

## What can be found from the observation records of Hong Kong Odonata over the past decade? (Part 1)

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### ABSTRACT

A brief account on the 13 Odonata species new to Hong Kong recorded or reported after 2011 is given. The known sightings in the territory are described. Comparing with the new-to-Hong Kong discoveries between 2002 and 2011, it is shown that citizen's observation records increasingly contribute to our understanding to the local Odonata fauna. Residential status of the 13 new species needs continuous observation to confirm. Citizen participation in a long term survey on Odonata over the territory would complement the work of professionals in closing this knowledge gap.

**Key words:** New record, citizen science, Odonata, Hong Kong

### INTRODUCTION

Establishing an ecological survey database through public participation is nothing new around the world, not even in Hong Kong. Since 2016, the Hong Kong Bird Watching Society (HKBWS) has been organizing yearly Hong Kong Sparrow Census, recruiting members of the public to conduct surveys over the city, not to mention the Society's long history of collecting bird observation records from members since its establishment (see HKBWS website: <https://cms.hkbws.org.hk/cms/resource-tw/bird-report-tw>). Green Power also engages citizens to participate in the "Butterfly Surveyor" programme from 2008 onwards (see Green Power website: <https://www.greenpower.org.hk/butterfly/eng/surveyor.shtml>). This type of "citizen science" is found to be a vital part in many ecology-related studies (Silvertown, 2009; Kullenberg and Kasperowski, 2016).

Among Hong Kong's local insect fauna, Odonata is a relatively well studied (e.g. works of Syoziro Asahina and Keith Wilson) and monitored order. The Dragonfly Working Group under Agriculture, Fisheries and Conservation Department (AFCD) of Hong Kong Government conducts regular surveys of local Odonata fauna since its inauguration in 2002. It is stated in the AFCD website (<https://www.afcd.gov.hk/english/conservation/hkbiodiversity/aboutus/aboutus.html>) that the survey results would be available to public after detailed analysis. As of today, the findings are yet to be publicized in full.

Odonata is also a more frequently observed insect group by both practitioners and enthusiasts in Hong Kong. Environmental Impact Assessment (EIA) Study Briefs issued by Environmental Protection Department (EPD)

of Hong Kong Government in the past two decades usually specify the need for an Odonata survey (among surveys of other taxa, but Odonata and butterflies are the only two named terrestrial macroinvertebrates), in case an ecological impact assessment is required for the particular project's EIA (all Study Briefs are uploaded to EPD EIAO website sorted by the year of issuance: [https://www.epd.gov.hk/eia/english/register/index4/all\\_2020.html](https://www.epd.gov.hk/eia/english/register/index4/all_2020.html)). To the author's observation, the number of dedicated photographers focused on Odonata is second only to that on butterflies, and many of them are capable of accurate species identification.

The sizeable population of Odonata observers implies the potential for a comprehensive database of local Odonata fauna in terms of spatial and temporal distribution, if the observation records are gathered systematically. This would not only enrich our knowledge on Odonata but also provide a basis for future studies, for example EIA or population variations due to climate change. While the official surveys are conducted regularly following scientific approaches, a citizen survey would certainly complement the dataset by a wider spectrum of locality and observation timing. Indeed, several observations of Odonata species new to Hong Kong in recent years were from enthusiasts.

### MATERIALS & METHODS

In this article, the observation records of Hong Kong Odonata fauna over the past decade (2011 to 2020) by several enthusiasts are reviewed to see whether trends can be seen from a long-term survey dataset. The method and the content of recording are also discussed in order to establish a suitable template for a citizen survey. Part 1 covers the Odonata species firstly recorded / reported in Hong Kong since 2011. Part 2 describes findings on the spatial and temporal distribution of all other extant and previously recorded species.

### RESULTS

#### Part 1: New Odonata Records of Hong Kong Since 2011

The book *The Dragonflies of Hong Kong* by AFCD describes 116 species recorded up to 2011 (Tam et al., 2011). In the following 10 years, a total of 13 new species were added to the Hong Kong list. Some of them are recorded prior to 2011, but the discoveries were publicized after the book was published. Leung and Tam (2016) and the website *A Checklist of Dragonflies (Odonata) of Hong Kong* (Ka, 2020) have outlined these

findings. A brief account of the Hong Kong records of these 13 species are given below.

### Zygoptera: Lestidae

#### *Sympecma paedisca* (Brauer 1877)

A single male sub-adult was found on 9.II.2009 in Shing Mun South by Sum Lam-Po as described in Ka (2020). For unknown reason this record was not mentioned in Leung and Tam (2016). This species is widespread throughout Palearctic region, with distribution stretching from France to Japan (Battisti and Pavesi, 2017). In China it is confined to northern provinces (Zhang, 2018). Given the lower dispersal ability of damselflies (Watts et al., 2006), it is possible that the individual was transported to Hong Kong with aquarium plants.

### Zygoptera: Calopterygidae

#### *Matrona basilaris* Selys 1853

Seehausen (2014) described the discovery of specimens in the Übersee-Museum, Bremen, Germany. The two male and two female specimens are mounted with the label stating "Hongkong" as the collection locality, probably during the late 19th / early 20th Century. It is widely distributed in China (Zhang, 2018) but there is no sighting reported in Hong Kong other than the specimens in Germany.

### Eiprocta: Aeshnidae

#### *Anax indicus* Lieftinck, 1942

Yam (2012) described the only reported sighting of this species in Hong Kong. A male was spotted at Yuen Tun Ha on 25.IX.2010 and it occurred for a few minutes. Zhang (2018) mentions its occurrence in Vietnam and Yunnan, China in addition to the distribution between Pakistan and Thailand as stated by Yam. It is not sure whether it is a vagrant individual, or just that the presence of this species is overlooked, as locally common species *Anax guttatus* and *Anax parthenope* tend to fly continuously above ponds without rest when occur, and it is challenging to identify similarly coloured *Anax* species during rapid flight.

#### *Gynacantha ryukyuensis* Asahina, 1962

The occurrence of this species in Hong Kong was announced by AFCD (2014), based on records in northeast New Territories (in 2004 and May 2014) and Tai Lam Country Park (April 2013 and June 2014), as detailed in Leung, Hui and Fung (2016). Subsequently the species is recorded in a wide range of localities over Hong Kong. An earlier photo record dated 26.VII.2011 taken at Sha Lo Tung by the author was later identified as *G. ryukyuensis*. Below are the personal observation records of the author and Cheung Che-Man (pers. comm.) showing the locality and the dates, among other records posted in the internet:

1. Sha Lo Tung - Dates recorded: 26.VII.2011, 21.VI.2014, 12.VII.2014, 6.VI.2020
2. Wu Kau Tang - Dates recorded: 29.VI.2014, 27.VII.2014
3. Luk Keng - Dates recorded: 16.V.2015
4. Ping Nam Stream - Dates recorded: 13.V.2019

On iNaturalist website, sightings of *G. ryukyuensis* were reported at Shui Hau, Lantau Island on 26.IV.2019, Sha Lo Tung on 15.VI.2019 and Lamma Island on 26.IV.2020, illustrating that its range spans over a large part of the territory from north to south.

Hong Kong is within the distribution range of *G. ryukyuensis* which spans between Guangxi, China and Tanegashima, Japan (Ozono et al., 2012; Zhang, 2018). It was first reported in Taiwan in the early 1990s (Yeh, 2006). There is no clue on whether the species only expands its range to Hong Kong in recent years, but because of their cryptic, crepuscular behaviour and similarity with other *Gynacantha* spp., it may well be a resident species that has just been overlooked. The many recent records by enthusiasts indicate that a steady community may have been established in Hong Kong.

#### *Polycanthagyna ornithocephala* (McLachlan, 1896)

Up to date there are two reported sightings of this species in Hong Kong. A female was found in northeast New Territories by Sum Lam-Po on 13.VII.2017 as illustrated in Ka (2020). A male was recorded at Tai Po Kau Outdoor Study Centre on 23.VIII.2018 by Ernest Chiu as described in a post on the "HK Dragonfly" Facebook page (<https://www.facebook.com/groups/hkdragonfly/permalink/917793205376318>). According to Wong et al. (2012), it usually occurs near woodland pools that are small in area, sharing the same habitat type with *P. erythromelas* which is locally a widespread and well recorded species (Tam et al., 2011). Although Hong Kong is within the reported range of its distribution from India to the Ryukyu (Wong et al., 2012), more observation record is needed to confirm its status in the territory.

### Eiprocta: Gomphidae

#### *Stylurus annulatus* (Djakonov, 1926) and *Stylurus clathratus* (Needham, 1930)

Wilson (2019) gives a comprehensive account of the discovery of these two species in Hong Kong: *S. annulatus* was first recorded in the eastern water outside Sai Kung on 13.VIII.2008 by Samson So. It was identified as *S. kreyenbergi* but this name is synonymized with *S. annulatus* now as explained in the same article by Wilson. It was also recorded by AFCD on 15.IX.2014 (one female) and 27.VI.2017 (one male) in Ma On Shan. All three records occurred in the eastern

side of the city. A female *S. clathratus* was recorded at Tai O, Lantau Island by Ernest Chiu on 19.VI.2018. Both species are recorded from Guangdong province, but again additional records are required to confirm whether they breed in Hong Kong.

### **Eiprocta: Cordulegastridae**

#### *Anotogaster cf. klossi* Fraser, 1919

AFCD (2015) reported the first record of Cordulegastridae in Hong Kong in May 2015. It was found in central New Territories and subsequently identified as *Anotogaster* sp., close to *A. klossi*. On and on there have been sightings of *Anotogaster* sp. at different localities in central and northeastern New Territories. A Japanese visitor photographed a flying adult in Wu Kau Tang on 5.VI.2016 (Bergman Ng, pers. comm.). Teneral individuals were photographed in April 2018 and on 7.V. 2020 in Shing Mun, where an ovipositing female (on 20.VII.2017) and a larva have also been recorded at various locations within the country park (Mahler Ka, pers. comm.). A male was recorded at Sha Lo Tung by Cheung Che-Man on 15.VII.2020 (pers. comm.). Apparently there are breeding communities of *Anotogaster* sp. in Hong Kong. Species under this genus closely resemble each other and correct identification may require dissection of genitalia (Zhang, 2018).

### **Eiprocta: Libellulidae**

#### *Indothemis carnatica* (Fabricius, 1798)

The first reporting of this species was by AFCD (2018a), describing the discovery at a pond in northwest New Territories, where both sexes occurred between 4.IV.2018 and 9.IV.2018 and mating was recorded. It was later checked that a male was photographed in Luk Keng on 28.X.2017 by Cheung Che-Man (pers. comm.; Ka, 2020). In the following two years, this species has been recorded in various sites as west as in Castle Peak and as east as in Tsiu Hang and Ngong Wo, both in Sai Kung (Bergman Ng, pers. comm.).

Von Ellenrieder et al. (2015) mentioned that *I. carnatica* was only recorded in limited sites in India, Sri Lanka, Thailand and Malaysia, and reported the first record in northern Vietnam. Later Zhang (2018) mentioned its occurrence in Yunnan, Guangxi and Guangdong provinces of China. The first Singaporean record was seen in 2018 (Soh et al., 2019). Whether it is spreading its range over the past years remains in question, although sighting in Hong Kong is getting more common.

#### *Orthetrum albistylum* (Selys, 1848)

A species widely spread across the Palearctic region from Europe to Japan. It is also said to occur throughout China (Zhang, 2018). The first local record (a male) was found in Hong Kong Wetland Park on 26.IX.2018 reported by AFCD (2018b). On 16.IX.2020 a female was photographed by M Y Lai, also in Hong Kong Wetland

Park (pers. comm.).

#### *Rhyothemis fuliginosa* Selys, 1883

On 11.X.2014, a species resembling *Rhyothemis triangularis* but with a bigger size was spotted by Bergman Ng at an abandoned fish pond in Luk Keng. It was later identified by Mahler Ka as *Rhyothemis fuliginosa*, with larger and darker metallic blue patches on the wings. This is the first reported sighting in Hong Kong. At least two males were observed on that day. One individual was observed each day on 12.X.2014, 14.X.2014 and 17.X.2014. It rested on the leaf tips of pond-side weeds, but was frequently disturbed by dominant species there such as *Anax guttatus*, *Pantala flavescens*, *Tramea virginia* etc. No more sighting of this species was recorded in Hong Kong after October 2014.

Upon checking the records, it was found that a male *R. fuliginosa* was photographed by Truman Kwok at the same pond on 1.X.2014. The colour pattern on the hindwings of this earlier individual is clearly different from the ones photographed on later days in the month. According to records in Japan, there can be significant variation in shape and shade among communities in different regions (Ozono et al., 2012; Futahashi, 2013).

*R. fuliginosa* inhabits vegetated freshwater ponds in East Asia, spanning between Korean Peninsula to the north and Guangdong, China to the south. Wilson (2009) cast doubt on the authenticity of reports on its occurrence in Hainan province. Records from Cambodia are believed to be *R. plutonia* (Kosterin, 2010; Kosterin et al., 2012). *R. fuliginosa* was first reported in Taiwan in 2006 (Yeh et al., 2007). As of today Hong Kong is near the southernmost part of its distribution range.

#### *Sympetrum darwinianum* (Selys, 1883)

The only reported sighting of this small reddish species in Hong Kong was at Wu Kau Tang on 14.XII.2014 by Bergman Ng and Cheung Che-Man with identification help from Mahler Ka. It rested on a concrete footpath for a few hours on a sunny day with temperature around 16°C. It has not been reported in Hong Kong afterwards.

*Sympetrum* spp. are mostly Holarctic species, living in the temperate areas of Eurasia and North America. *S. darwinianum* is found in Korea, Japan and most provinces of China other than the northwest regions (Zhang, 2018). Wilson (2013) mentioned that the species has not been recorded at locations below Latitude 23°N, but the current record rebuts this statement. The author has recorded this species in northern Guangdong. This individual may be vagrant and arrive at Hong Kong together with the winter monsoon.

#### *Sympetrum fonscolombii* (Selys, 1840)

The first record of this species in Hong Kong was from Moody Au who discovered a male at Pak Nai on 5.X.2017 (pers. comm.). A few days afterwards, a



female was found in southern part of Hong Kong by Denis Wong, Ernest Chiu, Yuet Yin Ling and Ken Cheng (AFCD, 2017). Two years later, Moody Au recorded a female in Tai Lam Country Park on 9.XI.2019 (pers. comm.). Not long later the author found a few males and females (about two to three for each gender) at Mount Davis on 10.XI.2019, upon earlier sightings by Tom Li. This later group of individuals lasted for a week more before disappearing from the site (Cheung Che-Man, pers. comm.).

*S. fonscolombii* has an extensive range of distribution in Asia, Europe and Africa (Clausnitzer, 2013). Its seasonal migratory behaviour have been widely reported (e.g. Campbell and Reimer, 2011; Borisov et al., 2020). The first sighting in Taiwan was recorded in 2006 (Tsou and Yeh, 2007) and the species has since been observed visiting the island in autumn every year (Tang et al., 2013). The Hong Kong sightings in the autumns of 2017 and 2019 and the occurrence pattern observed at Mount Davis may imply that the city is on its regular migration path, though persistent and more extensive monitoring is needed to confirm so.

## DISCUSSION

Table 1 summarizes the 13 species new to Hong Kong described above. Only two of them are damselflies (Zygoptera), and one of these are just historical records from a museum collection. All others are dragonflies (Eiprocta: Anisoptera) that are usually considered as more capable of dispersal (Heiser and Schmitt, 2010).

Four out of these were discovered by AFCD, while the other nine are by other researchers and enthusiasts. In the previously reported new-to-Hong Kong records between 2002 (after AFCD Working Group was established) and 2011 as listed in Table 2, five were first recorded by AFCD and four were by researchers. Comparing these, it can be seen that citizen observations play an increasingly important role in contributing to the knowledge of the evolving Odonata fauna in Hong Kong. With the strength in numbers and diversity of sites visited, a publicly participated observation scheme would definitely complement the regular survey and monitoring schemes by the authority.

Fundamental knowledge of the Hong Kong Odonata fauna has been well established with the effort of previous researchers and field workers. New records in recent years may be attributed to the following reasons:

1. Resident species with a very cryptic life cycle: the seldomly seen but breeding *Anotogaster cf. klossi* may be an example.
2. Species that naturally expand their range to Hong Kong due to environmental factors like climate change: the originally more southerly distribution of *Indothemis carnatica* in Asia and its recent discovery in locations closer to Hong Kong may reflect a northerly spread colonization.

3. Species accidentally introduced into Hong Kong by human activities, e.g. shipment with aquarium plants: For occasionally recorded Zygoptera (*Sympecma paedisca*) this reason may be of higher possibility than others, as they are weaker fliers with lower dispersal range (Purse et al., 2003; Watts et al., 2006).
4. Seasonal migrants that have been previously overlooked or have recently chosen Hong Kong as a stopover location: The repeated visit of *Sympetrum fonscolombii* in a group in 2019 and its seasonal appearance in Taiwan may be a cue for its migrating through Hong Kong.
5. Vagrant: The single occurrence of *Sympetrum darwinianum* may belong to this category.

After all, these are only speculations that require verification. Without sufficiently long and widespread observations, it would be hard to determine whether these new species are regular migrants, occasional visitors or residents. Again, citizen participation through extensive survey and continuous monitoring would help close the knowledge gap more efficiently than solely relying on the hard work of professionals.

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## TABLES &amp; FIGURES

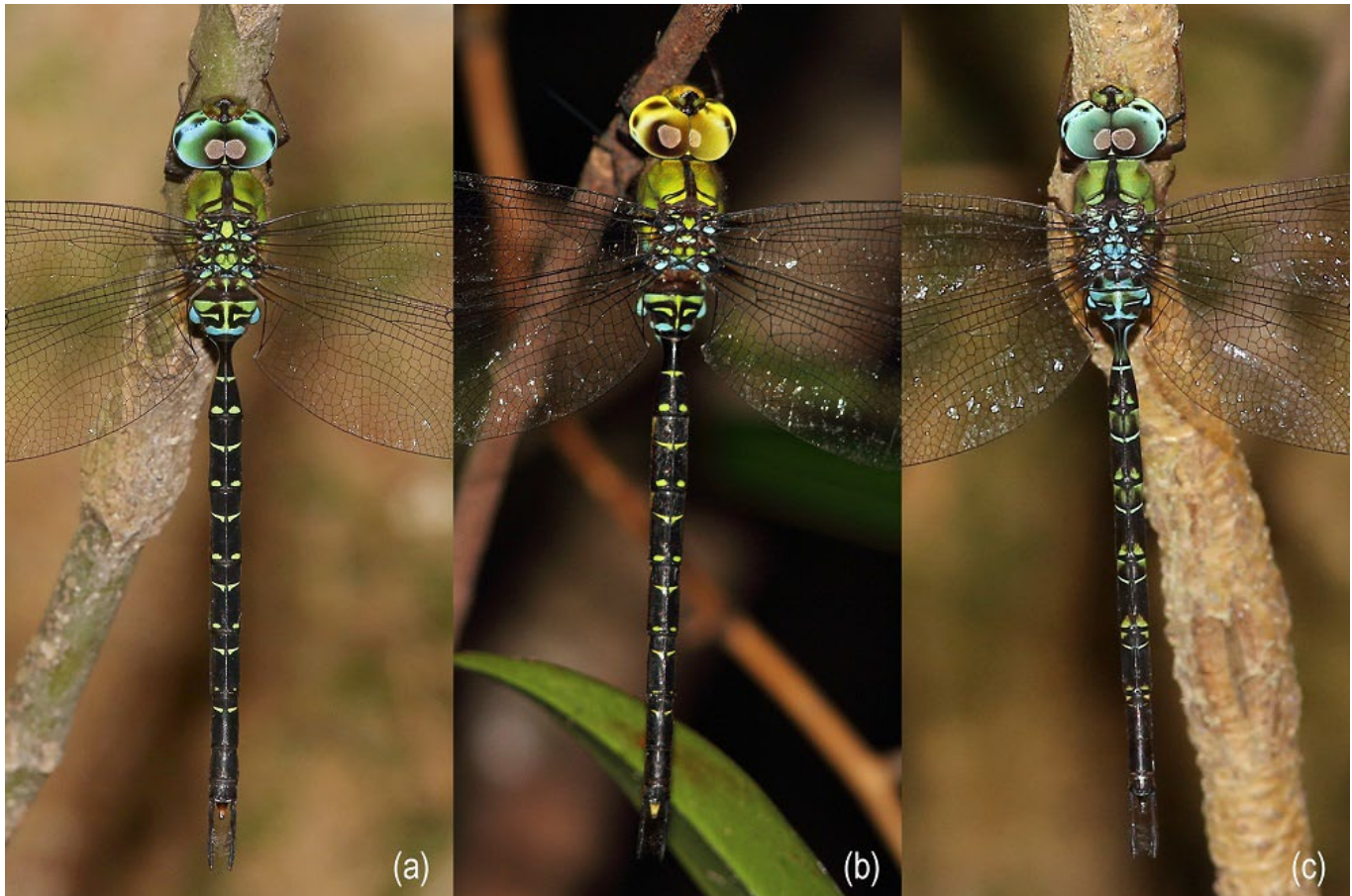
Species	Year of first record in HK	First record by
<i>Gynacantha ryukyuensis</i>	2004, reported in 2014	AFCD
<i>Stylurus annulatus</i>	2008	Samson So
<i>Sympecma paedisca</i>	2009	Sum Lam-Po
<i>Anax indicus</i>	2010, reported in 2012	Eddie Yam
<i>Matrona basilaris</i>	Historical, reported in 2014	Malte Seehausen from museum collection
<i>Rhyothemis fuliginosa</i>	2014	Bergman Ng; an earlier record retrospectively checked by Truman Kwok
<i>Sympetrum darwinianum</i>	2014	Bergman Ng, Cheung Che-Man
<i>Anotogaster cf. klossi</i>	2015	AFCD
<i>Polycanthagyna ornithocephala</i>	2017	Sum Lam-Po
<i>Indothemis carnatica</i>	2017	First reported by AFCD in 2018; an earlier record retrospectively checked by Cheung Che-Man
<i>Sympetrum fonscolombii</i>	2017	Moody Au
<i>Stylurus clathratus</i>	2018	Ernest Chiu
<i>Orthetrum albistylum</i>	2018	AFCD

**Table 1.** Summary of new Odonata records in Hong Kong since 2011 in chronological order of discovery discussed in this article.

Species	Year of first record in HK	First record by
<i>Pseudagrion pruinatum frasei</i>	2003	AFCD
<i>Anax nigrofasciatus</i>	2003	AFCD
<i>Cephalaeschna klotsae</i>	2003	AFCD
<i>Trithemis pallidinervis</i>	2003	Graham Reels
<i>Fukienogomphus choifongae</i>	2004	AFCD
<i>Planaeschna skiaperipola</i>	2005	Keith Wilson
<i>Sieboldius deflexus</i> *	2007	Samson So, Dickson Wong
<i>Aethriamanta brevipennis</i>	2008	AFCD
<i>Heliogomphus retroflexus</i>	2009	Mahler Ka

**Table 2.** Summary of new Odonata records in Hong Kong between 2002 and 2011 in chronological order of discovery, based on information in Tam et al. (2008) and Ka (2020). [\* = exuviae only]





**Figure 1.** Comparison of the dorsal markings of three *Gynacantha* species recorded in Hong Kong: (a) *G. japonica*; (b) *G. ryukyuensis*; (c) *G. subinterrupta*. All three insects shown here are male. Photos by: (a), (c), Eric Tse; (b), Cheung Che-Man.



**Figure 2.** A male *Anotogaster* sp. recorded at Sha Lo Tung in 2020. Photo by Cheung Che-Man.





**Figure 3.** An *Anotogaster* sp. larva found at a stream in Hong Kong. Photo by author.



**Figure 4.** *Indothemis carnatica* has been observed in many localities in Hong Kong. Shown here a male recorded at Tsiu Hang, Sai Kung. Photo by author.



**Figure 5.** A female *Orthetrum albistylum* recorded at the Hong Kong Wetland Park in 2020. Photo by M Y Lai.



**Figure 6.** Different male *Rhyothemis fuliginosa* individuals recorded at Luk Keng. Note the difference in the colour pattern on their hind wings. (a) observed on 1.X.2014, photo by Truman Kwok); (b) observed on 11.X.2014, photo by author.





Figure 7. *Sympetrum darwinianum* recorded at Wu Kau Tang. Photo by Bergman Ng.



Figure 8. A male *Sympetrum fonscolombii* found at Pak Nai. Photo by Moody Au.