**, 471 (1989).
- 32 G. de Vaucouleurs to R. J. McKim, 1991 September 13. I myself find it hard to see how Antoniadi could have made such precise colour estimates with the 33-inch. Using the same eyepieces with this fine instrument, I find that the secondary spectrum is still quite noticeable.
- 33 *Bull. Soc. Belge d'Astron.*, **16**, 209–222 (1911); *The Flammarion Book of Astronomy*, Allen and Unwin, 1964; *Communications of the Lunar and Planetary Laboratory of the University of Arizona*, volume 2, frontispiece (1964).
- 34 E. M. Antoniadi to E. E. Barnard, 1910 June 21; Vanderbilt University Archives.
- 35 Antoniadi, E. M., *J. Brit. Astron. Assoc.*, **22**, 331 (1912); *Bull. Soc. Belge d'Astron.*, **17**, 197–204 (1912).
- 36 E. M. Antoniadi to E. E. Barnard, 1913 May 28; Vanderbilt University Archives.
- 37 E. M. Antoniadi to Gabrielle Flammarion (Camille's second wife following Sylvie's death in 1919), 1928 August 23: 'M. Deslandres had asked me to go to Leyden. I have replied to him that I was not the man for these meetings, and that I've always liked to work in isolation'. (Fonds Camille Flammarion de l'observatoire de Juvisy-sur-Orge (France).)
- 38 See the following brief account, for example: Corbierre, Anne-Marie, *Welcome to Paris*, Collins, 1984.
- 39 The BAA Council Minute Book gives no reason for his resignation.
- 40 E. M. Antoniadi to W. H. Wesley, 1916 March 8; RAS Letters, 1916.
- 41 E. M. Antoniadi to E. W. Maunder, 1918 October 28 (citing correspondence in 1910 with the then BAA Secretary, F. W. Levander); RAS MSS Molesworth papers.
- 42 Thomson was a leading BAA planetary observer.
- 43 'M. Eugène Antoniadi, attaché à l'Observatoire de Meudon, vient d'être promu Chevalier de la Légion d'Honneur, pour "services signalés rendus à la science française". Cette distinction, que lui ont valu ses beaux travaux astronomiques, en particulier ses recherches magistrales sur la planète Mars, bien connues de nos lecteurs, vient récompenser une vie de labeur désintéressée, presque entièrement consacrée à l'astronomie'. (*Bull. Soc. Astron. France*, **41**, 137 (1927).) Neither M. Pernet nor the writer has been able to obtain the full citation from the Grande Chancellerie of the Légion d'Honneur in Paris.
- 44 Other 1923 RAS Letters only refer to his resignation in passing.
- 45 *Mon. Not. R. Astron. Soc.*, **82**, 544 (1921).
- 46 Antoniadi, E. M., *Mon. Not. R. Astron. Soc.*, **76**, 643 (1916). Antoniadi's interest in the sizes of the polar caps predated the work of the Russian astronomer; in the BAA Mars *Memoir* for 1901 he had already begun to compare regression data from one apparition to the next. His conclusion in 1916 was, broadly speaking, that when sunspots are numerous, the melting of the Martian caps is accelerated. Later work has not confirmed this hypothesis. Antoniadi's reply to the RAS Secretaries can be found in: *Mon. Not. R. Astron. Soc.*, **83**, 82 (1922).
- 47 Shahn, G., *Bull. Soc. Astron. Russ.*, **18**, 243 (1912).
- 48 Dollfus, A., *Eugène Antoniadi et les observations planétaires* in Proceedings of IAU Colloquium 98, Paris, 1987 June 20–24. Antoniadi's 'amateur' standing is confirmed by his own remarks: 'Science owes much to the great French Observatories, which, apart from the admirable, regular work done by them, keep their doors open to all amateurs intending to undertake some serious investigation.' (*J. Brit. Astron. Assoc.*, **25**, 411 (1915).)
- 49 The SAF *Bulletin* contains many fine papers and drawings on Antoniadi's Meudon observations of Mars from 1924 to 1941.
- 50 *J. Brit. Astron. Assoc.*, **39**, 122 (1929).
- 51 B. M. Peek, Phillips, F. J. Hargreaves, the Ellisons, McEwen, Thomson and E. A. L. Atkins made up the British contingent.
- 52 References to the first and last of these, respectively, are: *Popular Astronomy*, **22** (1) (1914) and **38** (5) (1930). Further discussion of Pickering's life may be found in: Plotkin, H., *J. Hist. Astron.*, **24**, 101 (1993).
- 53 Pickering, W. H., *Popular Astronomy*, **37** (10) (1929).
- 54 Antoniadi, E. M., *J. Brit. Astron. Assoc.*, **39**, 86 (1929).
- 55 Antoniadi, E. M., *J. Brit. Astron. Assoc.*, **44**, 341 (1934).
- 56 Antoniadi, E. M., *Bull. Soc. Astron. France*, **44**, 1, 49 and 158 (1930).
- 57 Antoniadi, E. M., *Bull. Soc. Astron. France*, **40**, 394 (1926).
- 58 Antoniadi, E. M., *J. Brit. Astron. Assoc.*, **39**, 326 (1929).
- 59 The Antoniadis were naturalised on 1928 July 10. The French Ministry of Social Affairs and Integration (sous-Direction des Naturalisations) informed me that other details are closed for 100 years.
- 60 The archives of Hermann & Co. no longer contain any material relating to Antoniadi's transactions with this publishing house.
- 61 MacDonald, T. L., *J. Brit. Astron. Assoc.*, **41**, 135 (1931).
- 62 Drawn and presented by Antoniadi in 1937.
- 63 Antoniadi, E. M., *La Planète Mars*, p. 21.
- 64 Antoniadi, E. M., *La Planète Mars*, p. 20.
- 65 Antoniadi, E. M., *Bull. Soc. Astron. France.*, **40**, 345 (1926).
- 66 Antoniadi, E. M., *La Planète Mars*, p. 52; English edition, p. 67. For his review 'La Vie Dans L'Univers', see *Bull. Soc. Astron. France*, **52**, 1 (1938).
- 67 Antoniadi, E. M., *l'Astronomie Egyptienne*, Gauthier-Villars, 1934. Dr P. A. Moore has deposited copies of his translation in the BAA and RAS libraries.
- 68 Antoniadi, E. M., *J. Brit. Astron. Assoc.*, **44**, 311 (1934).
- 69 Antoniadi, E. M., *La Planète Mercure et la Rotation des Satellites*, Gauthier-Villars, Paris, 1934.
- 70 E. M. Antoniadi to B. M. Peek, 1940 February 17; courtesy Mr Brian Peek.
- 71 McEwen and Antoniadi both published their independent early charts at the same time: McEwen, H., *J. Brit. Astron. Assoc.*, **39**, 310 (1929); Antoniadi, E. M., *J. Brit. Astron. Assoc.*, **39**, 86f (1929).
- 72 Murray, J. B., Dollfus A., and Smith, B., *Icarus*, **17**, 576 (1972).
- 73 Maggini, M., *Il Pianeta Marte*, Ulrico Hoepli Editore – Librai Della Real Casa, Milan, 1939, pp. 226–227. Maggini's papers do not contain any of his correspondence with Antoniadi. I am grateful to his son Dr Pierre Maggini of Rome and to Sr Luigi Prestinzenza for this information.
- 74 J. Dragesco to R. J. McKim, 1991 September 22.
- 75 G. de Vaucouleurs to R. J. McKim, 1991 September 13.
- 76 In 1933, for example, there were no useful published accounts other than Antoniadi's in *Bull. Soc. Astron. France*, **47**, 345 (1933).
- 77 Slipher, E. C., *Mars: The Photographic Story*, Flagstaff, Arizona, 1962. Many of Slipher's own drawings failed to take account of perspective, so he was hardly in a position to criticise Antoniadi's drawing skills, as he attempted to do, long after the latter's death: see p. 142. Slipher's artificial-looking map was a standard reference for NASA for the early *Mariner* flights.
- 78 E. M. Antoniadi to R. L. Waterfield, 1935 June 28; BAA Mars Archives.
- 79 P. A. Moore to R. J. McKim, 1992 March 27.
- 80 A. Dollfus, personal communication.
- 81 Antoniadi, E. M., *J. Brit. Astron. Assoc.*, **47**, 252 (1937).
- 82 Antoniadi, E. M., *J. Brit. Astron. Assoc.*, **48**, 275 (1938).
- 83 Antoniadi, E. M., *J. Roy. Astron. Soc. Canada*, **33**, 273 (1939).
- 84 *The Journal of the British Astronomical Association: General Index to volumes 1 to 50 (1890–1940)*, 1963.
- 85 As early as 1932 Antoniadi stated he had completed some 30,000 cards.
- 86 A. Dollfus to R. J. McKim, 1981 January 7.
- 87 Antoniadi, E. M., *Bull. Soc. Astron. France*, **55**, 241 (1941).
- 88 This reproduction does Antoniadi more justice than the poor quality reproduction (on wartime paper) of this portrait in the Obituary Notices in the BAA and SAF publications.
- 89 Perhaps heart disease? His last letters to Peek suggest this could have been a source of worry to him. The death certificate does not help: it states his address, perhaps in error, as 33 Rue Saussier-Leroy.
- 90 Ryves, P. M., *J. Brit. Astron. Assoc.*, **55**, 163 (1945); *Bull. Soc. Astron. France*, **58**, 58 (1944).

Received 23 July 1992; accepted in revised form 2 January 1993