Activity report on the project "*Microplastic concentration in sediments and waters of Matagorda and San Antonio Bays: Initial assessment and mitigation plans*"

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Period: April 1st 2022 to June 30th 2022 – Laboratory separation of microplastics from sediments.

During the quarter of April to June 2022, we worked on separation of microplastics from sediments, preparing the map with microplastics distribution and open the sediment cores collected. The microplastics separation was done for all grab sediment samples (10-20 cm surface sediments) collected from San Antonio and Matagorda bays and the map distribution was made (Figure 1). The distribution of microplastics in top sedimentary layer.

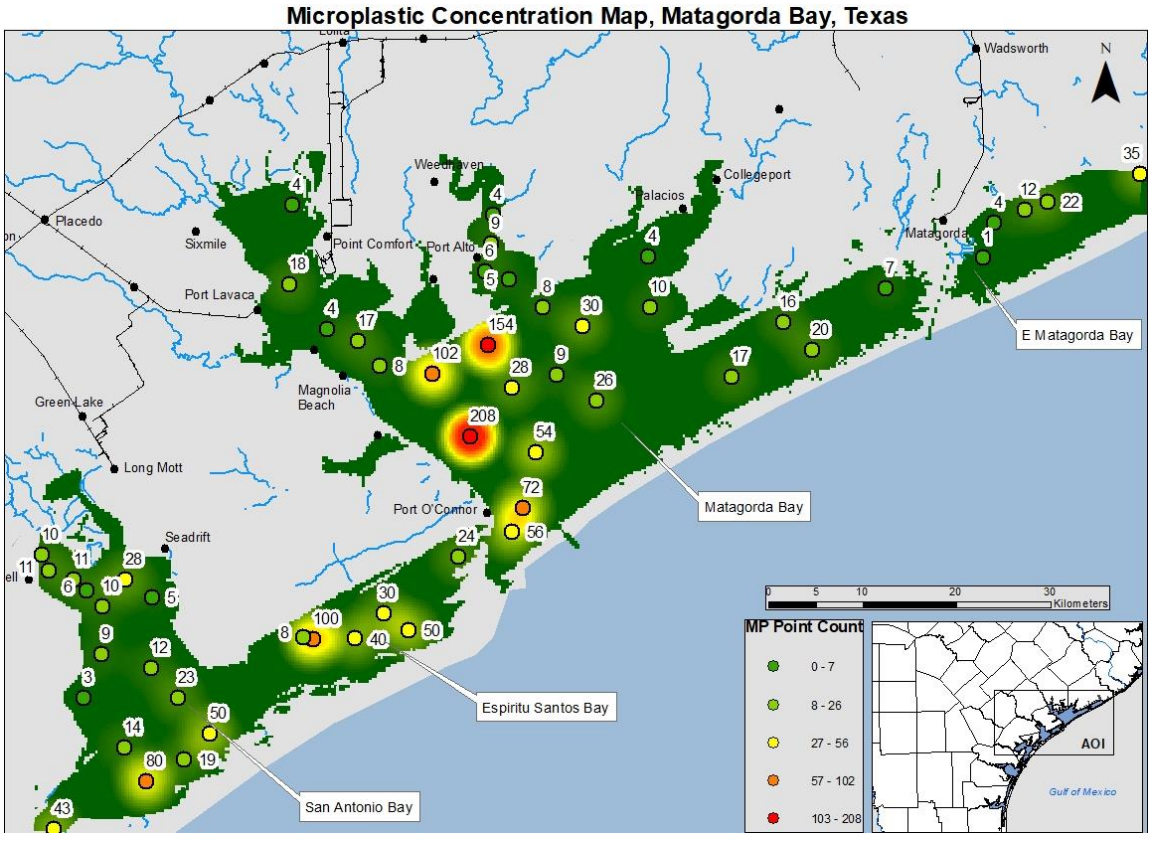

Figure 1. Map of microplastics distribution in bottom sediments (~ 10cm thick) in San Antonio and Matagorda bays. The numbers represent microplastics (smaller than 5 mm particles) counts per 100 g of sediments. The extremely high numbers, 100 or higher, will have to be reassessed after FTIR analysis because it is likely that many of the "disk particles" identified initially as microplastics are diatoms frustule ("shells" of microorganisms). See more discussion in text.

The analysis procedure which was used for separation (was also mentioned in a previous reports) has 3 main steps (1) **Wet sieving: c.a. 100g sediment using 45um sieve; (2) Separation with JAMSS (2) using LMT solution (diluted at c.a. 1.5 g/cm^3); (3) Microscope examination and photography of the filtered material.**

However, while the method used so far is very good, we are trying to improve the separation method and are developing an additional step for samples that have high content of organic detritus and interfere with microplastics separation (clog the filter) and identification (similar visual appearance with microplastics).

The material content of filters with clasts lighter than 1.5 g/cm^3 have been described using the optical microscope and identified microplastics (Figure 2) with most common morphologies as fibers, fragments and "particle" (Figure 2).

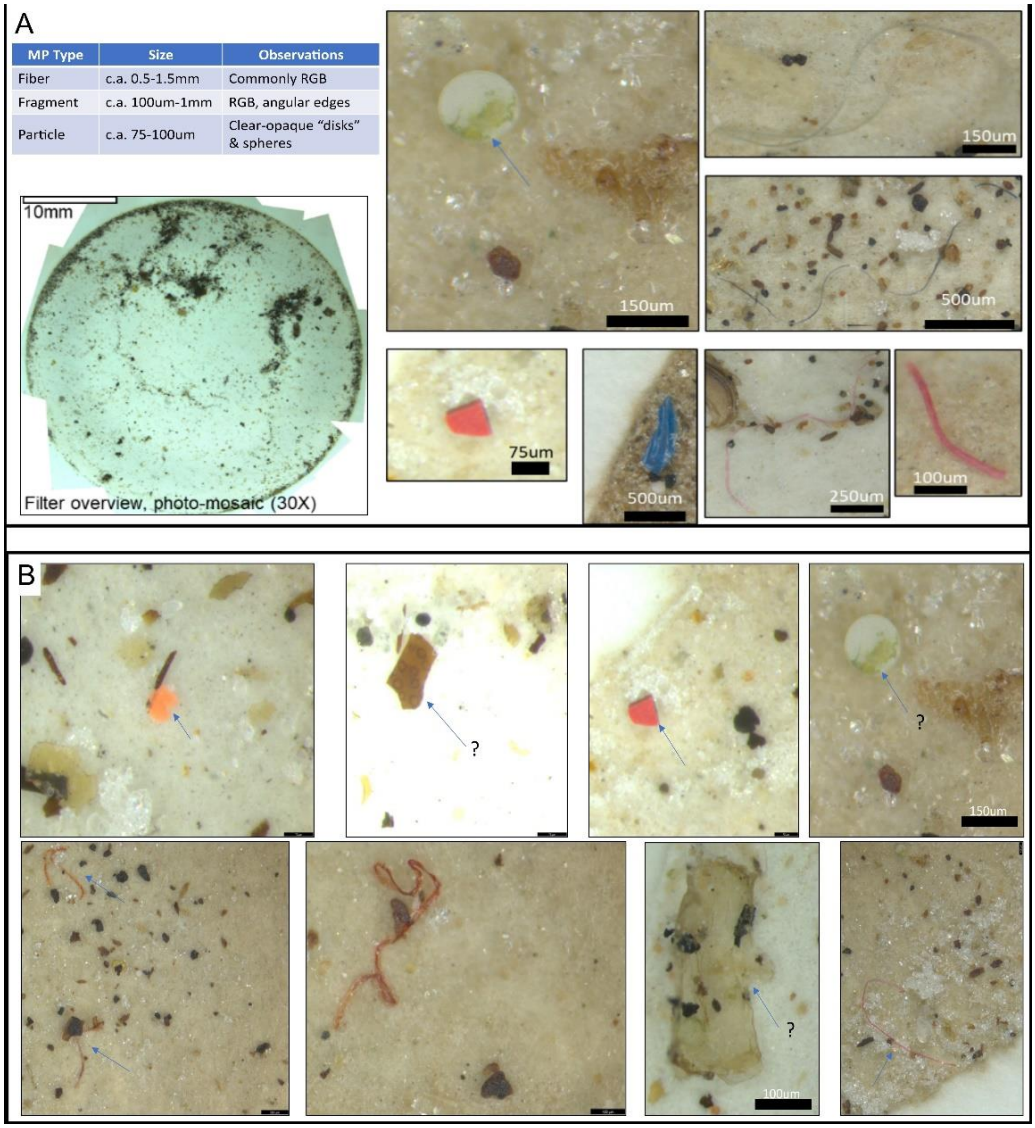

Figure 2. Identification of microplastics using optical microscope. A- method to identify different microplastics morphologies. B- Examples of microplastics, please note the scale of the photos, most fragments are in the range of 100 µm or smaller.

It is likely that high numbers (larger than 100 microplastic particles) reported on figure 1, are organic (diatom frustule) rather than plastics, and therefore is useful to use microplastics particle morphology maps. The preliminary maps with microplastics by morphology type (Figure 3) individualize areas where fibers or fragments dominate.

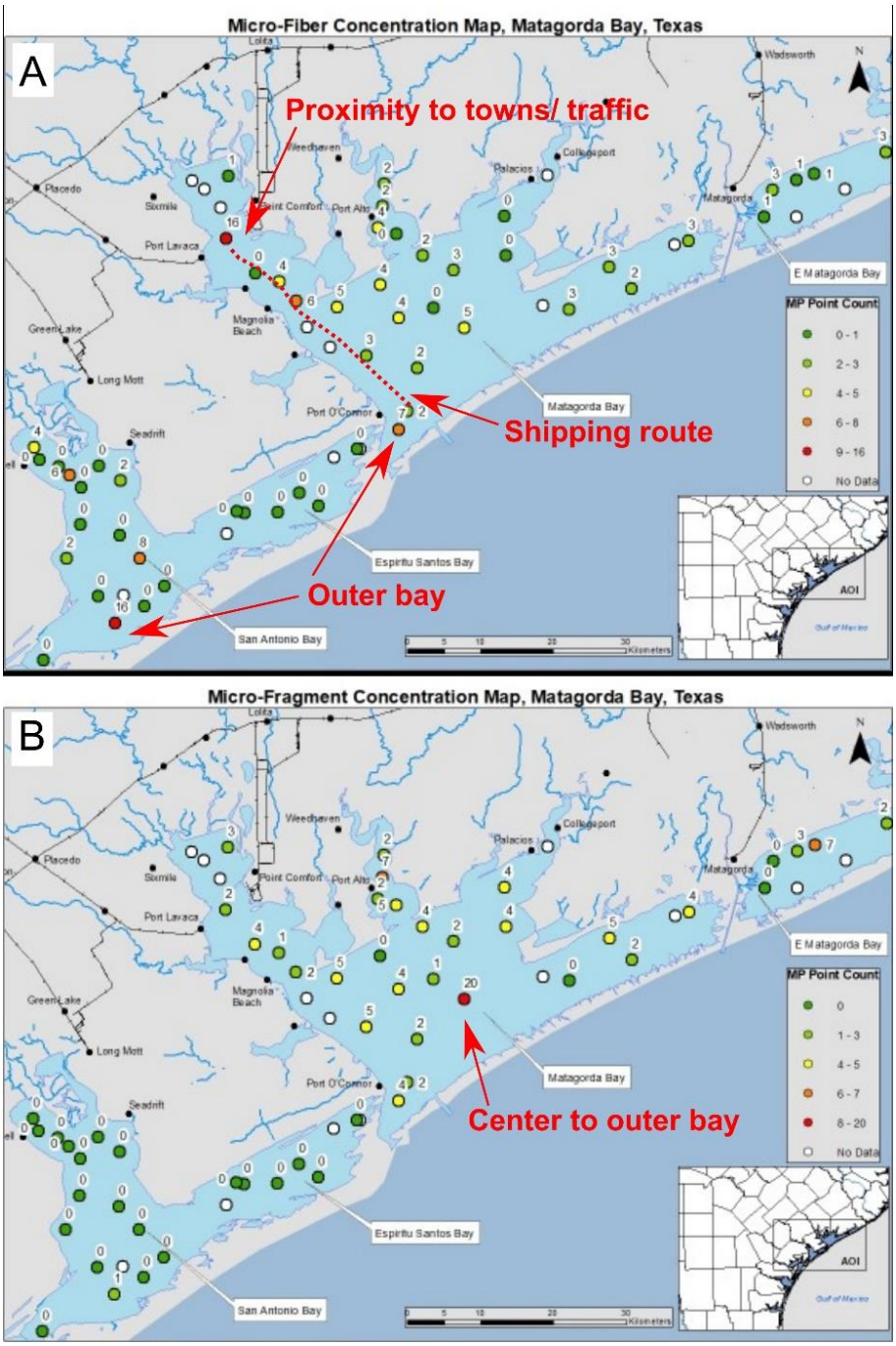

Figure 3. Microplastics distribution by microplastics type. A- Micro-fiber distribution in bay sediment. B- Micro-fragment distribution in bay sediment. The red arrows and text point to high occurrence microplastics.

Some initial observations related to the higher microplastics content samples (or areas) can be made and comment on the spatial variability. For example, micro-fiber distribution map (Figure 3A) shows there is higher content (tens of particles) on the outer bay and along the shipping route (Figure 3A). For the micro-fragment distribution map (Figure 3B), it seems to be higher content in the central (deepest?) part of the Matagorda Bay. Microplastics distribution will be analyzed in detail when more samples (from cores) will be added on the map and compared with the distribution of the factors controlling the microplastics dispersion such as wind, bays currents and water depth.

The higher microplastics content in bottom sediments in some samples of the outer bay and along the shipping channel (Figure 3) have to be linked to the source and bay dispersal pattern. The controls on the higher microplastics content are the source of microplastics (human activity areas and rivers discharging in the basin) and the factors that control sediment dispersal (wind) and sedimentation (bay water depth) (Figure 4). Long term wind patterns show a south-south east predominant direction (toward the land) and a less frequent but higher velocity from northeast (see wind rose Figure 4A).

The water depth in the bays (Figure 4B) is also likely to control the microplastics settling and it might be possible to segregate microplastics type based on their densities/shapes. However, these microplastics dispersal controlling factors need more in-depth analyses using river discharges, storm occurrences and seasonal wind patterns.

Following the grab samples, sediment cores will be analyzed initially sampling the top few cm which will improve the map with the bottom sediment microplastic content, and then middle and bottom of each sediment core (Figure 5). Microplastics was found at the bottom of the 2 cores analyzed so far, at a depth of about 34 cm and 50 cm (Figure 5). The presence of microplastics at that depth suggest the sediment was likely deposited after the microplastics appeared in the system (after 1950) or that bay sediment is mixed regularly and redeposited to the depth of the cores (34 cm and 50 cm). These two possible interpretations will be followed while more cores will be opened and analyzed.

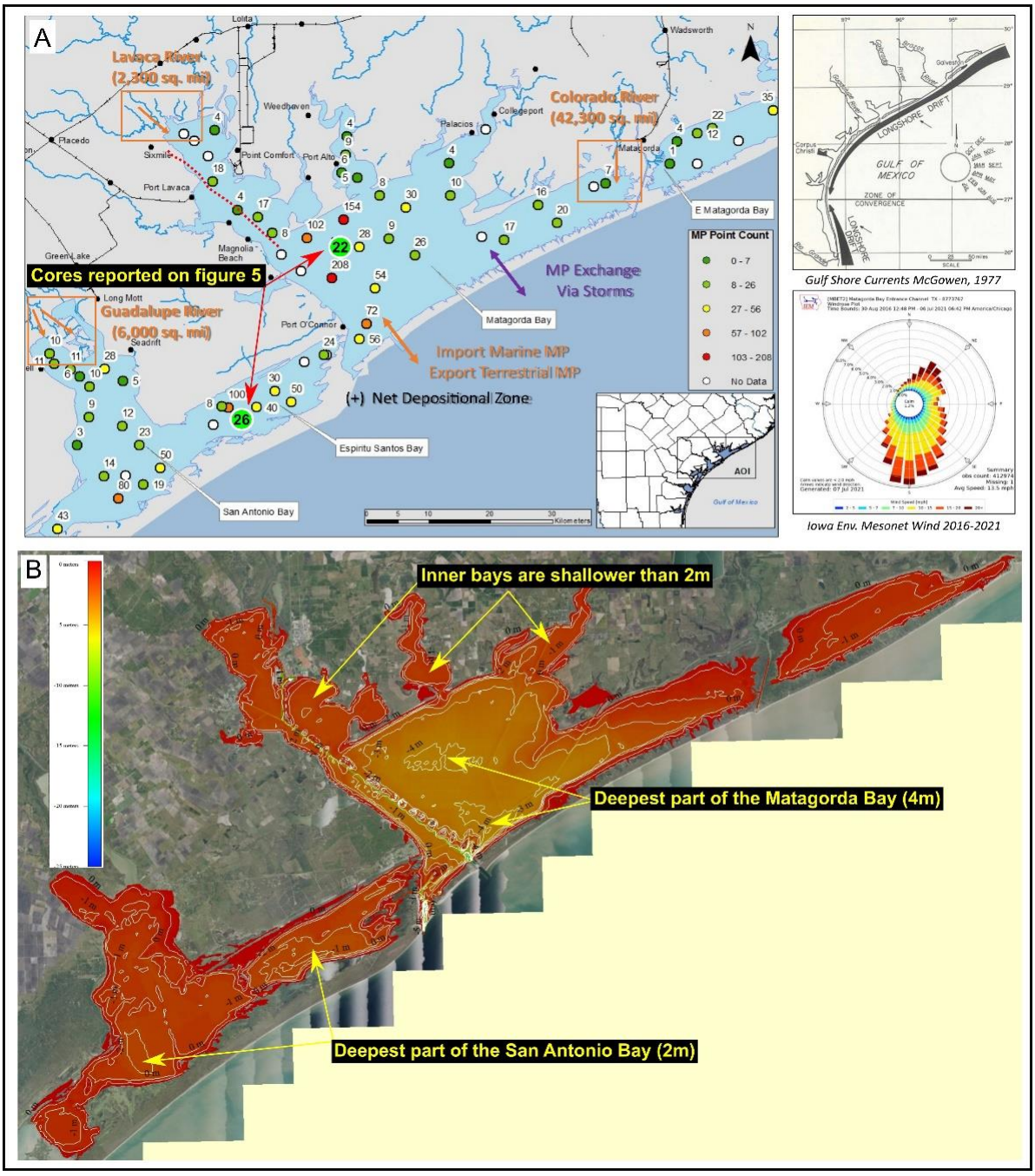

Figure 4. Observations pertinent to an initial interpretation of microplastics distribution. A- Microplastics content (samples with 100s are overestimated) and possible factors contributed to microplastic variability (longshore current, wind patter). B- Bays water depth, another factor that might contribute to microplastics variability.

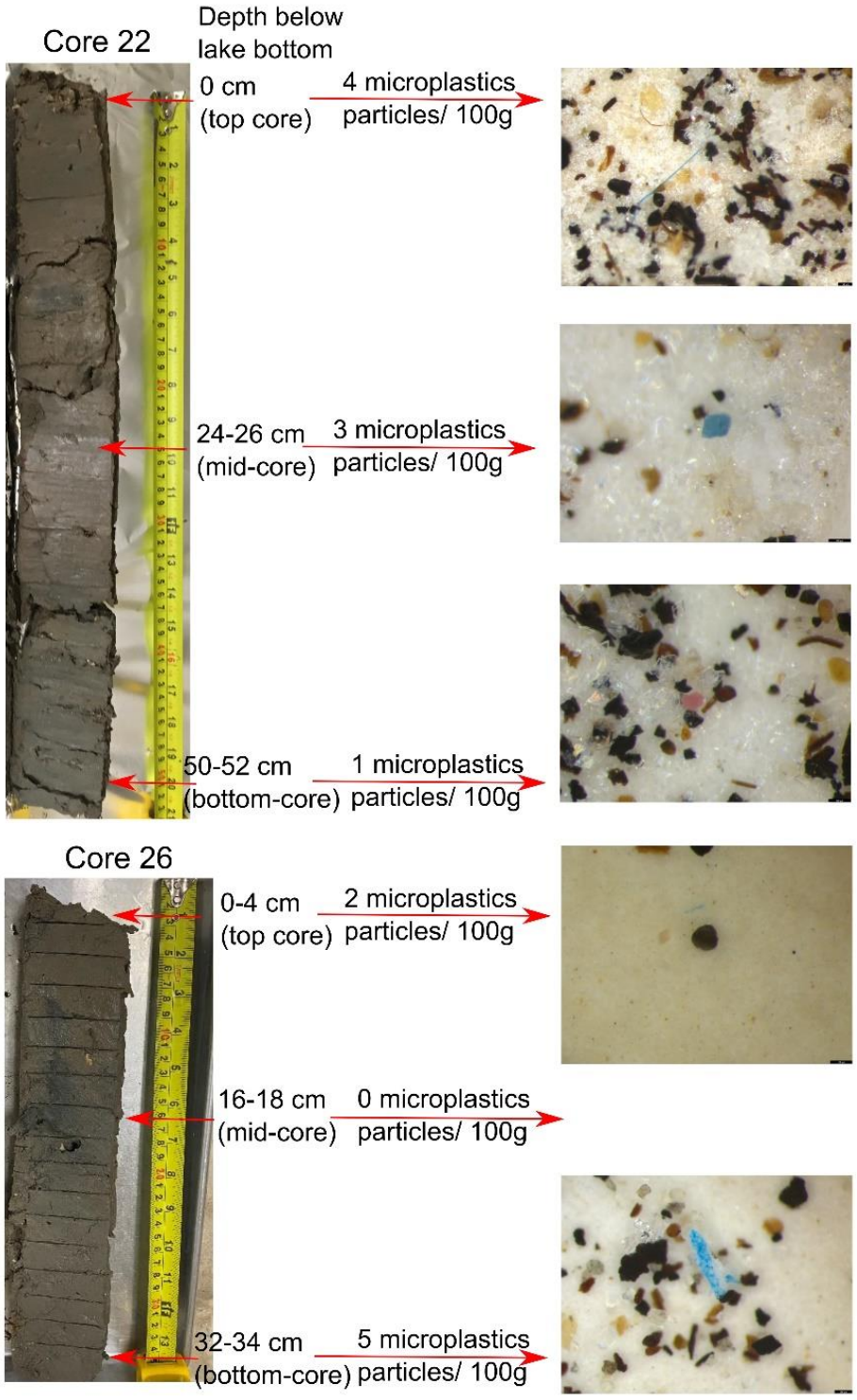

Figure 5. Microplastics content in the mud bay substrate from initial analysis of 2 cores. For location of the cores, core 22 in Matagorda Bay and core 26 In San Antonio Bay, see figure 4A.